

JSPS Summer Program 2023 Research Report

1. Name: Nicholas GALA	(ID No. SP23001)
2. Current affiliation: University of Tulsa	
3. Research fields and specialties: Social Sciences	
4. Host institution: Tokyo Metropolitan University	
5. Host researcher: Masami IZUHO (Associate Professor)	
6. Description of your current research	
<p>The peopling of the Americas is one of the most intensely debated topics in Archaeology. New hypotheses regarding how, when, and from where people arrived are always appearing. Recently, Buvit et al. (2020) proposed a possible migration of humans from Hokkaido to North America during the Late Pleistocene when land bridges connected Hokkaido and Alaska to mainland Asia. Buvit et al. (2020) rely on artifact similarities and radiocarbon dates to make connections between the two continents. Although their arguments are sound, further testing can strengthen this connection. Ancient DNA is the most robust data for this type of analysis; however, DNA data is sparse for the First Americans and no Pleistocene age Japanese DNA has been found to date. Therefore, preserved cultural material must be used to draw these connections.</p> <p>Across Japan, Northeast Siberia, and Alaska in North America, there is a shared stone tool technology called microblades. Microblades are small (< 5cm), razor sharp blades of stone that were utilized for hunting and cutting tasks. To make microblades, a specialized “core” must be prepared for the blades’ removal from the core. Preparing these cores can be done by a variety of techniques, however, only one is common in Japan, Russia, and Alaska; called the Yubetsu technique. Tracking differences in this Yubetsu style cores across the two continents can shed more light on the connections between Japan and North America.</p> <p>In order to track these changes, a cumulative founder effect model can be used. The founder effect is an extreme case of genetic drift, one of the four principles of evolution. Founder effect states that a population has a set amount of genetic variance. As smaller populations break away from the original population, the amount of genetic variance in the new population is smaller than in the original and is true for each new instance. Cultural knowledge functions much like genetic material and thus the founder effect can also be observed in cultural materials. My project aims to look at the variance of Yubetsu technique microblade cores in Japan, Siberia, and Alaska, and statistically analyze whether they conform to the founder effect model.</p>	

7. Research implementation and results under the program

Title of your research plan: Micro-changes in Microblades: PSHK Origins

Description of the research activities:

My first order of business in Japan was to search for published images and data on Yubetsu microblade cores. I arrived with some data, but the sample sizes were not large enough for analysis. Several weeks were spent searching the internet and books for images. I required samples from Hokkaido, Sakhalin Island, the Amur River Basin, Yakutia region, Alaska, and the Kamchatka and Chukotka peninsulas (NE Siberia). I added Alaskan Campus style cores to my analysis, as they are thought to be an elaboration on the Yubetsu technique and the number of Yubetsu cores in Alaska are small. Next, I searched for Hokkaido core samples and traveled to Hokkaido to look at collections curated by the Hokkaido Center for Buried Cultural Property and the Chitose Buried Cultural Property Center. During sample collection I took photos and measurements of the cores' blade removal surface. I took 5 measurements of the cores: length, platform width, and the width at 25%, 50%, and 75% of length. The photos were digitized using a set of software used to measure shape using a method called Geometric Morphometrics (GM). These two methods of measuring the cores were used to calculate the total within-group variance in my regions (Hokkaido, Sakhalin, Amur River Basin, Yakutia, Northeast Siberia, and Alaska, split into Yubetsu and Campus style). Campus cores should have more variance than the Yubetsu of Alaska in my model. The average variance per region was regressed against their distance from Hokkaido, calculated using Great Circle Arcs. Linear measurements were not strongly correlated with distance from Hokkaido and non-significant. However, GM data were shown to be very strongly correlated with distance from Hokkaido although bordering on being significant. This suggests that the number of linear measurements taken underestimate the changes microblade cores undergo. The GM data suggest there is a strong possibility of a migration of Yubetsu technique using humans from Japan to North America.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): This program was excellent. I feel like I have come out of this program better. It allowed me to explore my field in a way I had not done so before and in a part of the world I am unfamiliar with, providing a useful learning experience. I also was able to have access to books and information that I would unlikely have access to anywhere in the US thanks to my host. Additionally, although chances to exchange ideas with my host were few (given his busy schedule), the exchanges that did take place were quite meaningful. I look forward to elaborating on this project with him in the future.

9. Adviser's remarks (if any):

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1. Name: Arthi Bala	(ID No. SP23002)
2. Current affiliation: Georgetown University School of Medicine	
3. Research fields and specialties: Biological Sciences Medical, Dental and Pharmaceutical Sciences	
4. Host institution: Doshisha University	
5. Host researcher: Dr. Masaya Ikegawa	
6. Description of your current research My current research analyzes the role that the gut microbiome has on the human body's several physiological process. Past research has illustrated the impact that different compositions of gut microbiota have on physical and psychological well-being. My research specifically focuses on how the environment of space. I utilized a multi-omics approach to understand how the effects of space radiation had affected the gut microbiota of astronauts and these changes of the microbiota impacted the health of the astronauts.	

7. Research implementation and results under the program

Title of your research plan:

The Visualization and Analysis of Metabolites of Irritable Bowel Syndrome Mouse Model Through Mass Spectrometry

Description of the research activities:

IBS model (DSS) and standard mouse samples were obtained our collaborators in Kyoto University. The large and small intestine of the mice were extracted and “swiss roll” slices were made in preparation for the cryostat. The small intestine of both samples were divided in upper, middle, and lower tracts and the large intestine was kept intact. The cryostat was used the create 20 micrometer slices of the intestines and mounted for staining. The samples went through two staining processes, hematoxylin and eosinophil and immunohistochemistry staining. For immunohistochemistry staining, the antibody used was rabbit IgG derived from goat. The metabolites of interest were S100A9 and Ki67. S100A9 is a heterodimer composed of A8/A9, known as calprotectin that is produced in the upper intestines. It is a common biomarker for IBS positive areas and leaves in the molecular membrane of the zona prolicuda (zone of proliferation). Ki67 is a metabolite that is a potential candidate as a IBS marker.

After staining, S100A9 was present in the upper section of the small intestine and the brush border of the lower section of the smaller intestine of the DSS mouse. The presence of S100A9 signals that these areas are undergoing some form of inflammation. In the normal mouse, there was a presence of S100A9, but this could be due to general inflammation so further verification is needed. Ki67 was also present in the DSS mouse.

The next steps are further quantify and visualize these metabolites through a mass spectrometry imaging study.

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

I thoroughly enjoyed my time in Japan and had the amazing opportunity to travel to different towns and cities, eat amazing food, and immerse myself in a culture that prides itself on its ancient culture and modern technology. In addition, the people who I’ve met during my time made me feel welcomed and that helped with the home sickness. If given another chance, I would love to go back to Japan.

9. Adviser’s remarks (if any)”

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1. Name: Josh Feng	(ID No. SP23003)
2. Current affiliation: University of California, Berkeley	
3. Research fields and specialties: Humanities and Social Sciences	
4. Host institution: Kyushu University	
5. Host researcher: Fukachi Furukawa	
6. Description of your current research	
<p>My work examines the luxury fruit market, specifically the Miyazaki Mango, in relation to revitalization efforts in the Japanese countryside. This research is inspired by fieldwork I conducted while selling shaved ice at a night market in Taipei, where the mango was used as a marketing tool to brand products as distinctly “Taiwanese.” In the case of mangos grown in Southern Kyushu, what notions of tropicality connect Miyazaki to places such as Okinawa, Taiwan, and Hawaii?</p> <p>I lead with several interconnected research questions: How do local goods and souvenirs work to brand regionality — how is the “local” produced and packaged in products, and how is it conjured through taste? What is the relationship between the Miyazaki Mango and a constructed “natural environment” vis-a-vis branded Japanese seasonality?</p> <p>My analysis falls under three different frameworks: 1. Commodity and Value (the geopolitical relationship between JA agricultural cooperative, the Miyazaki Prefectural government, and farmers) 2. The Image of Tropicality (the branding of taste in mango advertisements and differentiation in marketing campaigns between Okinawa and Miyazaki) 3. Technology and Climate (examining greenhouse farming in Japan through cybernetics and the production of locality). For theoretical grounding, I look to literature on the social life of things and networks of trade (Anna Tsing, Ted Bestor), anthropology of image (Tadashi Yanai), and technology/cybernetics/media (Martin Heidegger, Yuriko Furuhashi, Yuk Hui).</p> <p>I also examine the history of the Irving Mango (the cultivar branded as the Miyazaki Mango), as well as the history of mango cultivation in East Asia (Taiwan, China, Japan, and Korea) from mango worship in Cultural Revolution China to greenhouse-grown luxury fruit in Kyushu and Jeju Island. These networks of scientific knowledge, plant seeds, and delicate fruit also connect to networked images of tropicality that trace colonial relations and histories of war in the Pacific.</p> <p>This summer research is designed to set the stage for more sustained research moving forward (including ideally a visit back to Miyazaki next summer, and about a year of dissertation fieldwork beginning in Summer 2025).</p>	

7. Research implementation and results under the program

Title of your research plan:

The Production of Locality through a Case Study of the Miyazaki Mango:
Greenhouse Farming, Tourism Strategy, and the Branding of Tropicality

Description of the research activities:

During my JSPS tenure, I spent about a month based in Fukuoka attending seminars at Kyushu University and conducting related fieldwork in Yame, Omuta, and Hagi about farming, tourism, and branding. I then spent a bit over two weeks in Miyazaki conducting fieldwork. My research included visits to mango farms and interviews with mango farmers, as well as wine makers and other young producers.

I also presented my research in Japanese at Kyushu University conference (九州人類学研究会・8月5日研究集会). My presentation was titled 「宮崎マンゴーの事例から見た地域性の形成 —— 温室栽培、観光振興と南国らしさ」 and I gave an hour-long presentation with comments from Professor Akamine Jun of Hitotsubashi University and 30 minutes of Q&A, to an audience of Japanese professors, researchers, and graduate students.

I thoroughly achieved my goals for this summer, of both creating and expanding a network of interlocutors at my field site of Miyazaki, as well as connecting with Japanese professors and presenting my research in Japanese, improving my academic language skills in the process.

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

As my work in sociocultural anthropology is about Japanese culture, my research itself can be considered such “cultural experiences.” For example, visiting farms or attending dinners and drinking events to meet farmers and producers in the area, being part of a farm event/karaoke contest put on by one of my interlocutors, meeting locals in Miyazaki and going out to eat and visiting beaches in the area, etc. In addition, on my free time I attended the famous Fukuoka Yamakasa Festival and took a trip to Takachiho Gorge with my former coworkers from when I used to work in Fukuoka, along with many more cultural activities.

9. Adviser’s remarks (if any):

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1. Name: Jeremy Sutherland	(ID No. SP23004)
2. Current affiliation: The Pennsylvania State University	
3. Research fields and specialties: Agricultural Sciences	
4. Host institution: Hosei University	
5. Host researcher: Dr. Shinya Tsuda	
6. Description of your current research I use computational methods to better understand the relationships between plants and their associated microbiome compositions. In agriculture, the host-microbiome relationship is vital to crop health and performance. My research innovates by combining host genotypic information with microbial and environmental information to more accurately predict and improve switchgrass (<i>Panicum virgatum</i>) production in the Northeastern United States.	

7. Research implementation and results under the program

Title of your research plan:

Understanding regional nanovirus outbreaks in Japan.

Description of the research activities:

- Completed an in-depth literature review of nanovirus outbreaks in Japan
- Visited urban eggplant farm to test A.I. enhanced mobile plant diagnostics tool
- One-on-one discussions with several professors at Hosei University to learn more about their research (Fungal Systematics, Integrated Pest Management (IPM) strategies for disease prevention, etc.)
- Completed two seminars describing my graduate work at Hosei university and the University of Tokyo
- Field visit to sustainable agriculture farm in Gunma prefecture to examine IPM strategies for disease management and comparisons with conventional agriculture methods
- Field visit to Chiba prefecture to assist with undergraduate research activities
- Co-led undergraduate literature review, assisting with English translations
- Provided feedback and edits on a publication for a PhD student at Hosei University

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

- I visited numerous historical and cultural landmarks throughout Tokyo and Gunma prefectures.
- With my advisor, I experienced unique dining and cultural experiences that are unique to Japan, including a baseball game and theme park.

9. Adviser's remarks (if any):

The acceptance of the JSPS Summer Program for Postdoctoral Fellowships was extremely meaningful for the Department of Clinical Plant Science, Hosei University. Analysis of the interaction between microorganisms, plants, and the environment is essential to promote "Integrated Pest Management," which is the foundation of modern agriculture in Japan. The research fellow applied the results of the interaction analysis he had demonstrated in his doctoral research to the crop cultivation system under development in our department, and explained its effectiveness at seminars and other events within the university. This enabled him to exchange meaningful information with graduate students of the same generation in our department, which accelerated mutual understanding. In addition, by visiting sustainable production fields of crops grown in the northern Kanto region and comparing them with conventional pest control systems, he was able to understand the current state of environmentally friendly agricultural technology being practiced in Japan and to confirm the differences with the regenerating agricultural system in own country, the United States. In this way, in addition to personal exchanges among graduate students of the same generation, the deepening of understanding of Japan's agricultural production system was extremely meaningful for both Japan and the U.S. in developing a stable production technology system for agricultural crops that can counter the global food shortage that will soon befall us. If there is an opportunity in the future to accept a research fellow based on such a program, we would definitely like to fulfill our role as a host university.

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1. Name: Wai Man Wong	(ID No. SP23005)
2. Current affiliation: City University of New York	
3. Research fields and specialties: Social Sciences	
4. Host institution: Hamamatsu University School of Medicine	
5. Host researcher: Dr. Kenji Tsuchiya, MD, PhD	
6. Description of your current research <p>Twins studies have shown that genetic inheritance of obesity is as high as 47-90% while child obesity in developed countries can lead to serious socio-emotional problems. Instead of Mendelian inheritance resulted from a single gene, obesity reflects single-nucleotide polymorphisms of numerous genes. Yet, research examining the polygenic mechanism of child obesity and socio-emotional difficulties is scant. Polygenic risk score of BMI (BMI-PRS) offers the opportunity to investigate obesity as a complex physical health issue, and its relationship with socio-emotional problems. The primary aim of this study was to examine the association between BMI-PRS and child socio-emotional difficulties. Moreover, the study also aimed to extend current literature on breastfeeding on mitigating the negative impact of obesity on child socio-emotional impairments. Breastfeeding has been supported by extent work as superior to formula milk given the highly nutritious-content and strong mother-infant bond building. However, no research has studied the moderation effect of breastfeeding on BMI-PRS and socio-emotional competence during early childhood.</p>	

7. Research implementation and results under the program

Title of your research plan: Breastfeeding moderates the association between BMI-PRS and child socio-emotional problems.

Description of the research activities: A total of 590 children recruited in the Hamamatsu Birth Cohort (HBC) Study were analyzed. BMI-PRS was generated using summary data from the genome-wide association study (GWAS) conducted in Japan. Child socio-emotional difficulties at 66 months were measured by the Strength and Difficulties Questionnaire (SDQ). Frequency of breastfeeding was assessed at 4 months. Multivariate regression results indicated significant association between BMI-PRS and child emotional problem as measured by the SDQ-emotional problem sub-scale (β [SE], -0.47 [0.14]; $p = 0.001$). Breastfeeding count at 4 months significantly moderated the relationship between BMI-PRS and child emotional problems (β [SE], -0.09 [0.14]; $p < 0.001$). Only when the frequency of breastfeeding at 4 months was high, BMI-PRS contributed to lower level of emotional problems. Yet, when the frequency of breastfeeding was low, BMI-PRS was associated with higher level of emotional problems. Covariances including birth weight, gestational age, parental household income, parity, gender, maternal education, postpartum depression, and pre-pregnancy BMI were controlled. The results supported the hypotheses that 1) BMI-PRS might predict early socio-emotional difficulties; and 2) breastfeeding might buffer the negative effect of BMI-PRS on child socio-emotional problems.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): The homestay was a wonderful experience. Living with a local Japanese has deepened my understanding on how people do in their daily life. My host shared a great deal with me about her story in every stage—very inspiring of a woman with bravery to make her own unique path. There were many things that I enjoyed doing with her such as a tea ceremony, and a boat trip along the mods of a castle. I am very thankful that I have gained and widened my horizon through the Summer fellowship program of JSPS.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Joselyne Aniceto	(ID No. SP23006)
2. Current affiliation: The University of Texas Rio Grande Valley	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Nagoya University	
5. Host researcher: Professor Soichi OKADA	
6. Description of your current research In 1975, Indian mathematician H. Gupta provides a "new" technique for computing values of $p(n,G)$, the function enumerating the partitions of n whose part sizes come from a finite set G . We generalize Gupta's main theorem and then use this result to establish an infinite family of partition congruences. The generating function techniques employed have a direct link to polyhedral geometry, which we then use to prove the existence of combinatorial witnesses, known as "cranks," for the partition congruences.	

7. Research implementation and results under the program

Title of your research plan:

Congruence properties of consecutive coefficients in arithmetic progression of Gaussian polynomials.

Description of the research activities:

A 2007 theorem of Dr. Brandt Kronholm on infinite families of consecutive partition congruences in arithmetic progression for the function $p(n,m)$, enumerating partitions of n into at most m parts, is at the center of my dissertation project. A more recent second theorem from Eichhorn, Engle, and Kronholm describes another infinite families of closely related partition congruences from the function $p(n,m,N)$ enumerating partitions of n into at most m parts, no part larger than N . However, empirically there appears to be a large infinite family of congruences awaiting general description. The research project consisted of conjecturing what this larger infinite family is and to the prove that conjecture. At a minimum, the proof of the conjecture will likely rely on an application of the 2007 theorem and a thorough investigation and modification of some of the techniques found in the proof of the second theorem.

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 2023 Research Report

1. Name: Evan Arlen Sherman MILLER	(ID No. SP23007)
2. Current affiliation: Department of Anthropology, University of Texas at San Antonio, San Antonio, TX, USA	
3. Research fields and specialties: Biological Sciences	
4. Host institution: Center for Ecological Research, Kyoto University	
5. Host researcher: Goro Hanya, Ph.D.	
6. Description of your current research My Ph.D. dissertation involves evaluating the roles of geological activity and past global climate change events on the diversification of primates. The specific study of my research is focused mainly on the loroid primates (galagos/bushbabies and lorises). My research involves utilizing museum specimens, genetic data, climate/paleoclimate data, and GIS and remote sensing techniques.	

7. Research implementation and results under the program

Title of your research plan:

A Comparative Analysis of Historical Forest Fragmentation Across Southern Japan: Implications for The Regional Extinction of The Japanese Macaque (*Macaca fuscata*)

Description of the research activities:

The goal of this project was to evaluate whether historical forest loss in Japan may have contributed to the local extinction of the Japanese macaque (*Macaca fuscata*) on Tanegashima in southern Japan. My research relied entirely on the geographic information system software QGIS. Before my arrival in Japan, my host advisor and his graduate student had found an open source database provided by the Geospatial Information Authority of Japan that contains thousands of aerial photographs from the late 1940's. The graduate student converted these photos to GeoTIFF raster files and georeferenced (added latitude/longitude coordinates to) each photo in the database using an ESPG 2000 coordinate reference system. Once georeferencing was complete, I uploaded each photo into QGIS and used a raster calculator function to classify each of the different land types for each photograph. I also used a QGIS plugin called LecoS (Landscape Ecology Statistics) to quantify seven different metrics of land cover and fragmentation of forests in each of the photos. Since Tanegashima was the location where *M. fuscata* went extinct, our focus was on reconstructing habitat for this island. In the future, my host advisor and his graduate student plan to georeference photographs of other neighboring locations where this species persisted, and to see if forest loss was significantly greater on Tanegashima than these other locations.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I loved Kyoto, and I also absolutely loved the festival and food cultures of this place!

9. Adviser's remarks (if any):

Evan has done a very good work during his stay in our lab. The technique he has applied, machine learning in the analysis of aerial photos, and he explored the methodologies all by himself. I am really happy with his achievement; we have so many things to learn from him.

JSPS Summer Program 2023 Research Report

1. Name: William G. GYORY	(ID No. SP23008)
2. Current affiliation: (1) The Graduate Center, CUNY (2) University of Texas, Rio Grande Valley	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Keio University	
5. Host researcher: Naoki YAMAMOTO	
6. Description of your current research	
<p>My research fits into a broad topic known as <i>mapping the QCD phase diagram</i>. Quantum chromodynamics (QCD) is the study of the strong force, which describes the interactions of fundamental particles called quarks and gluons. At the typical temperatures and densities of our everyday experience, these particles bind together into protons and neutrons, which form the nuclei of atoms. The behavior of quarks and gluons at more extreme temperatures and densities, however, is still not well understood. Mapping the QCD phase diagram is the attempt to predict and describe the states of strongly interacting matter that arise under all possible conditions.</p> <p>I research a phase of matter known as the <i>magnetic dual chiral density wave</i> (MDCDW), a spatially inhomogeneous chiral condensate that arises in cold and dense environments, such as the cores of neutron star cores. Recently, my Ph.D. advisor, Dr. Vivian de la Incera, and I have investigated important properties of this phase of matter. For example, we calculated the critical temperature, which indicates where phase becomes energetically disfavored. We also determined its thermal stability by calculating another quantity called the threshold temperature. We found that magnetic fields increase the phase's stability and significantly extend the region of parameter space where MDCDW is preferred, making it a plausible candidate for the matter structure of neutron stars.</p> <p>One of the methods for investigating MDCDW is a theoretical framework called <i>Ginzburg-Landau theory</i>, in which the free energy is expanded in powers of the condensate and its derivatives. This mathematical expression—called the <i>Ginzburg Landau (GL) expansion</i>—can be used to calculate important physical quantities, such as the critical temperature mentioned above. To use the GL expansion for these calculations, however, the coefficients in expansion must first be calculated. One of the key steps in our research was to derive a set of formulas that enable quick and easy computation of the coefficients in the GL expansion, allowing for very accurate calculations of other quantities. This latter topic was the point of connection to my research in Japan.</p>	

7. Research implementation and results under the program

Title of your research plan:

Convergence of the Ginzburg-Landau Expansion in BCS Superconductivity and Chiral Condensates in the NJL Model

Description of the research activities:

We investigated a theoretical tool known as the Ginzburg-Landau (GL) expansion, which has broad applications in physics: In condensed matter physics it is used to study electrical superconductivity, and in nuclear physics it is used to study exotic states of matter that might form in extremely dense environments, such as heavy ion collisions and the interiors of compact stars. The GL expansion contains infinitely many terms, but in applications only a finite number of terms are used to study a phase of matter. Each term has a coefficient that must be calculated if that term is included in the expansion.

Although the GL expansion is a well-known technique for investigating these subjects, typically only the first few coefficients have been calculated, and not much attention has been paid to finding the general behavior of the infinite series of coefficients. We found a set of formulas that give all the Nth-order GL coefficients for arbitrarily large N in two different physical theories. Then, using these formulas, we calculated the radius of convergence of the expansion, which determines the region of parameter space where the GL expansion gives reliable results. We are currently writing a paper in which we explain these findings and discuss the connections between the GL expansion in different physical contexts.

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

I participated in a homestay program in which I spent a weekend living with a Japanese family. We had many discussions about our lives and differences between Japanese and American culture, and we also saw some interesting historical sites together. I have enjoyed the opportunity to learn more about the Japanese language and culture.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Alec Lewis	(ID No. SP23101)
2. Current affiliation: University of Nottingham	
3. Research fields and specialties: Biological Sciences	
4. Host institution: Tohoku University	
5. Host researcher: Professor Satoshi Chiba	
6. Description of your current research <p>Snails are the only animal group that regularly survives a complete inversion of their body plan across the left to right axis, without facing massive fitness costs and reduction in their survival. On the contrary, body plan “mirror imaging” is a trait that has occurred numerous times across the evolutionary history of snails across the globe. In my research, I am looking to apply whole-genome research methods to understand both the evolutionary history “mirror-imaging” in some of the known variable species as well as comparative approaches to try and identify candidate genes for what causes the inversion to occur – and what genes are needed to survive a full body plan inversion. Inversions in early development in non-snail animals are an important class of congenital disorder, and by understanding how snails are able to survive such inversions we hope to learn why other animals are not, hopefully furthering our understanding of some serious developmental disorders. So far, my research has focused on a system of Hawaiian freshwater snails that vary in body-plan chirality, primarily looking at population genomics and evolutionary history. I have just started to study a the much more deeply research Japanese snails <i>Euhadra</i> to look at how chirality is established in this genus.</p>	

7. Research implementation and results under the program

Title of your research plan:

“Natural variation in body plan asymmetry of Japanese “mirror-image” snails”

Description of the research activities:

Working with collaborators in the Chiba-lab the opening stages of this project was to collect samples – as such we went and collected snails within the genus *Euhadra* from a number of sample sites recommended by the Chiba lab due to the presence of both sinistral (anti-clockwise spiraling shells) and dextral (clockwise spiraling shells).

Juveniles were collected with the intention of extraction DNA from the samples for genomics, this was done using a couple of different DNA extraction protocols that are specific to mollusk genomic work. This was carried out at the Chiba lab at Tohoku University. Extracted DNA will be sent for whole-genome sequencing.

Adult snails were set up in breeding trials to encourage them to lay eggs. The intention here was to generate transcriptomes for the 1-4 cell embryos as this is when the left-right axis is established it, so we know any candidate genes for controlling how the axis is established must be expressed here. The Snails did not lay eggs in my time here so this work will continue after I have returned to the UK.

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

I was very fortunate as part of my project to get out into the nature of Japan and into the Mountains around the Tohoku region -this has been wonderful. I also took time to travel around Japan learning about its history from Museums in major cities including Tokyo, Kyoto, Osaka, Hiroshima, and Nagoya.

I enjoyed visiting castles and temples and adapting to a diet of predominantly Japanese food.

9. Adviser’s remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Daniel GOSDEN	(ID No. SP23102)
2. Current affiliation: University of Bristol/University of the West of England	
3. Research fields and specialties: Engineering Sciences	
4. Host institution: Tohoku University	
5. Host researcher: Prof. Kenjiro TADAKUMA	
<p>6. Description of your current research</p> <p>My research is in the field of Soft Robotics (robots which use soft or compliant materials, where traditional robotics research has considered only hard materials). For my PhD, I have focused on hydrogel materials. These materials can absorb large amounts of water, and often show some response to stimuli such as heat, light, or pH. In particular, one group of hydrogel, superabsorbent polymers, can rapidly absorb hundreds of times their own weight in water.</p> <p>Part of my research has looked at how these types of gels can be easily 3D printed. Typically, gels like this have either been cast, or have been used in granular form, which limits how they can be used. Being able to 3D print with the gels widens the opportunity for these gels to be used in soft robots.</p> <p>The application of such gels has formed a second part of my research. By harnessing the swelling that occurs as the gel absorbs water, we can gain useful actuation. I have looked at how superabsorbent polymers can be used in artificial muscles, the contraction of which is driven by placement in water. In salt water, however, the gel does not swell as easily, allowing the muscle to relax.</p> <p>In the case of actuators like this, the energy for actuation is derived from the environment itself, without requiring batteries or pumps. This echoes behaviours we see in natural organisms such as plants or fungi. While their growth may be slow, it comes for “free”. This idea of “environmental actuation”, and the idea that using it we can move towards soft robots which act like these plants or fungi, was the motivation behind my project for this placement.</p>	

7. Research implementation and results under the program

Title of your research plan:

Environmentally triggered growth of polymeric soft robotic root-like structures

Description of the research activities:

Applying the idea of “environmental actuation”, we began the project by looking at implementing eversion-type robots driven by the swelling of the superabsorbent polymer. To test this would involve designing and assembling the body of the actuator, and producing a time lapse recording of the movement in a water tank.

Initial results were promising, however the extent of movement appeared limited by the design. To resolve this, alternative materials and configurations were tested. However, through the investigation it became clear that the implementation would be fundamentally limited by the properties of the gel. As it swells, it would block the movement of new wall movement which should be moving through the centre of the actuator.

To move around this limitation, a different approach was taken. Instead of looking at an eversion-type robot, a new design was investigated in which all material is located at the actuator’s tip. This means that the gel can swell freely without restricting material movement.

Further work then investigated improvement of this design to improve the speed and uniformity of swelling, as well as laying the groundwork for a future project into a seed-like robot using the same materials.

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

The duration of the placement was a good length to get an initial experience of working in Japan, and to set up the potential for future projects.

I have been fortunate to have a lot of varied cultural exposure during the placement. However, the homestay was a particularly good experience. I also had the opportunity to attend a Japanese domestic conference, which was a very valuable experience from a research perspective, and one that I would recommend to future Fellows, if they have the opportunity.

9. Adviser’s remarks (if any):

JSPS Summer Program 2023
Research Report

1. Name: Eleanor Sheekey	(ID No. SP23103)
2. Current affiliation: University of Cambridge	
3. Research fields and specialties: Biological Sciences	
4. Host institution: Research Institute for Microbial Diseases, Osaka University	
5. Host researcher: Prof Tohru Ishitani	
6. Description of your current research	
<p>Cancer is considered a genetic disease and affects all of us either directly or indirectly via friends and family members. The most commonly mutated gene seen in human cancer encodes the protein I study, p53, also known as the ‘guardian of the genome’. p53 binds DNA and activates genes in response to stress. Mutations in this gene for p53 also arise with age. Most of these mutations occur in the DNA binding domain of p53 preventing the canonical function of responding to cell stress, so-called missense mutations. As a graduate student at the University of Cambridge, I’ve been examining what happens to cells that possess both wild-type and mutant p53 (p53^{+R175H}) – an early stage of tumorigenesis – how it affects the cell fitness to different cell stresses and how it perturbs or awakens novel DNA binding sites. Human tissues such as the oesophagus possess ~5-15% p53^{+R175H} cells, with the number increasing with age. While we do not all have cancer, cancer likelihood increases with age, and therefore, these cells could be causal.</p> <p>Ultimately, it has enabled me to explore the functionality of mutant p53. However, so far, this work has been conducted in cell lines. At Osaka University, I will be examining in Tohru Ishitani’s lab the organismal response to p53 missense mutation using zebrafish as a model.</p>	

7. Research implementation and results under the program

Identifying the response to heterozygous mutant-p53 cells:

To investigate this question, I have been mating and subsequently injecting transgenic zebrafish embryos, such that only the mutant-p53 protein is expressed in the skin. The rationale is that these cells, when mosaically introduced, can be easily tracked during the first week of development. Using this system, I was then able to track and quantify the number of p53-R175H cells in unstressed versus stressed conditions.

Main experimentation:

- Zebrafish handling/sex-sorting & embryo injection
- Fluorescence microscopy
- Confocal imaging & immunofluorescence
- SPiDER-Gal staining
- Image quantification

During my time in the lab I also attended lab meetings, journal clubs, and the 75th Annual Meeting of the Japan Society for Cell Biology.

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

During my stay I have had the opportunity to speak with many people, both practicing my Japanese but helping others with their English. With this communication in place, I have been able to explore many cities in Japan, try local cuisine and form strong friendships and memories with people both inside and outside of the lab. This allowed me to learn about the lifestyle here which will help inform my future career decisions. Everyone has been very welcoming and kind to me and have made me want to return to Japan in the future.

9. Adviser's remarks (if any):

Eleanor worked earnestly on her research, mastered inexperienced experimental techniques in a short period of time, and successfully obtained data that will serve as seeds for future research development through rapid troubleshooting and ingenuity. I would like to continue communication to link this species to research papers.

In addition, her participation was a good stimulus for my lab, and the Japanese students in my lab also enjoyed research exchanges and private exchanges with her. It was a valuable opportunity for the students to expand their future options.

JSPS Summer Program 2023 Research Report

1. Name: Farrukh Akhtar	(ID No. SP23104)
2. Current affiliation: Kingston University	
3. Research fields and specialties: Humanities	
4. Host institution: Kansai University	
5. Host researcher: Dr Akira Ikemi	
6. Description of your current research	
<p>My present research is a study 'Evaluating the impact of Focusing partnerships on the social connectedness and sense of belonging of students in Higher Education'.</p> <p>The research explores the impact of students participating in a Focusing partnerships (as part of a Focusing Skills course, especially in the following areas:</p> <ul style="list-style-type: none">• The impact on their sense of connectedness to themselves• The impact of the course on participants sense of connectedness to others, specifically their Focusing partners• The impact of the course on students' sense of belonging to their host institution <p>My time in Japan has been spent is An autoethnographic exploration of the intersectionality between Focusing & Buddhist meditation</p> <p>Description of the research activities:</p> <p>The method of Focusing is a new one in British Higher Education Institutions (HEI's) and one that is remains largely unexplored. However, it is well established within Japanese universities, and in Japan as a whole and is much more embedded within the cultural milieu.</p> <p>To date there have been over 30 theses from Japan exploring the impact of Focusing, and a third of these originate from Kansai University. Dr Akira Ikemi (my host) has supervised most of them.</p> <p>Dr Ikemi trained with Eugene Gendlin and is one of the founder members of the Japan Focusing Society. His recent work (Ikemi, 2021) explores the links between Focusing and mindfulness. In my informal discussions with Dr Ikemi, we have explored the possible variables that may have led to Focusing flourishing in Japan whilst it has been very slow to develop in the United Kingdom.</p> <p>One possible variable may be the similar steps that are involved in Focusing and some meditation practices, such as Zen Buddhism (Ikemi, 2021). As over 66.7% of Japanese people practice some form of Buddhism (largely Zen) (CIA, 2018), this may explain the popularity of Focusing in Japan.</p> <p>Dr Ikemi (2017) discusses the similarities between mindfulness and Focusing techniques and brings them together in 'Kanga Focusing'. But apart from this and his more recent paper Ikemi (2021) I am not aware of any other research in this area.</p>	

7. Research implementation and results under the program

Title of your research plan: **An autoethnographic exploration of the intersectionality between Focusing & Buddhist meditation**

The research carried out in Japan involved the following:

- To meet and spend time with Dr Ikemi and his students and to get a felt sense around their lived experiences of Buddhist meditation and Focusing, and also Kanga Focusing within a formal HE context.
- Interviewing six people (with experience of Focusing, Buddhist meditation practice, or both) about their experiences.
- To visiting and experiencing the many Buddhist temples and monasteries in the Imperial City of Kyoto (which is close to Kansai University, Osaka). This also involved attending two formal Zazen Buddhist meditation classes.

The data from the interviews has been transcribed and I am in the process of thematically analysing it. The written notes from my own autoethnographic experiences will also undergo a thematic analysis when I am back in the UK.

The final results will be written up and formally disseminated in a peer reviewed journal.

The whole experience has been overwhelmingly positive. The organization from JSPS has been impeccable. My host university have been warm and welcoming and have extended themselves to ensure that my needs as a researcher are fully met.

I am indebted to my host Dr Akira Ikemi, for making himself so generously available, and so attentive to my learning. I know that, at times, this has been at considerable cost to his usual work.

The knowledge and experience that I have gained by spending time in Japan has been invaluable in providing me with many new perspectives on Focusing. This I will take with me.

Japan has been exciting and fresh, it's people warm and welcoming. At times I have felt so at home here, it has felt as if I have always lived here. Indeed, I hope I may be allowed to return 😊.

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

I did not experience the Homestay Programme.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Frances Hu	(ID No. SP23105)
2. Current affiliation: The University of Manchester	
3. Research fields and specialties: Engineering Sciences	
4. Host institution: University of Tokyo	
5. Host researcher: Prof Akiko Kumada	
6. Description of your current research	
<p>Title: “Dynamic stressing of subsea cable insulation for floating offshore wind applications”</p> <p>The demand for more renewable energy is a key driver for floating offshore wind turbines in locations where traditional fixed-bottom designs are no longer economically viable. The cost of subsea cable repair includes not only the cost of the repair but also the loss of wind farm production over the repair period and the use of temporary emergency generators. In floating wind turbine applications, the cable is exposed to dynamic movement from the surrounding environment as it hangs from the floating platform to the seabed. With the introduction of extra mechanical stresses from tidal movements, there is an additional concern for cable failure.</p> <p>A well-known pre-breakdown phenomenon which can lead to insulation failure in high voltage power cables is electrical tree growth. Electrical trees are formed of gaseous channels and the processes which drive initiation and growth through solid dielectrics are not fully understood.</p> <p>The current project investigates the effect of mechanical strain on electrical tree growth in XLPE cut from cable samples. Partial discharge, tree growth rate and other electrical tree parameters have been investigated with static strain applied. Future work will investigate the effect of dynamic strain to understand how dynamic electrical and mechanical stress affects tree growth.</p>	

7. Research implementation and results under the program

Title of your research plan:

“Impact of Dynamic Mechanical Strain on Insulation Reliability of AC cables for floating offshore wind applications

Description of the research activities:

High voltage experiment setup to complete electrical treeing tests under 50, 250 and 500 Hz.

Tests completed on XLPE samples under 2 and 5% tensile and compressive strains as well as no strain condition. Total of 25 tests completed.

Growth rate, initiation time and partial discharge measured during energization.

Preliminary results show that under higher frequencies, tree growth rate is faster as expected from previous studies.

Similar to the 50 Hz condition, under 500 Hz, strain influences the final tree geometry however this effect is reduced under higher frequencies. Under compressive strain, the tree grows wider and under tensile strain, thinner.

The time taken for the electrical tree to initiate increases with compressive strain and similar to tree geometry, this effect is reduced under higher frequencies.

At 500 Hz, the growth rate increases with 5% tensile strain and decreases with 5% compressive strain while 2% strain has no influence. However, this is not seen under the 50 Hz condition.

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

I have been lucky enough to work in a wonderful laboratory environment under Kumada Sensei and with other laboratory members. Very grateful for the opportunity to spent a summer in Japan thanks to the JSPS program.

9. Adviser's remarks (if any):

During the limited time her stay in Japan, she constructed an experimental system and carefully obtained systematic and valuable data on the effects of mechanical stress on the growth and shape of treeing. After returning to her home country, she is expected to continue discussing the contents and reflect them in international conferences, journal papers and doctoral theses. Her enthusiastic and sincere approach to research has had a positive influence on the students in my laboratory. I believe that both she and our host-laboratory made full use of the opportunities given to us.

JSPS Summer Program 2023 Research Report

1. Name: Fraser Arnold	(ID No. SP23106)
2. Current affiliation: Department of Chemistry, University of York, United Kingdom	
3. Research fields and specialties: Chemistry	
4. Host institution: National Institute for Materials Science (NIMS)	
5. Host researcher: Professor Katsuhiko Ariga	
6. Description of your current research	
<p>Cyclic molecules with large open apertures have enticed synthetic chemists for decades owing to their fundamental ability to encapsulate filter smaller ‘guest’ molecules as well as the potential to interconvert between different macrocyclic configurations.¹ Over the last 20 years, a new class of rigid, shape-persistent molecular triangles have been developed as hosts for electron-rich guests and six-electron acceptors for use as cathode materials in Li-ion batteries.^{2,3} Furthermore, the macrocycles can self-assemble into chiral helices or two-dimensional tessellated sheets.^{2,4,5} The study of molecular triangles had been limited to unsubstituted aromatic cores, until 2023, when a core-brominated triangle using was reported where the presence of the halogen atoms influences the solid-state packing to form a hydrogen-bonded organic framework which encapsulates n-hexane solvent.⁶</p> <p>My current research investigates the impact of core-functionalisation on the structural and optoelectronic properties of molecular triangles, through the addition of three or six bromine atoms or 3,5-dimethylbenzene groups. Consequences that emerge from core-functionalisation of molecular triangles include (i) greater binding of electron-rich guests, (ii) room-temperature phosphorescence, (iii) enhanced photo-induced reactivity. (iv) easier addition of electrons through electrochemical reduction and (v) dynamic atropisomerism.</p> <p>¹<i>Chem. Commun.</i>, 2021, 57, 9029, ²<i>Angew. Chem. Int. Ed.</i>, 2013, 52, 13100, ³<i>Adv. Mater.</i>, 2015, 27, ⁴<i>J. Am. Chem. Soc.</i>, 2019, 141, 17783, ⁵<i>Acc. Chem. Res.</i>, 2021, 54, 2027, ⁶<i>Angew. Chem. Int. Ed.</i>, 2023, 62, e202217903.</p>	

7. Research implementation and results under the program
Title of your research plan: Redox-Active Macrocycles for Porous, Thin-film Ion Transistors
Description of the research activities:
Electro-active materials for use in electronic devices are in increasing demand and thus are required to be low costing, lightweight and readily available. These requirements can be met by organic semiconductors which can be used in devices including ion-gated transistors and photovoltaic cells.
The ability of core-functionalised molecular triangles to (i) assemble into ordered crystalline frameworks, (ii) encapsulate electron-rich guests and (iii) accept electrons <i>via</i> electrochemical reduction made them suitable candidates for use as organic semiconductors. In order to achieve these longer-term device objectives, we assumed to (i) establish conditions for thin-film formation, (ii) determine the assembly habits of molecular triangles at air-liquid interfaces and (iii) demonstrate proof-of-concept optical and redox-activity for the thin-films.
Initially, we studied how molecular triangles substituted with electron-poor or bulky, electron-rich functional groups assemble at the air-water interface by dispersing solutions of macrocycles onto a water surface and allowing the solvent to evaporate.

Upon compression of the resulting layer of molecular triangles, the surface pressure increased and we were able to deduce that the macrocycles possibly assemble 'stood-up' with the cavity of the macrocycle perpendicular to the water surface.

After we characterised the nature of the assembly of molecular triangle monolayer thin-films at the air-water interface, we proceeded to study their structure using X-ray diffraction (XRD) and optical properties using UV-vis absorption spectroscopy. For triangles with bulky, electron-rich pendant groups the diffraction pattern revealed a monolayer with homogenous coverage on the surface whilst clearly resolved absorption peaks were observed at the same wavelengths as in the solution state. Conversely, for the monolayer containing electron-poor functional group appended macrocycles, the X-ray diffraction pattern was similar to that of the glass substrate and the absorption spectrum was less resolved. These XRD and UV-vis spectroscopy results led to a conclusion that thin-films of triangles with bulky, electron-rich pendant groups experienced stronger interactions with the glass surface compared with the electron-poor functional group substituted macrocycles.

We also investigated the behavior of the electron-deficient macrocycles when mixed with different electron-rich polymers. It has previously been shown that electron-rich polymers can form intercalated chains in the crystalline state, with the cavity between chains being able to encapsulate the electron-acceptor fullerene. We envisaged that mixing electron-poor molecular triangles with electron-rich polymers would also form such intercalated bimolecular systems with a potential application as a photovoltaic device in solar cells. We analysed crystalline thin-films of triangle/polymer mixtures formed from spin-coating using XRD, with the resulting diffraction pattern revealing spacing between polymer chains increasing slightly in the presence of core-functionalised molecular triangles. This promising result indicates potential incorporation of highly electron-poor molecular triangles within the intercalated polymeric crystalline thin-film structure. This could lead to the application of thin-films as photovoltaic devices in solar cells, however, further optimisation of conditions for thin-film fabrication is first required.

The research completed during this JSPS summer project has utilized the favourable properties of core-substituted molecular triangles as electron-deficient, electro-active hosts to investigate their suitability as organic semiconductors through fabrication of thin-films. In the future by designing and tuning the core-functionality of molecular triangles, the assembly and formation of macrocyclic thin-films could be improved allowing for additional property analysis and application in electronic devices.

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

I am very grateful to my co-workers who have been very welcoming during my stay, introducing me to different Japanese foods and helping me to learn the language. I have also enjoyed different cities (Tottori, Nagoya, Himeji and Tokyo) and experiencing different sporting events including football, baseball and especially the Grand Sumo Tournament.

9. Adviser's remarks (if any)

Mr Arnold investigated various fabrication conditions of the PMDI film and their electrochemical characterisations, which made significant progress for the device applications even in a short stay. He actively communicated with the researchers/students in my group. The future progress of this project by the Japanese and British teams is highly expected.

JSPS Summer Program 2023 Research Report

1. Name: Heather ANNAN	(ID No. SP23107)
2. Current affiliation: University of Glasgow	
3. Research fields and specialties: Humanities	
4. Host institution: University of Tokyo	
5. Host researcher: Prof. John O'DEA	
6. Description of your current research	
<p>Autism prevalence rates are three times higher in Japan (3%) than the global average (1%). The reason for increased prevalence rates in Japan is currently unknown.</p> <p>During this research visit I have been working independently to examine how the theory of autism that I am developing in my PhD thesis, which investigates perceptual and attentional differences as a core aspect of autism, could account for increased autism prevalence rates in Japan.</p> <p>Throughout this research project I have identified differences in field dependence-independence as particularly relevant aspects which might help to explain increased autism prevalence rates in Japan. Field dependence-independence refers to the ability to separate embedded parts from their contextual wholes. Individuals who utilize a 'field-independent' processing style find it easier to separate embedded parts from their context while individuals who utilize a 'field-dependent' style find it difficult to separate parts from their contextual backgrounds. Visual tasks such as the Rod-and-Frame Test and the Embedded Figures Test have been used to examine these abilities. These tests have been used to separately study both Japanese populations and autism populations. The results of these studies generally indicate that autistic participants tend to utilize a 'field-independent' style while Japanese participants tend to utilize a 'field-dependent' style. One potential explanation for the increased prevalence rates in Japan may be that autism is more noticeable and/or reported more frequently due to greater social differences which arise as a result of these differences in visual processing style.</p>	

7. Research implementation and results under the program

Title of your research plan:

Autism and attention – investigating national differences

Description of the research activities:

During this research project I have conducted an extensive literature review on national differences in attention and perception and on attentional and perceptual differences in autism populations. As outlined above, I have identified differences in field dependence-independence as potentially relevant factors which may provide a possible explanation for increased autism prevalence rates in Japan.

Throughout this research project I have met with other philosophers who specialize in philosophy of mind to discuss my theory and I have also presented talks at both the University of Tokyo and Hokkaido University.

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

I have learned a lot about how autism is socially perceived in Japan and about early years support opportunities. I have also enjoyed learning and using Japanese. Thank you to both the JSPS and the University of Tokyo for making this research trip possible.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Henrik Pak Hong Wong	(ID No. SP23108)
2. Current affiliation: The University of Manchester	
3. Research fields and specialties: Medical, Dental and Pharmaceutical Sciences, Engineering	
4. Host institution: The University of Tokyo	
5. Host researcher: Professor Ikuro ABE	
6. Description of your current research	
<p>My current research focuses on the molecular modeling and simulation of biocatalysts in iron systems, such as heme and nonheme enzymes. I use theoretical model complexes and Quantum Mechanics / Molecular Mechanics (QM/MM) techniques to conduct mechanistic studies of novel enzymes. Specifically, I am specialized in applying density functional theory (DFT) in quantum chemical calculations to define complex chemical and biological systems in molecular scales. I also use molecular dynamics (MD) simulations to validate the behavior of my models in nature. My research aims to provide insights into the nature of high-valent oxo-iron oxidants and their biological roles and activities. These studies lay the foundation for understanding how nature catalyzes important reaction mechanisms, and their broad applications in bioengineering, drug discovery and reactivity. I hope to be promoting green chemistry and innovative sustainable approaches to the chemical industries.</p> <p>Keywords Molecular Modelling QM/MM DFT Biosynthesis Enzyme Iron</p> <p>Research Platforms (Optional) Email: henrik.wong@manchester.ac.uk Manchester Profile: https://research.manchester.ac.uk/en/persons/henrik-wong LinkedIn: https://www.linkedin.com/in/henrik-wong-2962a7180/ Research Gate: https://www.researchgate.net/profile/Henrik-Wong?ev=hdr_xprf Twitter: https://twitter.com/HenrikPHWong</p>	

7. Research implementation and results under the program

Title of your research plan:

Origin of the Stereoselectivity and Substrate Specificity of the Fe(II)/ α -Ketoglutarate-Dependent Oxygenase Tqal.

(Research in Progress)

- **MD Simulation completed.**
- **QM Simulation Reactant Complex Optimized**

Description of the research activities:

- Developing computer models of complex enzymatic systems*¹
- Developing novel reaction pathways of chosen enzymes*²
- Solving chemical equations using chemical programs (DFT)*³
- Performing statistical analysis of data*⁴
- Interpreting the results of computer simulations*⁵
- Communicating findings to groups*⁶

Justifications

1. Using computer programs to create models of enzymes and their interactions with other molecules. This can be used to study the structure, function, and dynamics of enzymes.
#Collaboration with RIKEN (Fusako 富岳 Supercomputer)
2. Involved using computer programs to simulate the reactions that enzymes catalyze. This can be used to identify new reaction pathways that enzymes can use, and to study the mechanisms of these reactions.
3. Applying density functional theory (DFT) to calculate the properties of molecules. DFT is a powerful tool for studying the properties of molecules, and it can be used to calculate the energies, structures, and reaction pathways of molecules.
4. This involves using statistical methods to analyze data from experiments and simulations. This can be used to identify trends in the data, and to test hypotheses about the data.
5. Interpreting the results of computer simulations and using them to draw conclusions about the behaviours of molecules or systems.
6. Regularly reporting to supervisors and principal investigator this can be done in the form of presentations and reports. (2 times a week)

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

While exploring the University of Tokyo campus, I was particularly impressed by the Akamon (赤門), a gate that dates back to the Edo (江戸) period. The history of the building, which was once owned by the Maeda clan (前田), sparked my interest in the Sengoku period and the famous samurai Maeda Toshiie (前田利家), who was the founder of the Kaga clan (加賀藩の祖). In addition, I have met many people both in my group, homestay, and on the street (please find it on the photo-uploader). Everyone is very kind to me, and I appreciate the relationships we have built. I really wish to come back for another JSPS internship as soon as possible!

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: HARRIS, Kieran William	(ID No. SP23110)
2. Current affiliation: University of Manchester	
3. Research fields and specialties: Engineering Sciences	
4. Host institution: Kyushu University	
5. Host researcher: Prof. Keiji TANAKA	
6. Description of your current research <p>Epoxy polymers are often used as coatings and adhesives, and contain two main component chemicals – an epoxide and a crosslinker, which is often an amine. Additive particles can also be added to improve mechanical properties and provide colour to the polymers. At the interface of the polymer with surfaces of substrates and additive particles, differences in chemistry, size and shape of the epoxide and crosslinker species can result in preferential adsorption, resulting in an imbalance of reactants close to the surface. This may prevent the polymer from fully reacting and compromise the mechanical and chemical properties. While there has been some qualitative experimental measurement of unreacted epoxy polymers close to such interfaces, quantitative measurement is difficult due to the nanometer scale of the interface.</p> <p>Using atomistic simulations, we aim to provide insight into the structure of epoxy polymers at common substrate interfaces. Due to the prevalence of steel in infrastructure, common iron oxides are used as model surfaces. In order to more easily simulate the chemical reactions involved in polymerization, most previous research replaces the epoxy chemical with its “activated” form, in which the reactive groups of the molecule are replaced with a similar group, a reactive intermediate, that more closely resembles the final product. This makes forming the crosslink bonds in code significantly easier, and the effect of the use of the reactive intermediate on the bulk polymer structure is negligible. However, the use of reactive intermediates in simulations has a significant impact on the interactions of the species with substrate surfaces. Therefore, a crosslinking method has been established which removes the requirement for “activated” epoxies to enable the production of more accurate polymer structures at the interface with substrate surfaces.</p> <p>Structural properties such as the degree of crosslinking as a function of distance from the surface can be obtained from atomistic simulation results. These show a significant hindering of the cure at the substrate-polymer interface for all iron oxides investigated, in agreement with experimental findings. This results in large amounts of small polymer chains and unreacted monomers, which may impact the adhesion of the larger polymer to the surface. However, the reduced conversion close to the surface also results in unreacted terminal groups of the main polymer, which adsorb very strongly to the surface, which may act to assist the adhesion of the polymer to the surface.</p>	

7. Research implementation and results under the program

Title of your research plan:

Comparison of Crosslinking Techniques in Molecular Simulations

Description of the research activities:

In the Tanaka laboratory, an alternate method of forming crosslinked structures is used, which accounts for the heat produced by polymerization reactions, and the effect of this heat on the rate of subsequent reactions. This is not considered by the code used in Manchester. By simulating the polymerization of identical systems using both methods, the effects of this consideration can be directly compared for the system of interest.

Simulations of bulk polymer crosslinking have been performed. Early analysis of the structures produced by the heat of reaction method show a larger proportion of unreacted and fully reacted components, and a smaller proportion of partially reacted components, compared to previous simulations not involving heats of reaction. This supports the hypothesis that the heat produced by initial reactions promotes the reaction of nearby molecules, resulting in clusters of high and low polymerization which are not present otherwise. The degree of conversion at which the polymer becomes primarily composed of a single, macroscopic chain has also been calculated and shown to agree well with theoretical predictions.

Iron oxide surface polymerization simulations are ongoing at the time of the writing of this report.

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

My coworkers were kind enough to take me to a wide variety of restaurants in the surrounding area, giving me the opportunity to try a lot of new foods, all of which I have enjoyed greatly. The students in the lab even held a welcome barbeque for me, giving me the chance to try traditional Japanese yakiniku.

I have loved having the opportunity to see the beautiful scenery of the Kyushu area, including the dense forests of Yakushima island, Sakurajima volcano and even the basalt cave Keya no Ooto here in Itoshima.

9. Adviser's remarks (if any):

He quickly became accustomed to the laboratory environment and was able to begin his research smoothly. He reported to me what he had conducted each week and we had active discussions. Although it took him only about two months, he was able to achieve his goal regarding the simulation of epoxy resins. I hope that after his return to the UK, he will further discuss the results and summarize them in a paper.

JSPS Summer Program 2023 Research Report

1. Name: Mark Philip Lynch	(ID No. SP23111)
2. Current affiliation: University of Warwick	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Kyoto University	
5. Host researcher: Prof. Ryoichi Yamamoto	
<p>6. Description of your current research</p> <p>Physical, chemical, biological, and social systems can be understood as particular dynamical systems, in which the time-evolution of the state follows a given rule or law. Many of these systems can be represented as “differential games” where different interacting individuals are each seeking to simultaneously maximise their own utility function by modifying their behaviour. Here we consider rational individuals socially distancing in an epidemic.</p> <p>Given a specific form of utility, one can solve the related constrained optimal control problem to derive optimal system dynamics that result in the maximal utilities for each individual. We seek to use Machine Learning techniques to solve the inverse problem, that of inferring some unknown utility function that is being optimised by given system dynamics. Usually this has been solved by assuming some fixed form of the utility. We propose a more ambitious machine learning framework that is able to infer this hidden utility assuming no knowledge of the form of this function. The main issue to address is how to perform the learning of such a function using solely measurable data (the state of the system at any given time), that is, without knowledge of the hidden variables required to define the underlying constrained optimization problem (i.e., the Lagrange multipliers). Once the method has been established we will be able to analyze real-world epidemics data, observing the number of susceptible and infected individuals over time, and investigate the hidden functions that were being optimised for by the population. Not only this, but our method could then be applied to different systems representing differential games in fields such as economics and engineering.</p>	
<p>7. Research implementation and results under the program</p> <p>Title of your research plan:</p> <p style="padding-left: 20px;">Inferring the Utility from Optimal Behaviour in an Epidemic using Neural Networks</p>	

Description of the research activities:

Being in Japan allowed me to work more closely with an external partner for my PhD Project John Molina, a researcher in Physics Informed Machine Learning for Soft Matter Dynamics. During this time, we assessed our current Neural Network structure which relies on knowledge of these “hidden variables” (the Lagrange Multipliers). We were able to come up with an idea of a new, adapted structure that would give predictions for the utility without knowledge of these variables. As of writing this report, our formulation is very computationally expensive and is still in the testing phase. We hope to continue our work with this method as we are optimistic about it’s chances of success.

I was also fortunate enough to attend two academic conferences whilst in Japan. The first being STATPHYS28, where I orally presented this work, and the second being ICIAM 2023, where I presented a poster on this work.

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

Kyoto was a beautiful city to explore with many places to visit. A couple of particular highlights were visiting Arashiyama Park and the Fushimi Inari Taisha shrine. The Gion Matsuri Festival was an opportunity to find out more about Japanese culture and tradition, as well as try some very nice street food! Kyoto is also very well connected, it was easy to take a day trip to Osaka and Hiroshima for the different attractions and history in this country.

9. Adviser’s remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Natasha Brock	(ID No. SP23112)
2. Current affiliation: Rothamsted Research	
3. Research fields and specialties:	
Humanities	Social Sciences
Chemistry	Engineering Sciences
Agricultural Sciences	Biological Sciences
Interdisciplinary and Frontier Sciences	Mathematical and Physical Sciences
Medical, Dental and Pharmaceutical Sciences	
4. Host institution: University of Tsukuba	
5. Host researcher: Prof Ezura and Dr Ishiga	
6. Description of your current research	
<p>My PhD project is re-engineering amino acid metabolism in wheat grain using CRISPR/Cas9. Wheat is a vital crop for global food security, with over 2.5 billion people subsisting on wheat. Most animals, including humans, cannot synthesise lysine and so must gain it from their diet. Bread wheat (<i>Triticum aestivum</i>) contains low concentrations of lysine which has led to nutrient deficiencies, particularly in developing countries. In developed countries people obtain sufficient lysine from consuming meat as a main aspect of their diet. Farm animals, such as pigs and chickens, which are nutritionally dependent on grains also suffer from lysine deficiency, leading to imported soybean taking much of the market for animal feed manufacture in the UK and EU. To produce a sustainable and readily available supply of plant-sourced lysine will be essential for a more sustainable global agri-food system in the future.</p> <p>Lysine is synthesised by the DAP (diaminopimelate) pathway, of which the rate limiting step is the conversion of L-aspartate semialdehyde and pyruvate into (4S)-4-hydroxy-2,3,4,5-tetrahydro-(2S)-dipicolinic acid, catalysed by the enzyme DHDPS (dihydrodipicolinate synthase). High levels of lysine are prevented from building up inside the plant due to negative feedback inhibition by lysine (Soares da Costa et al., 2018).</p> <p>Using genome editing via CRISPR/Cas9 and a DNA-repair template using homology-directed repair, I will edit the wheat DHDPS gene so that the enzyme it encodes no longer binds lysine. As a selection mechanism I will use a lysine analogue that competes with lysine for protein incorporation and inhibitory compounds of DHDPS. Crucially, the inhibitors bind DHDPS over the lysine binding site and the changes that render DHDPS lysine-insensitive will also make it resistant to the inhibitors. I will synthesise these selective agents as they are not commercially available. Once I have grown the edited wheat to maturity, I will characterise the editing events that have occurred and measure the concentration of lysine.</p>	

7. Research implementation and results under the program

Title of your research plan:

Genome editing for improved agricultural traits and a review of gene edited crops in Japan.

Description of the research activities:

I have achieved the research aims that I outlined before arriving in Japan: Research genome editing techniques used to edit crops for improved agricultural traits, including high GABA tomatoes and long shelf-life melons, learn about the National Agriculture and Food Research Organisation's (NARO's) work on producing low-toxin potatoes, investigate how the commercialisation of gene edited crops has been implemented across Japan, using Sanatech Seeds Co. Ltd as a case study.

In addition to these aims, I have learnt about various projects at (Japan International Research Center for Agricultural Sciences (JIRCAS) including heat stress tolerance in tomatoes and rice, BNI wheat, salt and drought tolerant soybeans and Asian soybean rust. JIRCAS's work is focused internationally which is a different approach and focus to my own research institute. Learning about their successful collaborations, particularly in developing countries, was intriguing to see how these projects come about and the amazing results which can be achieved through this international collaboration.

At NARO, I also discussed their gene edited wheat, using CRISPR, to address pre-harvest sprouting which was incredibly useful and beneficial for my own PhD project. They have used a very similar technique to achieve their transformed wheat which allowed for me to discuss any problems that they faced and obtain some advice for my own PhD project.

My time at Sanatech Seeds was fascinating, with invaluable discussions with the President, Chairman, and key researchers, giving me unique insight into the Japanese regulations for gene edited crops. Commercialisation of GE crops is still in its infancy in the UK and this was an valuable experience to learn about the process and struggles bringing a GE product to market and gaining approval internationally.

I also had the opportunity to discuss the many different social factors that can impact social acceptance of GE crops in Japan, and other countries internationally, with experts from the field in sociology. This is very different from my own research, which gave me the chance to view the same issue from a different perspective and in turn has developed my own opinions gene edited crops, and how they could benefit society, if employed in the right way.

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

I have thoroughly enjoyed my time in Japan and would love to come back in the future. During my time here I took part in the homestay program which I absolutely loved and would highly recommend to anyone else. My experience has been made even better by all the kind and generous people that I have met here, everyone has been so nice and welcoming which really added to my enjoyment here.

9. Adviser's remarks (if any):

I am confident that this JSPS Fellow has been exposed to the forefront of the development and use of genome-edited crops in our country. I hope that this experience will be of great help to the Fellow in her future career as a researcher and engineer. I also look forward to continuing to network with the Fellow and Japanese researchers in the future.

JSPS Summer Program 2023 Research Report

1. Name: Niamh Hanrahan	(ID No. SP23113)
2. Current affiliation: University of Manchester	
3. Research fields and specialties: Humanities	
4. Host institution: Ritsumeikan University	
5. Host researcher: Associate Professor Yasuko HASSALL KOBAYASHI	
6. Description of your current research In my PhD project in the Humanitarian and Conflict Response Institute at the University of Manchester, I focus on Jewish refugees from Europe who made the journey to Japan to escape Nazi persecution. I argue that understanding this Jewish refugee movement evidences both the options and limitations that WWII refugees faced on a global scale. This can only be fully understood through a perspective which takes Japan into consideration, which is lacking in current scholarship. I focus on the journey that they made, their lives whilst in Japan and the destinations they continued on to.	

7. Research implementation and results under the program

Title of your research plan:

Beyond Europe: Jewish Refugee Journeys and Humanitarian Aid in Japan (1931-1953)

Description of the research activities:

My research whilst in Japan has been focused on working with my host professor and conducting fieldwork., I worked with Associate Professor Yasuko Hassall Kobayashi within the College of Global Liberal Arts at Ritsumeikan University in Osaka. Professor Kobayashi specialises in historical migration and has highlighted the importance of a focus on wartime movement between Japan and Australia, a route that many of the refugees I study took.

I also used my time in Japan to visit key sites that refugees spent time in: Tsuruga, where many refugees arrived by boat, Yokohama and Kobe, where the vast majority stayed and later left Japan from. Whilst in Kobe, I made contact with a tour group who have done research into Jewish refugees in the city. In Tsuruga, I was able to meet with those running the Port of Humanity Museum and speak to them about the memory of Jewish refugees in Japan. I also visited Nagoya, where there is a memorial to Sugihara, the Japanese diplomat who gave Jewish refugees visas to Japan.

I was invited to present on my work at Hitotsubashi University in Tokyo, in a joint symposium between Ristumeikan Univeristy and Hitotsubashi University. I got great feedback on my research from the graduate students and professors who attended the talk. Whilst in Tokyo, I conducted research in the National Diet Library Archives, finding useful shipping information from documents held on the *Nippon Yusen Kaisha* Line.

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

I really appreciated the opportunity to take part in a homestay whilst in Japan and would encourage others to do so. Outside of my research, I was also able to travel to other areas in Kansai and particularly enjoyed Nara and Uji.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Pak-Hin LEE	(ID No. SP23114)
2. Current affiliation: University of Leicester	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Tokyo Institute of Technology	
5. Host researcher: Prof. Tadashi OCHIAI	
<p>6. Description of your current research</p> <p>A central topic in modern number theory is the study of arithmetic information encoded in special values of L-functions, such as the Birch–Swinnerton-Dyer conjecture and the Bloch–Kato conjecture. As a basic example, the identities</p> $1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots = \frac{\pi^2}{6},$ $1 + \frac{1}{2^4} + \frac{1}{3^4} + \frac{1}{4^4} + \cdots = \frac{\pi^4}{90}$ <p>were discovered by Euler and should be interpreted as special values of the Riemann zeta function $\zeta(s)$ at $s = 2$ and $s = 4$ respectively.</p> <p>The theme of p-adic deformations (which, roughly speaking, refers to the study of an arithmetic object by continuously deforming it into a family of similar objects in the world of p-adic numbers) has proved to be a powerful technique and lies at the heart of various modern breakthroughs in number theory; for instance, the proof of Fermat’s Last Theorem by Wiles involves deforming modular forms. One fruitful area of research is the arithmetic properties of adjoint L-values, which are a specific type of L-values that measure how certain arithmetic objects deform p-adically; this study was pioneered by Hida.</p> <p>My research concerns p-adic properties of automorphic forms (higher-dimensional analogues of modular forms) and special values of L-functions (higher-dimensional analogues of $\zeta(s)$), with a particular focus on the construction of p-adic L-functions. I expect my work to have various arithmetic and geometric applications, including instances of the Bloch–Kato conjecture and the geometry of eigenvarieties.</p>	

7. Research implementation and results under the program

Title of your research plan:

The arithmetic of adjoint L-values for $\mathrm{GSp}(4)$

Description of the research activities:

The arithmetic theory of adjoint L-values originated from Hida's works in the 1980's, which showed that the value $L(1, \mathrm{ad}(f))$ detects congruences between the modular form f and other modular forms. This phenomenon has been generalized to other automorphic forms, such as certain endoscopic Siegel modular forms by Lemma and Ochiai (2023). My research during the JSPS Summer Program aims to extend this work in a number of directions, in collaboration with both authors.

The first direction is to refine the congruence criterion, which relates the p -divisibility of adjoint L-values with the existence of congruences, into a precise formula connecting the p -order of adjoint L-values and the size of relevant congruence modules. In the case of modular forms, this was carried out by Hida (1988, 2000). After scrutinizing Hida's arguments, Professor Ochiai and I investigated how each step can be adapted to Siegel modular forms in the setting of Lemma–Ochiai and identified a few technical issues that require further work, such as the construction of a Hecke-equivariant pairing on cohomology and the structure of certain cohomology groups and Hecke algebras. We plan on continuing our collaboration to resolve these obstacles in the near future.

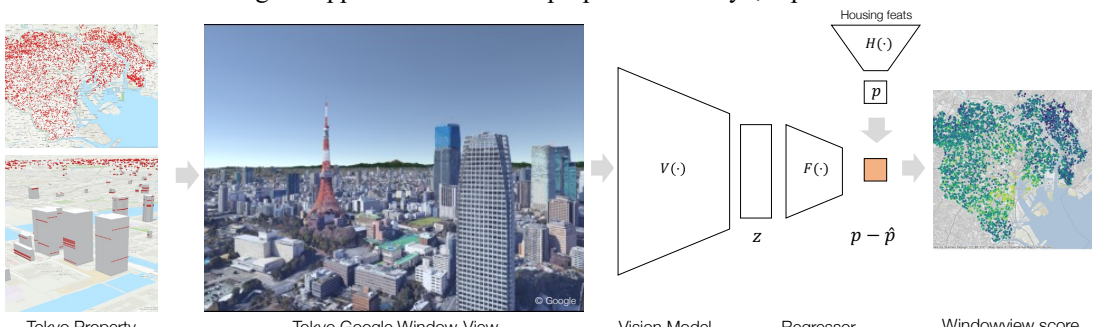
When such a p -order formula is available, it is possible to study integral period relations following the strategy of Tilouine and Urban (2022). For endoscopic Siegel modular forms arising as the Yoshida lift of two modular forms, there is a factorization of adjoint L-values similar to the case of quadratic base change studied in Tilouine–Urban. Together with Lemma, Professor Ochiai and I identified some complications in extending Tilouine–Urban's argument and discussed potential solutions. Based on these ideas, we will continue to work on this joint project in the longer term.

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

The JSPS Summer Program has provided me with a valuable opportunity to conduct research while gaining a deeper understanding of Japanese culture in an immersive environment. Among all the cultural and sightseeing experiences, the homestay program was undoubtedly the highlight of my visit. I feel very fortunate to be hosted by a family with generous hospitality and warmth. The time we spent together, as well as the many conversations we had, will be forever memorable.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Wai Pan Stephen Law	(ID No. SP23115)
2. Current affiliation: University College London	
3. Research fields and specialties: Social Sciences	
4. Host institution: Osaka Metropolitan University	
5. Host researcher: Professor Atsushi Takizawa	
<p>6. Description of your current research:</p> <p>Despite burgeoning interests in machine learning, there had been limited research that studies the value of urban and architectural design in cities. My research seeks to explore the value of these intangible goods leveraging on both data science techniques and new forms of data. Understanding the implicit value of urban design can act as evidence to improve the planning of cities in both Japan and worldwide as we face critical challenges such as climate change, inequality and livability in the future.</p>	
<p>7. Research implementation and results under the program</p> <p style="text-align: center;">Leveraging Google Maps Photorealistic 3D Tiles to estimate Tokyo Window-view Desirability</p> <p>Background: We yearn for a connection with nature and a sense of refuge from where we live and the vistas from within. Despite these inclinations, there has been limited investigation into appraising views from our residence[2,3]. The limited research can be attributed to the lack of data and computational methods for analyzing vistas from properties. To address this gap, this study will leverage on the newly accessible photo-realistic 3D tiles from Google Maps, the Plateau dataset and the At Home property dataset, coupling with machine learning techniques [1]. The aim of the research is to study the extent the views from homes can improve housing price/rent prediction accuracy and to establish a novel window-view metric for assessing the appeal of views from properties in Tokyo, Japan.</p> <div style="display: flex; justify-content: space-around; align-items: center;">  </div>	
<p>Fig1. Architecture of model</p> <p>Methodology (Fig1): Following the framework proposed in [1], we estimate a standard hedonic regression model $H(\cdot)$ that maps the standard housing attributes to rents. Second, we extract deep image features from two pretrained vision model $V(\cdot)$; i. Vision Transformer [4] and ii. Clip [5]. Third, we take the deep image features from these models to predict the residuals $p - \hat{p}$ from the first stage to infer a window-view desirability score that minimises the mean squared error loss function with $F(\cdot)$. For the experiment, we randomly split the data into a train and hold-out test-set (60-40 split), trained with the ADAM optimizer. Results are then reported and plotted geographically.</p> <p>Results (Fig2): We ran a baseline model with the standard housing attributes ($R^2=68.6\%$ and $rmse=0.196$) and then four other regression models on top of the baseline model. The base+clip model, which uses the Clip encoder, showed improvement over the baseline model ($R^2=78.8\%$ and $rmse:0.161$).</p>	

The baseline base+vit models (ViTLin) showed similar improvements ($R^2=78.9\%$ $rmse=0.160$). As ablations, we ran two additional ViT models (ViT_{MLP} and ViT_{Lin>2}). The former was trained with a neural network while the latter was trained on all properties above the second floor. The R^2 and $rmse$ showed only minor differences. As a result, we will use the simpler base+ViTLin for interpretations.

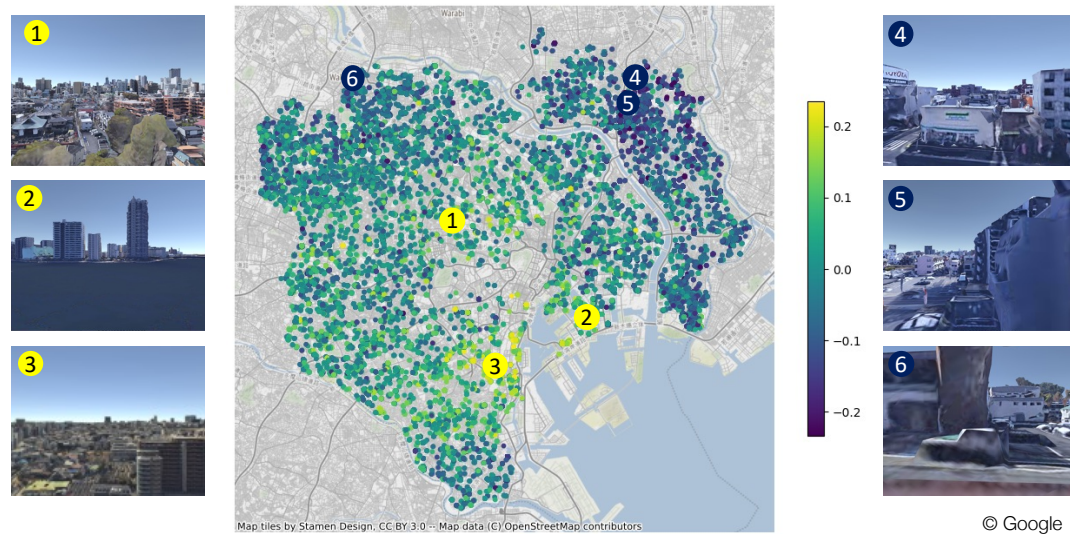


Fig 2. Window view desirability in Tokyo (centre) with selected top (left) and bottom (right) rank views.

To interpret the results, we visualised the Tokyo window-view desirability score geographically (Fig2). The window-view desirability map of Tokyo shows that the neighbourhood in the southwest with more expansive views towards Tokyo Bay have a higher window-view desirability, while the neighbourhoods to the east of Arakawa river with lower-level views have lower window-view desirability.



Fig 3. Visual explanations of top rank views (left) and bottom rank views (right)

Furthermore, the visual explanations (Fig3) [6] highlight that view of skyline and water bodies tend to have a positive impact while views of shorter buildings and car-parks to have a negative impact.

Discussion: To summarise, this research shows the window-view desirability in Tokyo can improve predictive accuracy on housing rents and the resulting metric can provide some intuitions on the window view quality in the city geographically. These findings indicate a potential need to enhance the quality of ground-level views in the city. Further research is necessary to validate the Window-view desirability metric through surveys as the next stage of the project.

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- [4] Dosovitskiy, A., et al., 2020. An image is worth 16x16 words: Transformers for image recognition at scale. *arXiv preprint arXiv:2010.11929*.
- [5] Radford, A. et al. (2021)., Learning transferable visual models from natural language supervision, in: *International conference on machine learning*, PMLR, 2021, pp. 8748–8763.
- [6] Zeiler, M. and Fergus, F. (2014). Visualizing and understanding convolutional networks, in: *ECCV 2014: 13th European Conference, Zurich, Switzerland, September 6-12, 2014*,

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I visited many places in the Kansai Region including Kyoto and Nara. I have also visited Awaji Island (Water Temple) with my host researcher which was fantastic as well as Sapporo Hokkaido for the Artificial Life Conference in July.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Audrey ANNE	(ID No. SP23201)
2. Current affiliation: Caen university	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Tohoku University, Department of Physics, Faculty of Science	
5. Host researcher: Pr. E. Hiyama	
6. Description of your current research My research is related to the analysis of multi-neutron correlations in the decay of heavy Helium isotopes, motivated by the recent observation by the SAMURAI collaboration of a strongly correlated 4-neutron system. I implement multi-neutron decay channels in a Monte-Carlo simulation of the SAMURAI/NEBULA setup, explore the cross-talk rejection algorithms needed in the case of the detection of several neutrons in coincidence, and finally compare the different decay hypotheses to existing experimental data on the decay of ^8He into $^4\text{He}+4n$. These experiments are being undertaken at the Radioactive Isotope Beam Factory (RIBF) of the RIKEN laboratory in Japan. The LPC group (Laboratoire de Physique Corpusculaire de Caen) has obtained important experimental results and works in close collaboration with theoretical experts in the field for their interpretation, in particular with Emiko Hiyama's group at Tohoku University. Hiyama-san's group has already contributed to their research through calculations on the structure of the tetraneutron system, and more recently on the interpretation of strong correlations of the 4 valence neutrons in Helium-8.	
7. Research implementation and results under the program	

Title of your research plan: Theoretical description of neutron resonances

Description of the research activities:

During this program, I worked on theoretical calculations and simulations of few-body systems. Pr. Hiyama taught me her method to calculate few body interactions: the Gaussian expansion method (GEM). With this method we can calculate the states of few body systems. For systems with only 2 bodies, the analytical method can be used, however, for systems with 3 bodies and more, these calculations become difficult. For such systems, we can use the variational method that uses a trial function to compute states. The difficulty of this method lies in finding a good trial function. GEM is a variational method using functions expanded in terms of a set of Gaussian basis functions.

I began calculating the energy of few-body systems to compare the different methods. Then I used a code to compute energy states and wave functions of few body systems using the GEM method. The results are in very good agreement with data. This method can be used to study few body systems with 3 bodies or more.

I went to the RIKEN research facility to visit experimental areas and see the experimental setup and detectors I will work with during my Ph.D. I also went to RCNP in Osaka to meet other researchers and visit their research facility.

Since I will start an experimental PhD next October, being able to work with Hiyama-san on the related theory a few months earlier gave me a unique perspective in the field, and will allow me to make the most of my PhD from the start.

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

I experienced a lot of cultural experiences such as festivals, fireworks, baseball-game, etc. I also visited several cities with other fellow students and see various places. I was able to appreciate the richness of Japanese culture throughout my stay, both historically and culinarily.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Guillaume Bernard	(ID No. SP23202)
2. Current affiliation: Paris-Saclay University	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Tohoku University	
5. Host researcher: Prof. Makoto Kohda	
6. Description of your current research	
<p>My current research is in the field of spintronics and focuses on controlling the properties of magnetic materials with an electric field. This technique, called magneto-ionics, consists in moving oxygen species towards the surface of a magnetic film. The interaction at the surface changes the magnetic properties of the device. The goal is to design a new class of artificial intelligence hardware based on spintronics nanodevices that will have additional memory features thanks to the magneto-ionic gating. Changing the magnetization of the magnetic film is done using the spin-orbit torque mechanism. My current work focuses on characterizing the devices and discussing with AI experts to find the optimal device architectures and algorithms.</p>	

7. Research implementation and results under the program

Title of your research plan:

Magneto-ionic control of magnetization switching in spintronics nanodevices

Description of the research activities:

My goal was to measure the impact of magneto-ionic gating on the spin-orbit properties. Knowing these properties is essential to understand the behavior of the devices.

I adapted the existing setup and optimized measurement parameters to perform Second Harmonic Hall measurements.

Measurements were performed in multiple magnetic field directions and magneto-ionic states.

The Field-like and Damping-like spin-orbit torques were measured using this method. I showed the dependency of the Second Harmonic Voltage with the magneto-ionic effects. The discussion and interpretation of the measurements is still ongoing with the host research team.

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

I enjoyed several Japanese summer festivals like the Tanabata festival of Sendai. I also discovered Japanese culture through the time spent with my homestay family.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Simon BESGA	(ID No. SP23 203)
2. Current affiliation: University of Montpellier	
3. Research fields and specialties: Computer Sciences	
4. Host institution: University of Tokyo	
5. Host researcher: Pr. Gentiane VENTURE	
6. Description of your current research	
<p>In one hand, immersive analytics is defined as the science of computer-aided analytical reasoning facilitated by immersive human-computer interfaces. This means that data foraging and sensemaking processes are performed in cooperation with a computer, and with the ability to interact with a system using additional or more-immersive displays and user interface techniques. Virtual reality (VR) is one of those technologies often used in immersive analytics problems. The study of humans affective and cognitive states (ACS) is an important part of VR research and is used to provide more immersive and impactful environments. Indeed, virtual environments (VE) can be modulated in a more or less transparent way in order to adapt itself to the user's affective and cognitive state.</p> <p>On the other hand, physical interactions have often been studied in Human-Robot Interaction (HRI), in order to understand human states when interacting with robots. This question can raise security issues, particularly when human and robot objectives differ. HRI data can be overwhelming and finding appropriate deductions from a large dataset is an extremely difficult task. Most people can't do that, except for detectives in police literature, but they are gifted with cognitive abilities that are out of the ordinary, nearly superpowers.</p> <p>My research aims at building a VE that can help VR users when they have an intense thinking process to perform. To do so, I am using visual and auditive stimulations to help attention and memorization.</p>	

7. Research implementation and results under the program

Title of your research plan:

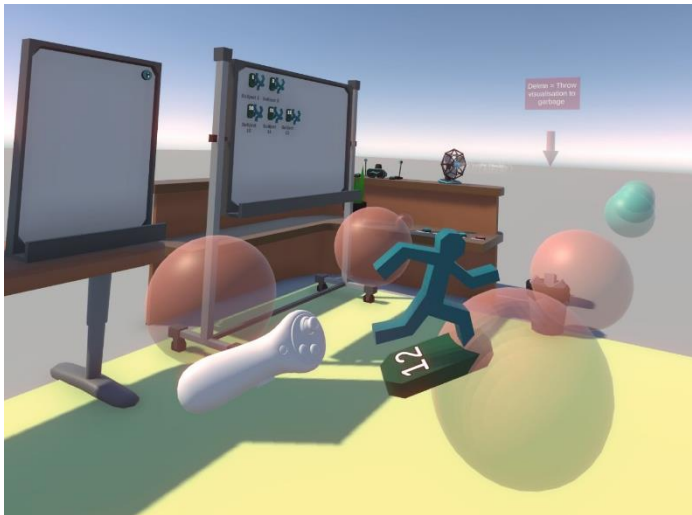
Super deduction empowerment during spatiotemporal data analysis in adaptive Virtual Reality

Description of the research activities:

In order to build our experiment, there was 3 mains research activities. First, the understanding of the dataset that is the base of the experiment. It's complex and it was important to decide what would be in and out of application.

Secondly, we had to build the design of the experiment. Graphic aspect, interaction system, tasks and help system.

Finally, the last research activity was the development of the application, as seen in the picture.



On top of that, I had great exchange with researchers of my lab and I could present my work to the team. I also was able to visit some Japanese lab working in similar research topics. It was really important for me to have a better vision of research in VR in Japan, for any future project or collaboration.

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

Living in Japan allowed me to better understand and immerse myself in Japanese culture. I loved to discover more deeply that country.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: BOURCHANIN Matteo	ID No. SP23 204
2. Current affiliation: CNRS Pascal Institute	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Research Institute for Sustainable Humanosphere, Kyoto University	
5. Host researcher: Miyuki MATSUO UEDA	
6. Description of your current research My research focuses on natural and artificial aging of oak wood. The general goal is to study the evolution of wood properties through time. This is done through the comparison of old and recent wood. Thermal treatment methods are used to simulate the aging of wood and will be compared to the natural aging of wood. Samples of old timber have been recovered from the frame of Notre-Dame-de-Paris cathedral after the fire of 2019. This cathedral frame was the oldest in Europe with beams up to 800 years old. According to literature the heat only affects the first few centimeters of wood next to the carbonized parts, so that the wood in the middle of the beams has only been affected by time. Physical and mechanical properties are measured, such as density, rigidity, shrinking/swelling and absorption of visible and infrared light. Samples of contemporary oak wood are also being characterized for comparison.	

7. Research implementation and results under the program

Title of your research plan:

Comparison of the effect of time and heat on the degradation of oak wood.

Description of the research activities:

During the program most of the experiments on old wood samples took place. A skilled woodworker from the university helped me process the pieces of timber into test bars.

Once the test bars were processed and stabilized mechanical tests were run using the host laboratory's equipment. Three-point bending tests were run for contemporary wood and old wood from the cathedral, giving information on the rigidity of the wood. Nondestructive tests were also run such as spectral properties and hygroscopic variation.

The main aspect added thanks to the collaboration with the host institution is the comparison with thermal treatment. The equivalence between heat and time for wood properties was highlighted by Japanese researchers and is one of the research topics of my host researcher.

So, all samples were heat treated to different temperatures and durations and then measured again. The comparison of properties allows to establish a link between the degradation due to time and heat. The results are still being treated.

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 2023 Research Report

1. Name: CORFA Alice	(ID No. SP23205)
2. Current affiliation : ICGM, Univ Montpellier, CNRS, ENSCM, Montpellier, France	
3. Research fields and specialties: Chemistry	
4. Host institution: Nagoya University	
5. Host researcher: Masami KAMIGAITO	
6. Description of your current research	
<p>My PhD project consists in: 1 - development of precise and easy synthesis pathways for fluorosilicone homopolymers, copolymers and architectures, and 2 - determination of the evolution of the molecular structure of fluorosilicones under ageing using NMR spectroscopy.</p> <p>The very particular physical properties of polysiloxanes make them very attractive polymers both for the scientific community and for high value-added/high performance applications. To better understand the influence of the structural parameters of these material on their properties, it is very important to find the polymerization path which lead to precise and controlled polysiloxanes structure. Particularly, the synthesis of fluorosilicones is not well described in the literature and only few kinetics data are available for p-1,3,5-trimethyl-1,3,5-tris(3,3,3-trifluoropropyl)cyclotrisiloxane (F_3) polymerization. In my work, TBD was chosen as a promising catalyst for organocatalyzed anionic ring opening polymerization (AROP) of cyclosiloxanes due to its commercial availability, chemical stability and high catalytic activity.</p> <p>This first study enabled me to start focusing on poly(trifluoropropylmethyl siloxane) (PTFPMS) synthesis which, as mentioned previously, has not been studied much and for which there is no dedicated investigation of the organocatalyzed AROP yet. Nevertheless, by adjusting the catalyst/initiator ratio, I successfully synthesized PTFPMS with M_n up to 14,000 g.mol⁻¹.</p>	
7. Research implementation and results under the program	
<p>Title of your research plan:</p> <p>Combination of cationic RAFT polymerization of vinyl ether and AROP fluorinated cyclosiloxanes for self-assembly block copolymers.</p> <p>Description of the research activities:</p> <p>Self-assembling polymers is an actively researched method for generating patterns of extremely small dimensions for microelectronics and respond to the need for higher surface density of transistors. The micro-, nano-electronics industry has developed around the use of photolithography to create surface features but it has revealed some limits regarding the adaption to very short dimensions. Block copolymers are renowned for their ability to self-assemble into a rich variety of ordered phases, producing intriguing morphologies on the scale of the natural dimension of the macromolecules (<i>i.e.</i> from a few to some tens of nm). Because fluoropolymers are incompatible with most polymers, BCP based on fluorosilicones are good candidates to understand the fundamentals of ordering and the behavior of BCP under</p>	

confinement. Of note, fluoropolymers have already been shown to be very appropriate polymers to form BCP with poly(vinylether) (PVE). Poly (3,3,3-trifluoropropyl)methyl siloxanes (PTFPMS) are low Tg (-70°), amorphous polymers incompatible with most ether moieties in order to observe self-assembly. In Nagoya University, the work will focus on the synthesis of high Tg PVE.

The synthesis of PVE was carried out with dihydrofuran (DHF) as it results in a polymer with a high Tg (~120 °C) which is suitable for self-assembly with very low Tg PTFPMS (-70°C). DHF was polymerized by photo-controlled cationic RAFT polymerization using 2,4,6-tri(p-tolyl)pyrylium tetrafluoroborate (PMP) as a visible-light-sensitive acid generator. Different CTA were tested aiming to obtain narrow dispersities: BEETC, TBEDPDC, BEDC, TBEDC. BEETC and TBEDPDC were chosen because they gave promising results whereas BEDC and TBEDC required too long reaction time (>30h). Thus, temperature and catalyst concentration were optimized in order to provide suitable results with convenient polymerization times (<3h) and narrow dispersities (≈1.4). TBEDPDC allowed to achieve narrower dispersities in shorter times than BEETC (1.34, 60 min for TBEDPDC; 1.55, 120 min for BEETC). Aminolysis was performed on both polymers in order to obtain a thiol terminated polymer, but dithiocarbamates are harder to reduce due to lower reactivity than trithiocarbamate. This step still can be improved in Montpellier.

Consequently, large amount of both polymers has been produced in order to perform various trials once back to France. To obtain BCP, thia-Michael coupling seems to be the most suitable method, but thiol-ene coupling and macro-initiated AROP are still pathways to explore. Thiol-ene coupling has been proven to be a very efficient method for the grafting of small molecules but hard to achieve for polymer coupling due to the homocoupling of thiol ended polymers by the formation of di-sulfur bridges. Thiol macro initiated AROP is a convenient method for BCP but in the case of fluorinated cyclosiloxanes, this post polymerization will be subjected to strong back-biting and eventually slow initiation compared to propagation. These issues could make the purification and isolation of the desired BCP.

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

9. Adviser's remarks (if any):

The research in this summer program was fruitful thanks to the enthusiastic contribution by the participant. The results open up the possibility of new collaboration between Montpellier and Nagoya, leading to the developments of new polymeric materials based on controlled polymer structures.

JSPS Summer Program 2023 Research Report

1. Name: Yero Harouna DIA	(ID No. SP23206)
2. Current affiliation: University of Bordeaux	
3. Research fields and specialties: Engineering Sciences	
4. Host institution: Institute of Industrial Science. The University of Tokyo	
5. Host researcher: Professor Hiroshi TOSHIYOSHI	
6. Description of your current research	
<p>The goal of this PhD project is to develop RF energy harvesting system that can be applied on human body to power wireless body area network (WBAN) such as sensors (temperature, pulse, oxygenation level, blood sugar level) for checking a person's physiological state. Having an on-body system leads to dielectric losses and a need for a miniaturised and conformable solution which reduces the expected performance. To answer to this challenge, the past year was used to develop a system using RF energy harvesting to power up a voltage controlled oscillator. This system is able to generate a 350 MHz signal with a minimal input power of -28.6 dBm. Such system is at the top of the literature because the developed system isn't an integrated circuit. Adding an other source of energy harvester can help to reduce the quantity of power needed to generate an output signal.</p>	

7. Research implementation and results under the program

Title of your research plan:

Use of MEMS for radiofrequency energy application: hybrid system and self driven switch.

Description of the research activities:

This summer program inside the Toshiyoshi lab allowed me to open my knowledge of MEMS applications through the different research topics.

I went also at the Transducers 2023 international conference where I've been to see the latest advance in the topic. Moreover, I spend some time with researcher from an international industrial research lab that started a collaboration with Pr Toshiyoshi.

During my stay, I've been able to use a circuit I'll bring back. Such circuit uses a piezoelectric element to let through a signal after a constraint is made over it. This circuit will be used in the following of my research to replace the mechanical switch.

Moreover, I've tested one of the electrostatic harvester from the lab. Through the internal document and simulation file, I've understood enough of the system such that I can work on an hybrid system back in my home lab in France. I've been also to the clean room to observe the fabrication of MEMS devices by the professor.

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

During this stay, I was able to open up to the local culture through the Homestay program. The host family really welcomed me and I intend to keep in touch with them. I was also able to travel in Japan (Kyoto, Nikko, Fukuoka...), discover magnificent places and landscapes and see a lot of local festival (Matsuri) and hanabi (fireworks).

This summer program really allowed me to open up to international research by seeing a different system from France. Through discussions with other fellows but also members of the lab and participants at the international conference, I was able to clarify my post-PhD project.

9. Adviser's remarks (if any):

Yéro has proved himself a very capable Ph.D. candidate in a short time by accomplishing a project which should be very new to himself. It should have been quite surprising to discover the difference of working/studying styles in two countries but he seems to have quickly adapted to the new environment. Yéro could be a strong player to initiate a new international collaboration between Tokyo and Bordeaux. He has a good chance of applying for the JSPS PD program in the future, as we have a Franco-Japon framework LIMMS/CNRS-IIS (IRL2820). H. Toshiyoshi 2023-08-15

Research Report

1. Name: Alexandre F. Y. DUFOUR	(ID No. SP23207)
2. Current affiliation: 3d.FAB, Institut de Chimie et Biochimie Moléculaires et Supramoléculaires, Université Lyon 1, CNRS 5246 ICBMS, Bâtiment Lederer, 1 rue Victor Grignard, 69622, Villeurbanne, Cedex, France.	
3. Research fields and specialties: Biological Sciences	
4. Host institution: Institute of Industrial Science, The University of Tokyo , 4 6 1 Komaba Meguro Tokyo 153 8505	
5. Host researcher: Associate Professor Dr. Yoshiho IKEUCHI	

6. Description of your current research

My scientific focus revolves around the utilization of cell aggregates as fundamental units to create well-organized cellular structures *in vitro*, with a specific focus on osteochondral tissue engineering applications. I am particularly interested in comprehending the key factors that govern the organization of tissues formed from human mesenchymal stem cell (hMSC) aggregates within a 3D-printed scaffold. My research hypotheses revolve around the potential influence of aggregate composition, size, maturation time and scaffold architecture on tissue organization. To investigate this, I have devised a methodology based on precise spatial patterning of spheroids using pick-and-place technology into scaffolds created via solution electrowriting (SEW) (figure 1).

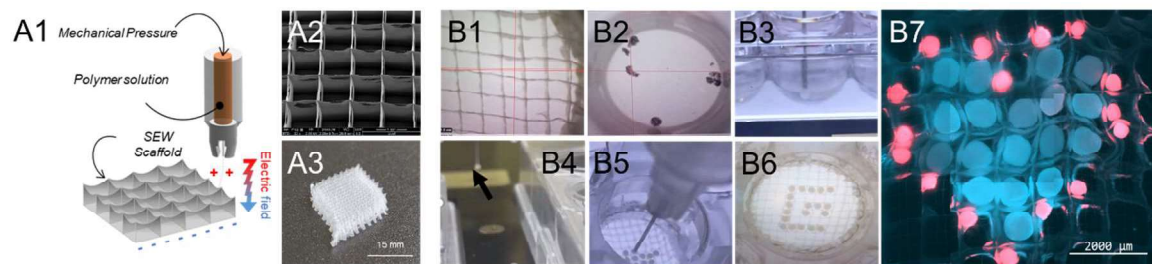


Figure 1: (A) Illustration of the SEW process. (A2-A3) SEW scaffolds produced with polycaprolactone (PCL) (B1-B7) Spatial positioning of hMSC spheroids in SEW scaffolds. (B1-B5) Process of picking and placing spheroid. placing spheroid. (B1) a pore of the scaffold is targeted and recorded followed by (B2) selection and (B3) aspiration of a spheroid from a multi well plate. (B4) The spheroid is transported from the well to (B5) the prerecorded location to be accurately deposited. (B6) the process can be repeated to generate a pattern. (B7) Spheroids of different sizes (500 μm diameter, red; 900 μm diameter, blue) can be manipulated and patterned. The black arrow indicates the transported cell spheroid.

I am concurrently exploring the application of medical imaging modalities, specifically magnetic resonance imaging (MRI) and micro-computed tomography ($\mu\text{-CT}$), for non-destructive analyses of hybrid synthetic-biological tissues (figure 2).

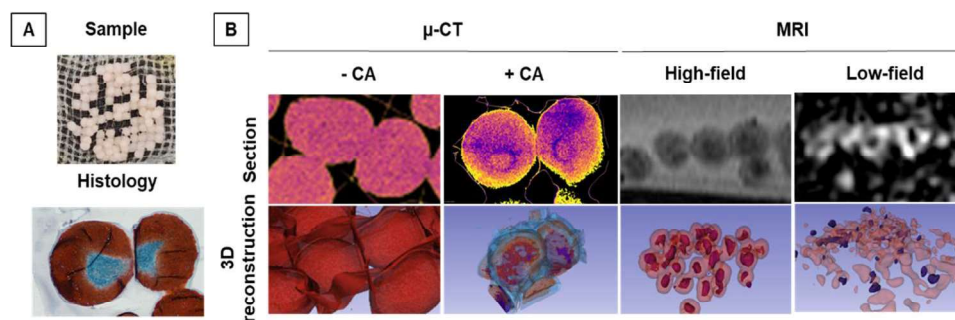


Figure 2: (A) Hybrid synthetic-biological cartilage construct and corresponding histological staining for cartilage matrix deposition (red). (B) Non-destructive volumetric analyses of the sample with representative section and volumetric reconstruction. Contrast agent was used (+CA) or not (-CA) for $\mu\text{-CT}$ imaging. Each color represents an element that could be segmented from the acquired data.

7. Research implementation and results under the program

Title of your research plan:

Investigating the potential of mesenchymal stem cell spheroid innervation for engineering cartilage and bone tissues

Description of the research activities:

My research aimed to investigate the impact of developing sensory nerve fibers in hMSC aggregates induced for bone or cartilage development. To achieve this, I initially underwent training in a protocol mastered by the host laboratory to generate human induced pluripotent stem cell (iPSC)-derived sensory neurons (hSN). Subsequently, I assessed the survival of hSN in various combinations of culture media designed to promote hSN maturation and the differentiation of hMSCs into either chondrogenic or osteogenic lineages (figure 3).

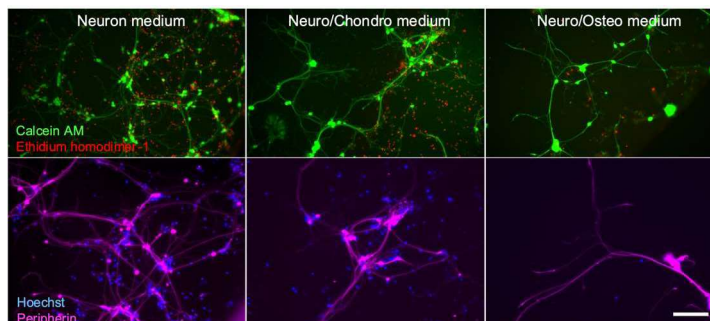


Figure 3: Live (Calcein AM) and dead (ethidium homodimer) assay on hSN cultured in different media composition and immunolabelled for peripherin marker. Scale bar: 100 μ m.

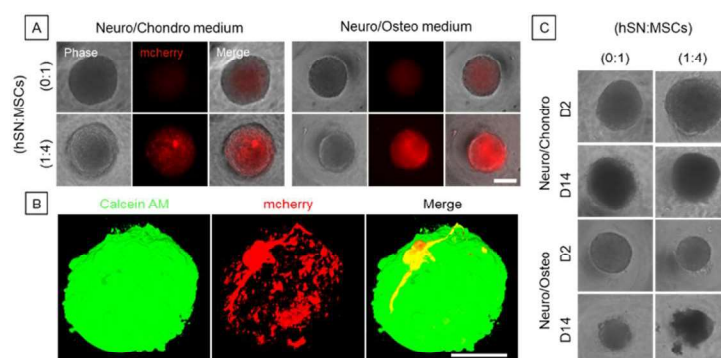


Figure 4: (A) hSN:hMSCs co-culture 48 after assembling. (B) 3D confocal observation of hSN:hMSCs mixed at a 1:4 ratio and cultured in neuro/osteogenic medium for 7 days. (C) Long-term observation of the hSN:hMSCs organoids. Scale bars: A and C = 200 μ m, B = 50 μ m.

Through our observations, we found that a combination of half neuron medium and half differentiation medium, while maintaining optimal concentrations of soluble factors that promote hMSC differentiation, yielded the most favorable conditions for hSN survival. Furthermore, we confirmed the identity of hSN as peripheral neurons by conducting immunostaining using the peripherin marker.

In our study, we mixed hMSCs and mcherry-expressing iPSC-derived hSN at several ratios, formed aggregates, and cultured them in the selected media combination for up to 21 days (figure 4A). Media and spheroids were collected at 7, 14, and 21 days. At these time points all cells were labelled with the viability marker calcein AM and imaged by confocal microscopy where hSN were detected through mcherry expression (figure 4B). Our observations confirmed the presence of hSN within the aggregates, with potential indications of axon bundles lying on the surface. Through long-term observations, we noticed that the presence of hSN led to a densification effect when the aggregates were cultured in osteogenic medium (figure 4C). However, in the chondrogenic medium, the presence of hSN did not show a significant difference.

Overall, this study demonstrated that hSN can be successfully cultured in hMSCs differentiation media and in the presence of hMSCs. The results hinted at the possibility of hSN's influence, which will be further validated through downstream analyses of the collected media and tissues (immunohistochemistry, secreted factors, extracellular matrix and gene expression assessments). These analyses will provide more insights into the potential effects of hSN in the context of our experimental conditions.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I am thankful to the host research lab for generously sharing their expertise in hNPCs culture and neuron biology. I also appreciated the high level of enthusiasm and positive research-oriented attitude that prevailed in the lab. I also had the chance to do the homestay program during my stay and enjoyed experiencing daily life in Japan.

9. Adviser's remarks (if any): Alex performed the optimization of co-culture and gained useful insights into the unexpected hetero-cellular interaction between osteoblast and neurons. I am impressed by his great enthusiasm, positive attitude for the research, and ability to quickly learn new techniques.

Research Report

During my 90-day research field work in Tokyo, I had the privilege of being affiliated with the University of Tokyo under the enlightened guidance of sociologist Ichinokawa Yasutaka. My primary objective was to delve deeply into the underlying mechanisms of activist engagement among disabled women in Japan. This research also aimed to analyze the impact of their involvement on their life trajectories.

Research Questions and Methodology

My inquiries converged around the profound reasons and processes that compel disabled women to engage in collective militant actions. However, instead of solely focusing on the ideological motives behind their engagement, my approach sought to dissect the social mechanisms that drive them towards sustained activism.

For this purpose, I opted for a life narrative approach, a methodological strategy that allowed for an in-depth exploration of individual experiences, challenges, motivations, and strategies of disabled women in their activist journey. To capture the various nuances of this engagement, I devised a preliminary questionnaire that was disseminated through diverse channels, including disability-focused organizations, activist networks, and my personal social media accounts.

Following this initial step, I embarked on recruiting participants, ensuring a meaningful diversity in terms of profiles and experiences. Recruitment primarily occurred through email contacts, allowing for a range of activist trajectories within the studied group, thereby facilitating a holistic understanding of disabled women's engagement.

Data collection comprised multiple rounds of individual interviews in the Japanese language, in which participants felt most comfortable expressing themselves. Each interview was recorded with participants' consent, enabling an in-depth analysis of the data. Subsequently, recordings will be meticulously transcribed, preserving the intricacies and nuances of the shared life narratives.

Preliminary Findings

Individual interviews played a central role in data collection. The first interview was pivotal in establishing a foundation of trust with the interviewees. It also served to map out the major milestones in their lives using a visual chronological timeline, thereby encouraging a detailed narration of significant events.

In an effort to enrich life narratives, I encouraged participants to provide visual elements such as photographs, flyers, and other relevant materials to illustrate their stories and activist involvements.

These visual aids not only served as concrete reference points but also stimulated participants' memories, leading to more profound discussions.

The analysis of the survey responses from 135 women reveals a multitude of insights into the engagement, affiliations, and demographics of disabled women in Japan. These findings shed light on their association memberships, activist tendencies, and social profiles :

- 67.2% of respondents reported being members of one or more disability-related associations, highlighting a significant level of engagement within this community
- 32.8% indicated non-membership in any disability-related association. Among them, 44.4% stated that the absence of nearby associations was the primary reason for their noninvolvement, while 35.6% stated a lack of awareness about such organizations
- Among respondents engaged in disability associations, the primary reasons included seeking new experiences (31.1%), being invited by an acquaintance (25.2%), and wanting to connect with individuals who share similar experiences (18.9%)
- A notable 42.4% of respondents claimed to be "extremely" involved in their chosen associations, indicating a high level of commitment and dedication.
- 76% of respondents reported not being involved in feminist associations, 39% of them stated a lack of knowledge about feminist associations as their primary reason for non-involvement, while 22% expressed a lack of desire to engage in feminist associations.
- Those who chose to be part of feminist associations often did so to advocate for important causes close to them.
- 63.9% of respondents reported no involvement in associations beyond the realms of disability and feminism
- 36.1% stated some engagement outside these spheres.
- 59.7% of respondents did not consider themselves activists
- 40.3% identified as activists, indicating a significant presence of engaged individuals.
- 51.2% of respondents did not identify as feminists.
- 48.5% identified as feminists, indicating a balanced distribution of feminist perspectives.
- Type of impairment:
 - o 59.7% physical impairment
 - o 27.6% with psychosocial impairment
 - o 25.4% with cognitive impairment
 - o 9,7 % visual impairment
 - o 7,5% auditive impairment
 - o 1,5% intellectual impairment
- 91.7% of respondents held administrative recognition as disabled individuals, highlighting a substantial acknowledgement of their disabilities
- 76.1% had never lived in care institutions for disabled individuals.

- 21.6% had experienced institutional living at some point, and 2.2% were currently in institutions.
- 67.2% did not receive support from centers for independent living, reflecting a potential gap in these services.
- Respondents were diverse in geographical origin, primarily from the Kanto region.
- Family association with political or syndicate organizations was relatively low, with 64.4% reporting no such affiliations.
- 42.2% of respondents held a bachelor's degree, while 27.4% had secondary education or lower, and 13.3% had a master's degree
- 51.5% were single, 32.6% were married, and 9.8% were divorced.
- 51.5% were employed, with a significant portion in disability-related fields.
- 71% did not have children, indicating a potentials difficulties surrounding disability and motherhood.

In conclusion, the survey data reveals a diverse and active disabled women's community in Japan, with varied association engagements, motivations, and levels of activism. It reflects the complexity of their identities and experiences, offering valuable insights for future research and advocacy initiatives.

Meetings, Interviews, and Observations

Over the course of these eight weeks of field research, my exploration continued through a series of visits to organizations advocating for the rights of disabled individuals and interviews with engaged disabled women in Japan. These interactions provided an in-depth insight into their motivations, experiences, and challenges in their activist roles. I had the privilege of engaging with individuals with remarkable journeys, such as S.Y., a woman who had undergone a double leg amputation, and Kimura Eiko, a politician living with cerebral palsy.

Data collection also included enlightening visits to centers for independent living, like "StepEdogawa," as well as the premises of Disabled People International (DPI). These experiences further expanded my comprehension of the dynamics and realities encountered by disabled women in their daily lives.

Exemplary Field Observation Notes

“On July 11, 2023, I had the exceptional opportunity to attend the Japan Disability Forum (JDF) meeting, graciously invited by Sato Satoshi of Disability Persons International (DPI). Established in 2004, the JDF has been actively engaged in promoting and implementing the Convention on the Rights of Persons with Disabilities in Japan. This significant gathering was

hosted at Toyama Sunrise, an establishment that also doubles as a training center for the Japanese Society for Rehabilitation of Persons with Disabilities (JSRPD).

The event adopted a hybrid format, with approximately twenty attendees on-site and an equivalent number participating virtually. Among familiar faces, I recognized Nagase Osamu, with whom I had collaborated during a Franco-Japanese symposium on disability. Following introductions by Sato Satoshi, I presented my research and objectives for the summer.

Two prominent discussion points marked the meeting. Firstly, the translation of specific terms from English to Japanese was raised, particularly concerning the term 'ablism'. This discourse highlighted the inherent challenges in translating disability-related concepts, underscoring the significance of precise terminology for effective communication.

Secondly, Ms. M.Y., a member of the DPI Women's Network and another association representing the deaf and hard of hearing, ignited a crucial debate by spotlighting the lack of women's representation in leadership positions. She emphasized that this issue transcends mere inclusion of 'women's issues and roles', advocating for the establishment of a minimum percentage of female representation. This observation underscored the persistent inequalities in decision-making and influence within the disability community.”

Provisional Conclusion and Future Perspectives

In summation, this 90-day ethnographic research endeavor in Japan has yielded a comprehensive and nuanced insight into the activism of disabled women. By amplifying the voices of the participants and delving into their experiences through life narratives, I've been able to uncover the underlying mechanisms that drive their collective activist engagement. Preliminary results underscored critical aspects, including the dynamics of association membership and the subtleties of feminist involvement among disabled women.

The next stages of this research will involve a more in-depth analysis of the collected data, illuminating both theoretical and practical implications of these findings. It will culminate in the publication of scholarly articles to disseminate the discoveries within the academic community. Indeed, 60.7% of survey respondents agreed to individual interviews, which will be subjected to thematic analysis. This method will unveil patterns, emerging themes, and meanings within participants' narratives. The key themes extracted from thematic analysis will contribute to a comprehensive understanding of the underlying mechanisms driving disabled women's activist engagement, whether or not they self-identify as activists.

JSPS Summer Program 2023

Research Report

1. Name: LE GARS, Lucas Ange Paul	(ID No. SP23209)
2. Current affiliation: Caen-Normandy University	
3. Research fields and specialties: Chemistry	
4. Host institution: Kyushu University	
5. Host researcher: Dr. SUEKUNI, Koichiro	
6. Description of your current research	
<p>Thermoelectricity is a promising technology that utilizes the unique electrical and thermal transport properties of certain materials to convert a temperature difference into usable electricity. This technology holds great potential as a sustainable energy source for waste-heat recovery, with applications ranging from solar energy and building systems to industrial manufacturing processes. Solid-state thermoelectric (TE) devices offer versatility in design, but their widespread adoption is hindered by the high cost and toxicity of current state-of-the-art materials. Recent breakthroughs have shown excellent performance in copper-based sulphides, inspired by natural minerals like colusites. These materials possess low cost and low toxicity, and share promising TE transport properties governed by a sphalerite-type Cu-S conductive network.</p> <p>My current research builds upon these "emerging" results with the main objectives of further exploring the Cu-Sn-S phase diagram, discovering new family members, and fully understanding the structure-properties relationship in these systems. Specifically, I aim to engineer the conductive network of these ternary copper sulphides to optimize their electrical and thermal properties for thermoelectric applications. To achieve this, I am investigating the substitution of divalent cation Zn^{2+} for Cu to decrease the carrier concentration of these intrinsic degenerate semiconductors. This investigation has two main goals: 1) to determine the role of the dopant on carrier concentration and mobility, and 2) to investigate whether the cationic ordering can be modified to create new phases.</p> <p>I utilize mechanical alloying along with SPS (Spark Plasma Sintering) densification for synthesizing powders, a successful method employed in my research group to create various sphalerite derivative systems. I am currently optimizing the sintering conditions to obtain dense and pure compounds. Subsequently, I conduct X-ray diffraction and electron microscopy analysis on the samples, along with measurements of TE properties. Once a promising series of materials is synthesized, I conduct an in-depth analysis of their structure, microstructure, and electrical and thermal properties with the goal of establishing rules and correlations between crystal structures and TE properties. Techniques such as Sn Mössbauer spectroscopy, neutron/synchrotron diffraction, and band structure and vibrational properties calculations are employed to support and interpret experimental data.</p>	

7. Research implementation and results under the program

Title of your research plan:

Synthesis and durability test for thermoelectric sulfide materials

Description of the research activities:

The group of K. Suekuni has built a solid experience in the synthesis of Cu-based sulfides using the solid-liquid-gas sealed tube synthesis technique. One of my main objectives was to compare the impact of this synthesis method on the thermoelectric properties with the mechanical alloying used at CRISMAT. To achieve this, I conducted the study on two families of compounds: the first of sphalerite type and the second of colusite type. I have succeeded in synthesizing the samples with trace impurity phases using sealed-tube technique and densifying the powder by hot-pressing.

A significant part of my study in Japan focused on testing the materials' durability. Specifically, K. Suekeni recently developed a new system in his laboratory to test the durability of thermoelectric materials under high thermal gradient and high current conditions, imitating those encountered in practical use for TE power generation. I tested some of my materials to determine their resistance to ion migration and degradation under operating conditions. Different thermal gradients and current densities were applied to each material. Resistivity distribution measurement using scanning voltage probe for and scanning electron microscopy demonstrated that the distribution of chemical composition was not altered in the thermal gradient under the operating conditions.

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

While conducting research, I had the opportunity to collaborate with Japanese researchers, providing valuable insights into their scientific practices and methodologies. I embraced this opportunity to exchange knowledge and build professional relationships across cultures. Outside of work, I've had the opportunity to visit historic sites and beautiful landscapes in weekend. The peace and quiet, along with the breathtaking views of the surrounding nature from the top of the mountains during a hiking session, are some of my most memorable moments.

9. Adviser's remarks (if any):

Mr. LE GARS, Lucas was able to conduct many experiments because of his quick learning of experimental techniques. In addition, he frequently prepared and submitted me reports, which allowed us to share problems in the synthesis and lead to the success of his experiments. Although it was only for a short period of two months, his research attitude and various discussions stimulated our activities.

JSPS Summer Program 2023 Research Report

1. Name: Kevin Ismaël MALL HAIDARALY	(ID No. SP23210)
2. Current affiliation: Institut Parisien de Chimie Moléculaire, Sorbonne Université, Campus Pierre et Marie Curie, 4 Place Jussieu, 75252 Paris CEDEX 5	
3. Research fields and specialties: Chemistry	
4. Host institution: Kyushu University, Department of Applied Chemistry, Center for Organic Photonics and Electronics Research (OPERA), Fukuoka, Japan	
5. Host researcher: Pr. Chihaya ADACHI	
6. Description of your current research	
<p>Molecular organization in semiconducting thin films has shown to be one key factor for improving their optoelectronic performances. For instance, the nanosegregation of electron donor (D) and acceptor (A) moieties into highly ordered molecular architectures is extremely promising for optoelectronic applications. This project aims at the synthesis and characterization of new mesomorph hybrid materials combining π-conjugated mesogenic electron donors and a lacunary Keggin-type polyoxometalate (POM) electron acceptor. Because of their opposite chemical nature, the covalent linking of the organic donors and the inorganic acceptor will lead to the self-organization of the materials in successive donor and acceptor subdomains. Such nanosegregation should favor charge transfer/propagation properties and thus improve the material's photophysical performances.</p> <p>Recently, I have synthesized a new D-A POM hybrid using a diarylbenzothiadiazole (DBT) core as calamitic mesogen units and I had the opportunity to spend 4 weeks at the OPERA Laboratory in Fukuoka (Japan). During this stay, I performed preliminary photophysical measurements on my new POM-DBT derivative and I evidenced a strong quenching of the photoluminescence in the hybrid material in comparison to the parent DBT organic part, suggesting the formation of an effective charge separation state. During this first stay, I also evidenced by X-ray experiments that this material exhibits a highly organized multilamellar structure in thin films deposited by spin-coating. In addition, the thin film morphology and topology were characterized by Atomic Force Microscopy (AFM). These measurements showed that the thin layers based on this material are extremely homogeneous over $10 \times 10 \mu\text{m}$ and revealed the presence of micrometric flat domains with a roughness corresponding to the interlamellar distance d_{LAM}. Unfortunately, due to the lack of time, the fabrication of devices based on POM-DBT and the investigation of their performances (photocurrent generation, charge mobility) have not been carried out.</p> <p>More recently, I have been working on developing a new family of D-A hybrids based on discotic mesogens (e.g., pyrene derivatives) that should lead to the formation of innovative multicolumnar assemblies for optoelectronic applications. It is worth noticing that such columnar POM hybrids have never been developed so far, and that they would be very suitable for photodetectors or photovoltaics conversion. Although the final target discotic hybrid has not been obtained yet, two different pyrene-based precursory mesogens were synthesized very recently and will be investigated during the 2 months stay at Kyushu University.</p>	

7. Research implementation and results under the program

Title of your research plan:

Photoactive nanosegregated polyoxometalate-based hybrid materials for photonics

Description of the research activities:

Adachi laboratory (OPERA) has proved itself to be very well equipped for the characterization of molecular materials that would interact with light. The purpose of my research is to develop a new type of photoactive hybrid materials with self-assembly properties and efficient charge separation and photocurrent generation. The principal objective of my stay at Kyushu University was to characterize the electrical and photoconduction properties of these materials in device configuration.

The first investigations were dedicated to studying the photophysical properties of materials. To this end, I probed steady-state absorption and photoluminescence properties in solution and solid state (thin film). In addition to those two measurements, their photoluminescence quantum yield (PLQY) and excited state lifetime were also measured. Furthermore, the self-assembly into highly ordered molecular architecture was assessed by atomic force microscopy (AFM) to investigate the morphology and the topology of the thin film surface.

Then, I fabricated electrical devices such as Time of Flight (TOF) cells or thin film transistors (TFT) to try to extract the charge transport properties (charge carrier mobility) of the materials. Unfortunately, no transient current or field effect has been observed until now. We also performed space-charge-limited current (SCLC) based on $I(V)$ curves to study the charge carrier mobility and the treatment of these measurements is currently in progress. Lastly, photoconduction properties were also investigated based on gap-type device architecture under white and monochromatic light illumination. These measurements provided insight into the photocurrent generation efficiency of the hybrid materials.

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

Outside of work, I was able to roam around Fukuoka/Itoshima by bike discovering the numerous sightseeing spots, the shrines as well as the landscapes the region had to offer. Moreover, I had the opportunity to taste several dishes of the Japanese culinary culture but also attend some festivals such as the Hakata Gion Yamakasa (博多祇園山笠) by myself or in the company of my lab mates.

Overall, I am sincerely grateful for having the chance to dive into Japanese culture, both on the professional side - thanks to being hosted for my research in a Japanese laboratory - as much as on the personal side – thanks to the people I have met.

9. Adviser's remarks (if any):

Kevin quickly adapted to the OPERA working environment and he rapidly became independent in the laboratory to perform his research work. He also interacted successfully and efficiently with OPERA students and researchers when it was necessary. His materials system aimed at photoelectron conversion is unique, and we wish to continue the collaboration in the future to obtain a good photo-conversion effect.

JSPS Summer Program 2023 Research Report

1. Name: Vanpeene Paul	(ID No. SP23211)
2. Current affiliation: University of Bordeaux - COMPTRASEC	
3. Research fields and specialties: Social Sciences	
4. Host institution: University of Tokyo	
5. Host researcher: Pr. Eri Kasagi	
6. Description of your current research	
<p>Currently in my third year of PhD at the University of Bordeaux and its Centre for Comparative Labour and Social Security Law (COMPTRASEC), where I am working on a research project looking at the protection of people with a precarious status, a precarious economic situation suffered despite their work ability or activity. Depending on the discipline or country chosen, these people have various doctrinal names: atypical workers, non-regular workers, precarious workers, etc. In law, however, the main focus is on the status of each of these workers, including part-time workers, dispatched workers, fixed-term workers (workers who do not have a permanent contract, with particular attention paid to workers whose contract lasts less than a year) or self-employed workers.</p> <p>Many articles from the political and social sciences seek to define as precisely as possible the model of social protection and social policy adopted in the countries of East Asia (and sometimes South-East Asia). This work, which stems directly from the work of Gøsta Esping-Andersen and is led by authors such as Ian Holliday and Kwon Huck Ju, sometimes attempts to group together several countries (often South Korea, Japan, Taiwan and Singapore) under a model of "East Asian welfare capitalism". But what about the contribution of law to this analysis? Since these articles focus primarily on issues of funding and spending in relation to GDP, what about the more technical issues relating to the legal protection of individuals? Can the study of the scope of social security standards, the implementation of these standards and the possible contribution of the courts play a role in defining this notorious 'East Asian welfare capitalism'? A relative convergence, or even proximity, between South Korea and Japan is regularly highlighted by certain authors, and it would therefore be interesting to study this link between the two countries in a more legal framework. The research project thus naturally turned towards a comparative study of the legal regimes arising from the social protection model of these two countries.</p>	

7. Research implementation and results under the program

Title of your research plan:

Segmentation of the Labour Market and the Welfare State in Japan and South Korea

Description of the research activities:

The principle axis of my stay in Japan was to be able to access resources not available or in limited quantity in France. This of course includes periodicals and textbooks available at the Faculty of Law Library but also to be able to participate in seminars and conferences that included conversations about Japanese Law.

This research stay was also a great opportunity to discuss labour law and social security law with established Japanese Professors. These conversations allowed me to have a better insight about my research subject and will help me to better define my project and to better understand its limits and challenges.

This stay was also a great opportunity for my research center and myself to establish or strengthen an international network of jurists specialized on the topic of labour law, social security and the Welfare State.

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 2023 Research Report

1. Name: Ulysse VIRGINET	(ID No. SP23212)
2. Current affiliation: Laboratoire de Physique Nucléaire et de Hautes Energies (LPNHE), Sorbonne Université, CNRS/IN2P3	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: High Energy Accelerator Research Organization (KEK)	
5. Host researcher: Tsunayaki MATSUBARA	
6. Description of your current research <p>T2K (Tokai to Kamioka) is a long baseline neutrino oscillation experiment that has been taking data in Japan since 2010. Using the J-PARC (Tokai-mura, Ibaraki), protons are accelerated to an energy of 31GeV and then collide with a fixed graphite target. The products of this collision are mostly positively (negatively) charged pions and kaons, which decay to form muon neutrinos (antineutrinos). Thanks to a system of magnetic horns, it is therefore possible to produce a nearly pure beam of muon neutrinos or muon antineutrinos. 280m downstream of this graphite target, a magnetized detector called ND280 aims to detect the non-oscillated (anti)neutrinos in order to constrain their flux and cross-section. Eventually, the Super-Kamiokande (Hida, Gifu), located 295km away, is a huge water Cherenkov detector that aims to detect the muon (anti)neutrinos together with the ones that oscillated into electron (anti)neutrinos. After having been the first experiment to detect electron neutrino appearance in a muon neutrino beam, T2K reached a precision era by excluding leptonic CP symmetry conserving points at the 2σ confidence level. Indeed, by measuring a electron neutrino appearance probability higher than the electron antineutrino one, T2K has got the first hints of an asymmetry between matter and antimatter behavior in the leptonic sector. My current PhD work is focused on the phase II of T2K, whose main goal is to confirm those first results at a higher confidence level. This phase II consists in an increase of proton beam power, together with an upgrade of the ND280. My work is focused on the development of the reconstruction software for this upgraded ND280, that I will use to analyze its first data once it will be installed. In addition to my work on T2K, I'm also part of the Hyper-Kamiokande collaboration. Hyper-Kamiokande (HK) is expected to take over Super-Kamiokande as far detector and I did some prospective studies on what the upgraded ND280 can bring to us in the understanding of muon neutrinos and electron neutrinos differences of cross-sections for the HK era that should begin from 2027.</p>	

7. Research implementation and results under the program

Title of your research plan:

Installation of the upgraded ND280 of T2K, tests of Hyper-Kamiokande PMTs, participation to the T2K and Hyper-Kamiokande collaboration meetings

Description of the research activities:

During my stay in Japan, I participated in the installation of a new gas system for the upgraded ND280. I also took part in the cabling for the low and high voltage alimentation of the detector. Although not all of the new subdetectors of ND280 have arrived during my period of stay, I was here for the installation of the first ones and I hope to come again in Japan to install the new ones in first semester of 2024. In addition to my work on the ND280, I also could participate to Hyper-Kamiokande and T2K collaboration meeting in order to show to the whole collaborations the work I have done on electron neutrino study at the ND280 on one side and the results of the ND280 reconstruction software on the other side. I also went during one week on the Hyper-Kamiokande future site in order to participate in the test of the photomultipliers tubes that will be installed.

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

In addition to this unique opportunity of participating to the HK and T2K on-site activities, this JSPS Summer Program allowed me to discover and enjoy the Japanese culture: I could visit Kamakura during the orientation program, and other cities such as Tokyo, Mito and Toyama during my period of stay. During one week-end I was in a complete immersion in a Japanese family thanks to the Homestay Program : I enjoyed the traditional Japanese breakfast, the visit of the giant Ushiku Daibutsu, a traditional Japanese summer festival and the visit of a natural history museum. Sushi, sashimi, karage, tonkatsu, soba, udon, ramen, katsudon, Japanese kare and so many other « おいしい » foods were of course also part of this amazing cultural experience!

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Begmuhammet GELDIYEV	(ID No. SP23301)
2. Current affiliation: University of Würzburg	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Hiroshima University	
5. Host researcher: Prof. Kenya SHIMADA	
<p>6. Description of your current research</p> <p>In the course of PhD research of mine, I investigate the electronic band structure of novel two-dimensional quantum materials (notably tellurium-based thin films), as well as their three-dimensional analogues. Our method of choice to this end is the angle-resolved photoelectron spectroscopy (ARPES), including the spin resolution [1,2]. Here, we utilize various light sources, especially synchrotron radiation, as the source of excitation.</p> <p>In essence, surfaces and interfaces serve as an ideal two-dimensional material class. In such two-dimensional materials, the spatial inversion symmetry is innately broken. In turn, this leads to the so-called orbital Rashba effect [3-5]. Once we consider the effect of spin-orbit coupling, the orbital Rashba effect transforms into the spin Rashba effect, and this ultimately results in spin-polarized states in the electronic band structure. Concisely, such Rashba-like spin split states form the basis for <i>spintronics</i> devices. In contrast to using the charge of an electron, these devices utilize the electron spin [6].</p> <p>In this regard, there are numerous research groups active in this field in Japan. I had a unique opportunity to have a scientific exchange with several of these researchers. In addition, I could also introduce the outcome of own research of mine in seminar talks in several instances.</p> <p>In conclusion, in our research we aim to understand the complex interplay between orbital degrees of freedom, spin-orbit coupling, and the underlying lattice, which is an often recurrence in novel quantum materials. Conducting very high-resolution ARPES measurements with various tunable excitation sources, alongside with the spin resolution, brings us one-step closer to the comprehension and design of materials of this kind.</p> <ol style="list-style-type: none"> 1) J. A. Sobota <i>et al.</i>, Rev. Mod. Phys. 93, 025006 (2021) 2) T. Okuda <i>et al.</i>, J. Electron Spectrosc. Relat. Phenom. 201, 23-29 (2015) 3) J.-H. Park <i>et al.</i>, Phys. Rev. B 85, 195401 (2012) 4) M. Ünzelmann <i>et al.</i>, Phys. Rev. Lett. 124, 176401 (2020) 5) B. Geldiyev <i>et al.</i>, arXiv:2308.02372 (2023) – also accepted at Phys. Rev. B (2023) 6) A. Manchon <i>et al.</i>, Nat. Mater. 14, 871-882 (2015) 	

7. Research implementation and results under the program

Title of your research plan:

Investigation of Two-Dimensional Materials using Spin- and Angle-Resolved Photoelectron Spectroscopy

Description of the research activities:

In the course of last two months at Hiroshima Synchrotron Radiation Center (HiSOR), I studied electronic band structure of novel two-dimensional quantum materials via spin- and angle-resolved photoelectron spectroscopy (ARPES). In terms of investigated systems, our focus was on tellurium-based thin-film materials on distinct metallic substrates. In the duration of the research visit, besides the auxiliary preparatory steps needed, I carried out ARPES experiments at two different beamtimes using the synchrotron radiation at HiSOR. In case of one beamtime, we paid especial attention to spin-resolved ARPES. Furthermore, we also conducted spin-ARPES measurements using laser sources available at HiSOR.

In addition to routine duties at HiSOR, we also travelled to other research groups active in the same field. It was a great opportunity to be able to visit laboratories of the leading researchers in the field and get familiar with their experimental apparatus. I was fortunate to visit Prof. H. Iwasawa at NanoTerasu, Prof. T. Sato at Tohoku University, Prof. T. Kondo at Institute for Solid State Physics (ISSP), the University of Tokyo, and Prof. K. Sakamoto at Osaka University. Other than invaluable scientific exchanges I accumulated from experts, there were also occasions to give seminar talks and receive an immediate feedback.

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

In brief, I would divide my stay in Japan as JSPS Summer Program 2023 fellow into three sections: Orientation Event at Hayama, Life and Research in Japan, and Home-Stay Program. I had a very memorable time in Japan overall. In the end, since I enjoyed each of the aforementioned events in a great deal, I cannot single out one.

9. Adviser's remarks (if any):

It was our great honor to accept Mr. Geldiyev through the JSPS Summer Program. For more than 16 years, we have collaborated with the research group, Experimental Physics VII, in the Julius-Maximilians-Universität Würzburg where Mr. Geldiyev is from. Mr. Geldiyev performed collaborative ARPES experiments using synchrotron radiation and ultraviolet laser during his stay. He presented his research work in the seminar. Our students enjoyed fruitful discussions and daily conversations with him.

JSPS Summer Program 2023
Research Report

1. Name: Christabel MENNICKEN	(ID No. SP23302)
2. Current affiliation: University of Bonn	
3. Research fields and specialties: Biological Sciences, Immunology	
4. Host institution: Teikyo University	
5. Host researcher: Prof. Hajime KONO	
6. Description of your current research	
<p>Atherosclerosis is the main underlying pathology of most cardio-vascular diseases. It is a chronic inflammatory process which develops and progresses upon excess of cholesterol in the blood that is taken up by macrophages (phagocytic cells of the innate immune system) that infiltrate arterial walls. Accumulation of lipids and cholesterol in the wall of the blood vessels lead to the formation of an atherosclerotic plaque. Its rupture can result in heart attacks and strokes which are the leading causes of death worldwide.</p> <p>Recent work demonstrates the potential of cyclodextrins as an anti-atherogenic drug. Cyclodextrins are cyclic sugars that form inclusion complexes with other molecules such as cholesterol thereby increasing their water-solubility and bioavailability. They are used as pharmaceutical drug carriers.</p> <p>In my current research I am investigating the effects of Cyclodextrin on the bone marrow which is the main site of hematopoiesis. Hematopoietic stem cells reside in stem cell niches and differentiate into lineage-committed progenitor cells that egress into the blood stream. As macrophages which are found in atherosclerotic plaques have their origin in the bone marrow, we want to find out whether Cyclodextrin has an early impact on these cells. It has been shown that granulocyte-macrophage progenitor (GMP) cells which give rise to macrophages are influenced by the diet. So called “western-type diet” that is rich in cholesterol, sugars and fat increases the number of GMPs and reprograms them on an epigenetic level. As unhealthy eating patterns are one of many risk factors for atherosclerosis, we think that investigating this compartment could give promising results to further understand how Cyclodextrin conveys its atheroprotective properties.</p> <p>I am mainly using mouse models to tackle this complex question as it is not yet possible to answer the above-mentioned research question on a cell culture-based approach with physiological relevance.</p>	
7. Research implementation and results under the program	
Title of your research plan:	
Optimization of a protocol to generate neutrophils from CD34 ⁺ hematopoietic stem cells and their manipulation via lentiviral transduction <i>in vitro</i> .	

Short: *in vitro* differentiation of neutrophils from human blood stem cells

Description of the research activities:

The Kono lab is working on a rare autoimmune disease called ANCA-associated vasculitis (AAV) in which the body produces antibodies against neutrophils, a type of immune cell. As a result of antibody-binding the cells burst and die an inflammatory cell death termed NETosis. This leads to inflammation of the vascular system leading to severe damage of vital organs. As there is no specific treatment yet it is necessary to search for new approaches to tackle this disease.

During my stay in Japan, I have been working on testing and optimizing a protocol for the differentiation of neutrophils from blood. Mature neutrophils isolated from blood have a very short half-life time of about 12 hours. They are therefore difficult to manipulate outside the body. Our aim is to overexpress a set of certain genes in neutrophils to investigate whether this might alter neutrophil extracellular trap (NET) formation (NETosis). From transfection of the DNA to protein expression it takes 24-48h which makes it impossible to work on primary neutrophils.

In the recent past several protocols have emerged for using isolated CD34+ cells (hematopoietic stem cells) from blood to culture them *in vitro* and differentiate them into neutrophils using different sets of cytokines. This approach allows to both interfere in the differentiation process and manipulate mature neutrophils and therefore appears suitable for our purposes. Due to the close cooperation to the hematology department of Teikyo University Hospital the lab has access to left-over human blood samples enriched in CD34+ cells. As it is a time-consuming procedure of about 3 weeks from CD34+ cell isolation to mature neutrophils we have not yet finished the optimization of the protocol for our specific needs. For example, usual protocols work with fresh blood whereas ours is frozen. This reduces the number of viable cells after thawing immensely. By modifying the thawing process and removing debris before starting the first step of immune cell isolation we have started to adapt the protocol. We have also performed first experiments of infecting the cells and observing their survival as well as characterization of mature neutrophils using flow cytometry and induction of NETosis. Prior to the transduction with the lentiviral library the procedure needs to be finalized, e.g. by assessing the best time point during differentiation for lentiviral transduction and evaluating the influence of the clinical background of each blood donor on the results.

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

I had a very friendly surrounding at work that made me feel welcome instantly. Although not everyone spoke English, we were able to overcome this barrier and had a lot of fun in and outside the lab! It was also nice to have many JSPS fellows around to explore the city and exchange experiences and impressions during the stay in Japan.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Christoph Sponsel	(ID No. SP23303)
2. Current affiliation: University of Oxford	
3. Research fields and specialties: Social Sciences	
4. Host institution: Waseda University	
5. Host researcher: Professor Atsushi TAGO	
6. Description of your current research	
<p>My doctoral research at Oxford covers social movements and protests during peace processes, leveraging primarily the Colombian experience following the country's 2016 peace agreement with the FARC guerilla. I investigate the political participation of demobilized rebel group members in protests and other forms of social activism. The research questions I seek to answer cover the factors that influence demobilized rebels' decision to join protests and how some of them become leaders during protests, what kind of consequences and impact the participation of former rebels in protests generates, and what kind of changes in public opinion their participation triggers. In terms of methods, my research includes qualitative approaches such as elite interviews and quantitative techniques such as survey experiments.</p>	

7. Research implementation and results under the program

Title of your research plan: Japanese-Peruvian Identities and Immigration Trajectories of the Peruvian Nikkei Community in Japan

Description of the research activities:

I researched the cultural and political identities of Peruvian immigrants of Japanese descent in Japan. I conducted various interviews to obtain insight into their values and beliefs, struggles with integration into Japanese society, sentiments of alienation, maintenance of connections to Peru, and identity affiliations. I went to Hamamatsu to conduct interviews since many Peruvian immigrants live there, given the city's industrial production sites of firms such as Yamaha and Suzuki. Unfortunately, I only managed to have access to a small number of interviewees in Hamamatsu. Instead, through private contacts at the Peruvian embassy in Tokyo, I conducted additional interviews online and in Tokyo. I am still in the data analysis phase but plan to publish a corresponding press article in late 2023. Initial insights show that for Peruvian immigrants of Japanese descent, integration into Japanese society is often difficult. Despite their Japanese family roots, they often face difficulties connecting with Japanese culture and live primarily in Peruvian social networks. As one would expect, a key challenge for them is language barriers, but other cultural differences also seem relevant.

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

I conducted many cultural experiences during my stay in Japan, both within Tokyo and across the country. In Tokyo, I visited many museums (for instance, the Mori Art Museum, the Museum of Modern Art Tokyo, or Hokusai Museum), several religious sites (for instance, the Meiji Shrine, the Ana-Hachimangu shrine, or the Kanda Sanctuary), and other sites of cultural interest (for instance, the Yoyogi park, the Koishikawa garden, or the Odaiba park).

Across Japan, I traveled to Hiroshima, Kobe, Hamamatsu, Naeba, Kyoto, Osaka, Naoshima, Iya Valley, and Mount Ishizuchi. On each of these trips, I tried to be in touch as much as possible with the local community by seeking conversation with locals, visiting many museums, reading Japanese literature (for instance, the Colorless Tsukuru Tazaki and His Years of Pilgrimage by Murakami), reading reports on Japanese politics, and eating exclusively Japanese food over the entire course of my stay.

9. Adviser's remarks (if any):

[SP23304]

JSPS Summer Program 2023 Research Report

1. Name: Daria Boscolo	(ID No. SP23304)
2. Current affiliation: GSI Helmholtzzentrum für Schwerionenforschung GmbH	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: QST National Institute for Quantum science and Technology	
5. Host researcher: Dr. Inaniwa Taku	
6. Description of your current research Carbon ion beam therapy is one of the most advanced radiotherapy techniques currently available. The physical and radiobiological properties of accelerated Carbon ion beams are exploited to efficiently deliver a sufficient dose in the tumor region while limiting the unwanted radiation side effects on the healthy tissues surrounding the target region. These characteristics allow the treatment of resistant deep-seated tumors or tumors close to sensitive organs which would normally not be considered to be treatable with standard radiotherapy techniques. Conventional Carbon ion therapy, as well as standard radiotherapy techniques, delivers the prescribed dose to the patient in a series of sections, lasting some minutes each, where only a fraction of the total dose is applied to the tumor (doses of a few Gy per fraction delivered with a dose rate of ~2Gy/min). Recent, in vitro and in vivo studies showed that when the full treatment is delivered in a few hundred milliseconds (doses > 8-10 Gy delivered with a dose rate >40 Gy/s) the radiation induced toxicity in normal tissue is reduced without compromising tumor control. This treatment approach using ultra-high dose rates is generally referred to as FLASH. My current research focus on the possibility perform Carbon ion therapy under FLASH conditions. This can further improve the effectiveness and selectivity of Carbon ion therapy but it can also help understand the basic mechanisms behind the FLASH effect, and thus optimize its application. There are, however, technical challenges that make FLASH with Carbon ion difficult to realize:	
<ul style="list-style-type: none"> • Most of the monitoring detectors used in standard Carbon ion therapy saturate with such high intensity beams. So new approaches have to be considered to guarantee a controlled and precise dose delivery. • In order to irradiate an extended target volume, several beam energies are used in a single treatment. Unfortunately, the time required for the energy switch is too long for the FLASH conditions, limiting significantly the FLASH applicability with these ion beams. In GSI we proposed the use of 3D printed range modulators (developed in GSI) which allow the irradiation of extended volumes without changing the beam energy. 	

- Carbon ion radiation is produced with synchrotron accelerators. These accelerators are not capable of reloading in a sufficiently short time to guarantee the FLASH conditions. The accelerator has, thus, to be large enough to contain all the carbon ions necessary to perform the full treatment in a single cycle. At the moment only two accelerator facilities are sufficiently large to allow the irradiation of > 50 ml volumes with doses larger than 8-10 Gy: HIMAC at QST and the SIS-18 at GSI.

7. Research implementation and results under the program

Title of your research plan:

Carbon FLASH: a proof of concept for a realistic tumor size

Description of the research activities:

During my stay in Japan, a series of experiments were performed in one of the clinical rooms of the HIMAC accelerator, in collaboration with the accelerator and medical physics group of QST. The aim of these experiments was to prove the feasibility of a Carbon ion FLASH irradiation in a therapy facility for a realistic human tumor volume (a sphere of 5 cm diameter).

At first, the capabilities of the HIMAC accelerator and its raster scanners were tested demonstrating the capability of the machine to provide up to $\sim 10^{10}$ carbon ions within 220 ms on a circular surface of 2.5 cm radius.

A dedicated dosimetry protocol was established to provide precise dose measurements at ultra-high dose rates. The reliability of the dose monitor and point measurements detectors were tested at different dose rates and proved to have a few percent accuracy.

Finally, the irradiation of a 5 cm diameter sphere placed at ~ 25 cm depth in water was performed in FLASH and conventional irradiation modalities. For this purpose, a 3D range modulator was used coupled with intensity-modulated raster scanning. A uniform dose in the tumor region of 10 Gy was delivered with 2 to 5 Gy/s for conventional irradiation and with ~ 45 Gy/s in FLASH conditions. Punctual dose measurements were acquired in both irradiation modalities and showed an agreement over the irradiated volume within 3-3.5%. We, therefore, proved that it is possible to irradiate a realistic human volume with Carbon ion FLASH in an operating clinical facility. This represents a solid motivation to continue further projects for carbon FLASH.

Additionally:

- I was invited to present my research activity to the group at QST and visit and at the Heavy Ion therapy center in Osaka.

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

- I participated to the homestay program
- I had the chance to travel a bit over Japan: visiting Kyoto, Tokyo, Nikko, Okutama, and Osaka.

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

JSPS Summer Program 2023
Research Report

1. Name: Johannes Heinrich Krebs (ID No. SP23305)
2. Current affiliation: Julius-Maximilians-Universitaet Wuerzburg
3. Research fields and specialties: Chemistry
4. Host institution: Kyoto University / Institute for Chemical Research (ICR)
5. Host researcher: Prof. Dr. Hironori Kaji
6. Description of your current research My current research focuses on the study of boron containing chromophores, their photophysical characteristics, and their various potential applications. My two focus points are on the one hand, three-coordinate boron-containing π -conjugated molecules and on the other hand, dicarba- <i>closo</i> -dodecaboranes as a substituent on three-coordinate boron. The boron moiety usually acts as a strong π -acceptor due to its vacant p_z orbital which is oriented perpendicular to its plane. In our work, we have employed a broad range of functionalizations to adapt the acceptor moiety to specific needs depending on the desired application. Both topics focus strongly on the rotation dependent effects of these moieties in molecules that can be utilized for specific properties.

7. Research implementation and results under the program

Title of your research plan:

Planarized triaryl boron π -acceptor TADF materials for OLED devices

Description of the research activities:

During my time in the group of Prof. Kaji I continued our existing collaboration compounds synthesized in our laboratory at the University of Wuerzburg have been studied in OLED devices fabricated in the lab at the Kyoto University.

In the first couple of weeks, I helped with the fabrication of OLED devices that were based on our groups computationally designed series of D- π -A (donor- π -acceptor) thermally activated delayed fluorescence (TADF) emitters with fluorinated triarylboron π -acceptors.

Devices of the compound in question have previously only been prepared using a wet film process that generally results in lower performance. This time, devices were prepared using a vacuum deposition method. Unfortunately, the obtained devices did not show an improved performance.

We were not successful in the timely preparation of planarized triarylboron acceptor TADF materials to test their performance in OLED devices. From our improved understanding, in its stead, compounds of a new generation of promising candidates for the emitting layer of OLED devices were synthesized in the second half of my stay. These compounds, similar to TADF, plan on harvesting the T1 generated excited states for improved device performance.

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

All in all, the JSPS summer program was a very well-organized short research stay. The length was just right to get accustomed and productively work in a new laboratory. Getting to know, chat, and socialize with my colleagues gave me good insight into the Japanese work environment and a better understanding of the academic system.

Thanks to an agreement with my Host, I was able to use my weekends for several travels to see the nature, experience the culture, and to talk to the people of Japan. Especially the Homestay program was a very valuable experience!

9. Adviser's remarks (if any):

JSPS Summer Program 2023

Research Report

1. Name: Len Jonah Tristan Brandes	(ID No. SP23306)
2. Current affiliation: Technical University of Munich	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: The University of Tokyo	
5. Host researcher: Kenji Fukushima	
6. Description of your current research	
<p>My research centers around using machine learning methods to better understand the ultra-dense matter encountered in neutron stars. Neutron stars are among the most extreme environments in the universe. In their interior, densities are realized which far exceed those reachable in terrestrial experiments. Hence, they provide a unique window to the unknown physics at ultra-high densities. The relationship between pressure and energy density, commonly referred to as the equation of state, can be used to describe the internal structure of neutron stars. It is governed by the degrees of freedom realized inside neutron stars. Unfortunately, the relevant degrees of freedom are yet unknown, and a plethora of different scenarios have been proposed in the literature, for example a possible phase transition from nucleonic matter to a new state of quark matter in the deep interior of neutron stars.</p> <p>To gain information on the unknown phase structure at extremely high densities, we introduce a general parametrization of the equation of state that can represent a variety of scenarios with different degrees of freedom. The parameters of the parametrization are constrained based on recent astrophysical data. This leads to an allowed range for the equation of state, which can be analyzed for signatures of possible phase transitions. A first-order phase transition, for example, would result in constant pressure along an extended energy density interval.</p> <p>In previous analyses, various authors have used machine learning to constrain the neutron star equation of state. But in their approaches, they need to simplify the astrophysical data, which introduces systematic bias. We propose to overcome these shortcomings by instead employing a recently developed technique known as neural likelihood estimation. With this method the full information from the astrophysical data can be extracted without introducing any bias. More specifically, a neural network is trained on simulated data to infer the likelihood for the equation of state parameters based on observed detector spectra.</p>	

7. Research implementation and results under the program

Title of your research plan:

Inference of the neutron star equation of state with machine learning methods

Description of the research activities:

During my two-month stay at the University of Tokyo, we have designed and implemented a neural network architecture for inferring the neutron star equation of state from astrophysical data. Based on simulated detector spectra, we have already trained the neural network to infer the parameters of a simplified equation of state parametrization with only two parameters. More analysis is needed, but preliminary results show that the equation of state parameters can be constrained more tightly compared to previous approaches. Before we can insert the real observed detector spectra, we must first extend our approach to a more realistic equation of state model. After that, we can hopefully report our findings in a scientific paper.

In addition to this research project, I had numerous stimulating discussions with Japanese researchers. I have given seminar talks at the University of Tokyo, RIKEN, and the Yukawa Institute for Theoretical Physics in Kyoto, and I visited researchers at Tohoku University. I hope to meet many of my new contacts again at future scientific conferences.

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

I am very grateful to JSPS for not only giving me the opportunity to considerably advance my scientific research, but also for allowing me to experience such a fascinating country as Japan and connecting me with such a kind host family.

9. Adviser's remarks (if any):

【SP23307】

JSPS Summer Program 2023 Research Report

1. Name: Maria MATVEEV	(ID No. SP23307)
2. Current affiliation: Technical University of Munich	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Osaka University	
5. Host researcher: Prof. Dr. Shin-ichi OHTA	
6. Description of your current research My research focuses on the mathematical foundations of machine learning. In particular, I study the underlying mathematical principles and techniques for designing and understanding machine learning algorithms. The general goal is to advance the capabilities of machine learning systems while making them more reliable and robust. These machine learning systems have numerous applications, among them in image and speech recognition, natural language processing, robotics, and healthcare. One exemplary subfield I am working on is the explainability of machine learning classifiers. In particular, the aim is to understand how the data points influence the model during the training and how data set problems such as mislabeling, noise, and imbalance can be recognized and mitigated. Therewith, a more explainable and reliable machine learning system can be realized, which is of uttermost importance for its application. Symbiotically, machine learning and computational methods in general are used to enhance the study of mathematics itself. An example of this is using numerical simulations to evaluate the tightness of a theoretical bound. Therefore, part of my research is programming and numerical experiments that confirm or enable the theoretical results.	
7. Research implementation and results under the program Title of your research plan: Riemannian Manifold Learning	

【SP23307】

Description of the research activities:

During my 9-week research stay in Osaka with Prof. Shin-ichi OHTA, I worked on optimal transport for Riemannian manifold learning. The broader idea was to use data science to attack a problem in pure mathematics which has a clear motivation from the applied, in particular from the artificial intelligence side.

For this, I studied relevant literature, especially recent papers that discussed computational challenges and theoretical bounds for approximate solvers. I then implemented two of the proposed algorithms from these papers to connect theoretical concepts with practical simulations in python.

As part of this research, we visited Prof. Asuka TAKATSU at Tokyo Metropolitan University. This collaboration allowed me to learn from her, share findings, and work together to address specific challenges in our project.

I also joined the weekly seminar of Prof. OHTAs and gave a talk for the group.

In addition to my research activities in Osaka, I attended a conference in Saitama on Geometry and Probability.

Overall, my research experience in Japan was very good and enriched my understanding of the mathematical foundations of machine learning.

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

During my 9-week stay in Osaka, I got the opportunity to learn not only about the similarities and differences of research but also about life in Japan. On some weekends, I took the opportunity to also explore diverse cities like Kyoto, Hiroshima, Tokyo, and Osaka, each offering a unique cultural experience. I was very impressed by the temples, shrines, serene gardens, and bustling atmosphere of the cities. To point out one unforgettable cultural experience, I attended a performance of traditional Bunraku theater. I was also able to immerse myself in the daily life of a Japanese family during the weekend and experience Japanese hospitality firsthand.

9. Adviser's remarks (if any):

Ms. Matveev was very active in research and we could have productive discussions on, for example, computational optimal transport. Also her skill of computation was helpful in discussions with Prof. Takatsu.

JSPS Summer Program 2023 Research Report

1. Name: Martin Juckel	(ID No. SP23308)
2. Current affiliation: Forschungszentrum Juelich GmbH	
3. Research fields and specialties: Chemistry / Engineering Sciences	
4. Host institution: National Institute of Advanced Industrial Science and Technology	
5. Host researcher: Dr. Haruo KISHIMOTO	
6. Description of your current research <p>In the current research project "WirLebenSOFC", degradation mechanisms in SOFCs (solid oxide fuel cells) are to be investigated and understood in cooperation with the company Bosch GmbH. To this end, SOFCs have been manufactured in the institute of energy and climate research (IEK1) at the Forschungszentrum Jülich GmbH. Subsequently, these SOFCs have been characterized after approx. 1000 hours of operation to visualize and identify possible changes in the microstructure of the SOFCs. To achieve this in the best possible way and initially to be able to exclude further interactions between the anode and the cathode, symmetrical half-cells were produced. For this purpose, an intermediate layer of GDC (Gadolinium-doped ceria) was first printed on both sides of the electrolyte substrate 8YSZ (with 8 mol% Y₂O₃ fully stabilized ZrO₂) and then sintered. For the corresponding conductive layer, conventional LSCF (Lanthanum strontium cobalt ferrite) was used in the case of the cathode and a mixture of NiO and GDC in the case of the anode. This was printed on both sides of the GDC interlayer and sintered again. The focus of the research is on electrolyte-stabilized cells, the so-called ESCs. Another aspect of this research project is the production of possible nanoparticles containing anode layers since these are particularly efficient and therefore can be operated at low temperatures. The reason for that is the high catalytic activity of nanoparticles, which results in a better electro-activity of the cell, as well as other nanosized effects, such as quantum tunneling behavior, high surface reactivity energy or high surface areas. The latter is especially important, as the reaction of the cell takes place on the triple phase boundary between the metal, the support, and the gas phase. This should enable the production of SOFCs, especially in the long term, which can be used for a sustainable future, when operating with renewable energies. Here, too, the subsequent characterization of the microstructure is indispensable. Both the symmetric anode half-cells and the symmetric cathode half-cells have already been fabricated and the first aging experiments have already been successfully completed. The production of nanomaterial- based anode half-cells at the IEK1 at the Forschungszentrum Jülich GmbH, on the other side, have shown some problematic issues, such as delamination or other adhesive problems, when operating at a longer period of time of around 1000 hours. This can be explained by the fact that so far only conventional manufacturing methods, such as screen printing, have been used and these normally come up with a variety of problems. For the use of screen printing, a paste, with NiO/GDC particles is essential. However, the high surface area of nanoparticles and their strong tendency for agglomeration makes it almost impossible to get enough solid content into the paste and consequently, there is not sufficient adhesive strength between the particles within the conductive layers.</p>	

7. Research implementation and results under the program

Title of your research plan:

Pulsed Laser Deposition for the manufacturing of nanomaterial-based symmetrical anode half cells.

Description of the research activities:

The research stay, which was sponsored by the Japan Society for Promotion of Science (JSPS) was a complete success for the National Institute of Advanced Industrial Science and Technology (AIST), Forschungszentrum Juelich GmbH and me.

During my research stay in AIST, I was able to produce nanomaterial-based anode half cells. In that, the handling of the pulsed laser deposition machine was learned and a variety of different parameters for this machine was used and altered to produce the best symmetrical anode half cells with regards to their stability and their electrochemical performance: Oxygen background pressure, stoichiometric composition as well as exposure time. The following characterization of the microstructure of these symmetrical anode half cells was done using scanning electron microscopy, including wavelength-dispersive X-ray spectroscopy. Therefore, the handling of this machine was improved, and all the produced cells were fully characterized. Both the surface and the cross section of the cells were investigated. Finally, the characterization of the electrochemical performance was done using electrochemical impedance spectroscopy. For that, the existing measurement stand in AIST was modified for the injection of hydrogen gas. Due to the limited amount of time and the big success of producing a great variety of different symmetrical anode half cells, the established collaboration between Forschungszentrum Juelich GmbH and AIST will be continued for the generation of more data and consequently a publication in a scientific journal.

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

During my stay in Japan, I was able to discover all the beauty of this wonderful country and its friendly and gentle people. I gathered new experience in the Japanese way of life during the homestay with a Japanese family as well as during my work at AIST. Furthermore, it was a great pleasure to experience the Japanese work culture not only in the research facilities in AIST in Tsukuba, but also in their research facilities in Nagoya, which was financed by the travel grant of JSPS. The research facility in Nagoya was especially impressive, as their research and consequently, their equipment is related to their collaboration with big partners of the Japanese industry, working in the research field of solid oxide fuel cells. In that, it was very nice to see that the sustainable research of AIST, finds its use in the Japanese daily's life. Finally, I want to mention the joyful experience of studying the Japanese language both in a Japanese class, sponsored by JSPS and during my stay in Japan. In summary, I am very grateful for JSPS to give me this great opportunity to discover the way of living in Japan and to help me promote my current research project.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Okan Altan	(ID No. SP23309)
2. Current affiliation: TU Dortmund University	
3. Research fields and specialties: Chemistry, Biological Sciences, Pharmaceutical Sciences	
4. Host institution: Tohoku University	
5. Host researcher: Prof. Fumi Nagatsugi	
<p>6. Description of your current research</p> <p>Cellular DNA is subject to a wide variety of endogenously and environmentally (exogenously) induced mutations, for example via reactive oxygen species (ROS) or photo-irradiation. This type of damaged DNA strands is also known as DNA lesions and one of the most important DNA lesions are the so-called DNA interstrand crosslinks (ICLs), which can be cytotoxic if not repaired. Since ICLs get formed by the formation of strong covalent bonds, DNA replication and transcription can get blocked, thus leading to cell death (apoptosis). DNA lesions like ICL are a challenge for the DNA repair machinery, due to this strong ICL formation and a defect in this repair system is closely related to the cause of diseases like cancer.</p> <p>One approach to regulate this process is the targeting of DNA/RNA via novel therapeutic methodologies, like for example via oligonucleotide-based therapeutics (ONT). To develop these highly effective ONT against DNA lesions, e.g. the introduction of so called: CFO (cross-link forming oligonucleotide) is of great importance, since they can inhibit the respective target DNA/RNA function.</p> <p>For this, we previously investigated the ICL formation of dsDNA sequences based on the Dickerson-Drew (DD) dodecamer and its correlation with AP-sites as well as oxidative lesion formation. We proposed that via our novel photocatalytic system the formation of ICL is following a 1-e⁻ oxidation pathway based on a Guanine radical cation species.</p>	

7. Research implementation and results under the program

Title of your research plan:

Synthesis and evaluation of DNA photochemical labeling via ATTO-465 based PET pathway

Description of the research activities:

In this project we tried to investigate further our prior proposal of a photocatalytic ICL formation following a $1-e^-$ oxidation pathway based on a Guanine radical cation species. For this, I synthesized ATTO-465-OH and optimized via screening of different conditions the PET (photoinduced electron transfer) quenching process between the fluorophore ATTO and DD-DNA derived duplex sequences. Via denaturing PAGE and MALDI-TOF analysis I could observe ICL formation band and oxidative lesions like 8-oxo-G ($2-e^-$ oxidation product) which support the idea of a PET based $1-e^-$ oxidation pathway. Moreover, we could observe that by using Aura- N_3 based labeling reagents (+/- SPAAC click reaction) the DD DNA based sequences with terminal GC-tracks could be more favourably labeled. However, we need to further screen different conditions and sequences for the investigation of the correlation between ICL formation by photooxidation and photolabeling based on the PET system via ATTO-465-OH and thus in order to gain a deeper understanding of the proposed $1-e^-$ oxidation pathway for ICL formation.

The main objectives of my research at Prof. Nagatsugi lab can be summarized as:

1. Synthesis of ATTO-465-OH monomer and optimization of its PET quenching mechanism towards DD-DNA derived sequences.
2. Evaluation of the formation of ICL and oxidative lesions by a ATTO-465-OH PET based approach following a $1-e^-$ oxidation pathway.
3. Evaluation of DD-DNA based photolabeling reaction by using Aura- N_3 derived labeling reagent in the presence of ATTO-465-OH induced PET.
4. Investigation of the correlation between PET based photooxidative ICL formation and photolabeling in order to gain a deeper understanding of the proposed $1-e^-$ oxidation pathway for ICL formation.

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

I firstly want to thank everyone within the JSPS team and beyond for the great support from the beginning of our arrival in Tokyo towards the end of this summer program term. I highly appreciate the perfect organization in every aspect and hope I can pay this kindness back in the future!

I hereby once again want to thank my dear research group at Tohoku University for all the support I received throughout my whole stay in Japan!

I am looking forward to collaborate in the future again with the JSPS society for the promotion of science within Japan!

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Raphael Frederik TRUMPP	(ID No. SP23310)
2. Current affiliation: Technical University of Munich	
3. Research fields and specialties: Engineering Sciences	
4. Host institution: The University of Tokyo	
5. Host researcher: Prof. Manabu TSUKADA	
6. Description of your current research	
<p>My research is interested in approaches that help to bridge the sim-2-real gap in machine learning (ML), focusing on deep reinforcement learning (DRL) methods. In DRL, agents learn an action policy through trial-and-error with their environment, e.g., they learn how to play ATARI games or, as a more practical example, how to steer a car. The sim-2-real gap describes that synthetic data generated in simulation and used to train ML models does not resemble real-world data correctly. Because of the sim-2-real gap, DRL agents trained in simulation show reduced performance when applied in the real world.</p> <p>Residual policy learning (RPL) is a subarea of DRL that learns a residual action on top of a classical controller, which has proven to accelerate the training of DRL agents with application examples in robotics. Similarly, this approach is suitable for autonomous driving and vehicle control, e.g., a residual action can be learned on top of a vehicle controller for improved driving performance.</p> <p>In this regard, an interesting testbed for real-world evaluation is the F1TENTH cars. These cars deploy a fully autonomous driving stack on an RC car (scale 1:10) with access to various sensors (including a LiDAR) and a central microcontroller unit. They are used for autonomous racing competitions and have recently gained much attention in the autonomous driving community.</p> <p>During my work, we use RPL techniques for F1TENTH cars to reduce race lap times. Our results show that RPL allows efficient training, which can help to bridge the sim-2-real gap, e.g., by finetuning on real-world data. Since our previous results were only obtained in simulation, my work now focuses on using this approach in the real world and finding ways to bridge the sim-2-real gap efficiently.</p>	

7. Research implementation and results under the program

Title of your research plan:

Learning-enhanced Online Path Planning for Multi-Agent Autonomous Racing

Description of the research activities:

During races of the F1TENTH cars, path planning plays a fundamental role in obtaining fast lap times. Previous works assume that precise map data of the racetracks can be used to calculate a racing line. However, these approaches cannot be used in unknown environments and are not robust to mapping/localization errors. Thus, my research activity focused on developing an online path planner that can be used in unknown environments using only the F1TENTH car's local sensor readings. Together with the lab group I visited, we decided to use an artificial potential fields (APFs) method. In this technique, objects are described as repulsive forces and the target location exerts an attractive force. A path to the target location can be calculated by following the APF's gradient. Each LiDAR point is directly modeled as an obstacle in our approach, implicitly defining the racetrack's walls. Since APF-based planners avoid obstacles and can overtake other vehicles, my activities focused on extending the racing scenario to multi-agent racing with opponents. Our tests show that while the APF planner can navigate the racetrack successfully without opponents, overtaking maneuvers only succeed in straight sections. After discussing potential improvements in the lab group, we introduced a residual policy learning-based controller on top of the APF planner to correct wrong overtaking decisions. Early results show that the learning-enhanced online path planner improves the overtaking behavior for specific scenarios.

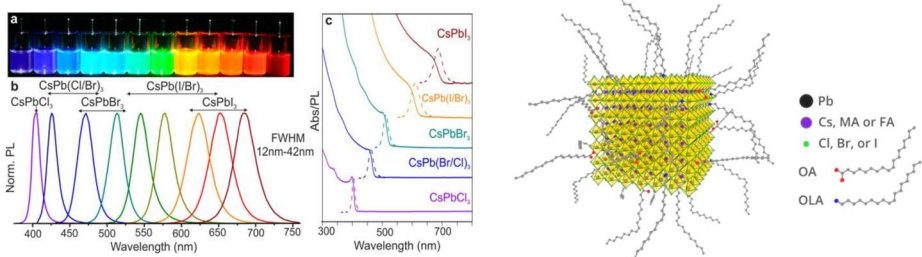
8. Please add your comments, including any cultural experience during your stay in Japan (if any):

Participating in the JSPS summer program was a rewarding experience from both a professional and a personal experience. First, the work in the lab I visited exposed me to several interesting research questions. It brought me in contact with people with a similar research focus and a high potential for future collaborations. Due to the friendly working atmosphere at the lab, we had an inspiring exchange of experiences with people from different cultures. In the same sense, the JSPS summer program is quite a unique setup because it brings international researchers in contact. It was fun to explore and get to know Japan together as a group of open-minded people from many countries worldwide.

9. Adviser's remarks (if any):

The innovative application of residual policy learning techniques to the F1TENTH cars demonstrates a blend of technical depth and inventive thinking. Furthermore, creating an online path planner using artificial potential fields signifies their adept problem-solving skills. On a personal front, Raphael's enriching experiences during the JSPS program and their positive embrace of collaborative and intercultural opportunities showcase their adaptability. I'm confident that their foundational research will propel advancements in their field, and I look forward to their future contributions.

JSPS Summer Program 2023 Research Report

1. Name: Roshini Jayabalan	(ID No. SP23311)
2. Current affiliation: University of Augsburg	
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	
<p>Light Emitting Diodes (LEDs) have swept the conventional lighting marketplace for a variety of reasons, most notably due to their extended lifespans, reduced energy consumption and lower maintenance requirements. Often explored materials include III-V semiconductors, organic molecules and quantum dots which are even commercially used in applications such as displays and lighting. In recent developments, metal halide perovskite-based LEDs (PeLEDs) have shown a great potential and can pose as a viable material to organic and quantum dot LEDs (OLEDs/QLEDs).</p>	
	
<p>Fig: Perovskite nanocrystal solutions with emission spectra (left) and nanocrystal capped with ligands (right).</p>	
<p>Polycrystalline thin films of lead halide perovskites (LHPs) contain large amounts of grain boundaries that are rich in charge traps, causing an adverse effect on the optoelectronic properties and stability of the perovskite materials, with the growth and morphology control of such crystals is challenging¹. On the other hand, perovskite nanocrystals (NCs) are versatile; with various synthesis techniques allowing for particles to be shrunk down to only a few nanometers in all directions. Additionally, the shape, size, and composition of the NCs can be tuned and influence important properties like the emission wavelength, charge carrier diffusion or the coupling between NCs².</p>	
<p>Despite the huge advancements in the proficiency of perovskite NCs, their application is still far-fetched compared to other materials used in current display technologies. Some of the properties that need to be addressed include the study on electro/photo-chemical degradation of NCs by ion migration, charge imbalance, luminescence quenching, and device degradation under electrical operation. Therein, the ligand sphere plays a key role, which is why we are focusing on improving them by tailor-made new ligands for NCs.</p>	
<p>¹Jiang, Y et al. 2020. ACS Energy Lett. 5, 6, 1797–1803</p>	
<p>²Protesescu, L. et al. 2015. Nano Lett. 15, 6, 3692–3696</p>	

7. Research implementation and results under the program

Title of your research plan:

Charge-carrier dynamics of Lead Halide Perovskites studied using simultaneous Displacement Current Measurements and Photoluminescent Intensity.

Description of the research activities:

The main goal of this study is to understand photoluminescence (PL) quenching in perovskites NCs by injected charge-carriers. The system of perovskite NCs has a large surface area which are prone to defects and therefore must be almost completely passivated by ligands to suppress ion migration. Studying PL quenching in perovskites can help us better understand the NC system under operation and identify centers that contribute to PL quenching and degradation.

The DCM-PL setup available at Prof. Noguchi's lab simultaneously measures the displacement current (DCM) and photoluminescence (PL) intensity in devices. The DCM-PL technique can successfully detect the correlated behavior of the charge-carrier dynamics and the PL losses in emitters. By using a metal-insulator-semiconductor (MIS type) device structure, one can ensure unipolar charge injection (holes/electrons) and the system is simplified to study the effect of accumulated charges on the PL individually. Such devices have been fabricated with LHP perovskites capped with various ligands and as a preliminary result, we have found electrons do not contribute much to PL quenching. This result is contrary to our initial hypothesis, and thanks to this program, we now have a new perspective to understand the physics of this system much better.

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

Personally, I have been an admirer of the Japanese language, food, and culture and therefore, this was a golden opportunity to not only do research, but also explore and discover the essence of this country to the fullest. In terms of activities, Japan has so much to offer, from the lively city life to beautiful and serene nature, I had the opportunity to experience them all and to me, it felt like home. Though the summer heat and rain were a hurdle, this never stopped me from exploring different parts of Japan. The people from my lab and my professor were very kind and made me feel comfortable and my work here was quite enjoyable. If given another opportunity, I'd would love to visit this country again.

9. Adviser's remarks (if any):

Kindly clarify the visa requirements and procedures for future applicants.

JSPS Summer Program 2023 Research Report

1. Name: Sabrina TULKA-VOLLRATH	(ID No. SP23312)
2. Current affiliation: University of Applied Sciences and Arts Bielefeld	
3. Research fields and specialties: Social Sciences	
4. Host institution: Kyoto University	
5. Host researcher: Prof. Sayaka TAKENOUCI	
6. Description of your current research	
<p>The doctoral project is located in the field of vocational qualification research. Vocational qualification research in nursing should focus on identifying key problems. Such key problems are intrinsic to a special educational potential because they characterize typical, interdisciplinary, and multidimensional problems, conflicts, and dilemmas in nursing that cannot be overcome by using mere textbook knowledge.</p> <p>In the field of nursing, there have been only a few studies to date on the systematic investigation of key problems. With regard to the doctoral project, challenging, conflict-ridden situations in psychiatric nursing are explored in order to derive educational content for psychiatric nursing. This is accompanied by answering the question of what is challenging about psychiatric nursing and what educational moments it can enable for trainees. The findings serve as the empirical foundation of nursing curricula.</p> <p>The following questions are connected with the research interest:</p> <ul style="list-style-type: none">• Which key problems can be identified in psychiatric nursing and how are these dealt with by nurses?• What educational goals and content result from these key problems for learners in nursing education? <p>Key problems in psychiatric nursing are explored using a triangulation of work observation and episodic interview. Methodologically, the doctoral project is embedded in qualitative social research, ethnomethodology, and grounded theory methodology.</p>	

7. Research implementation and results under the program

Title of your research plan: Key problems in psychiatric nursing in Japan

Description of the research activities: An interview was conducted with a professor of psychiatric nursing at Kyoto University. The interview guide contained the following two topics: Challenges for nurses working in psychiatry and design of teaching in psychiatric nursing. The interview was recorded and transcribed according to the transcription rule of Dresing and Pehl (2015). The transcript was analysed using content analysis in the style of Mayring (2019). MAXQDA software was used for data analysis.

Regarding challenges for psychiatric nursing, one key problem emerged from data: "Feeling Frustrated." Nurses in psychiatric wards in Japan sometimes have to deal with feelings of frustration. They feel frustrated because there is a discrepancy that they cannot overcome. On the one hand, they try to encourage their patients to be discharged from the psychiatric ward and live again in the community. Leading a fulfilling life in the community is an important goal of psychiatric care.

But on the other hand, there are currently too few outpatient care services for people with mental illness in Japan. Many patients cannot be discharged from hospital because they cannot receive outpatient care. For this reason, the rate of inpatient admissions is still high. Outpatient psychiatric care is recently developing in Japan. Nurses in Japanese psychiatric hospitals have to cope with this discrepancy. To prepare future nurses for those challenges, lectures, seminars, role-plays, and materials such as movies or novels are used in teaching at Kyoto University. These methods are essential to give nursing students "lived experience." In order to understand mentally ill people, it is crucial for nurses to understand how patients experience their illness. In addition to the research activity, a lecture about the PhD topic and results of the interview was held at Kyoto University. In the lecture, we discussed similarities and differences in psychiatric nursing, nursing education, and doing research in a doctoral program in nursing science.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): The stay in Japan was very enriching for me. I was able to gain an insight into the way a Japanese university works. I learned that the clinical practice and education within nursing science have many similarities between Japan and Germany. Also, key issues in psychiatric nursing and teaching in university seem to be similar. It was a pleasure for me to work at Kyoto University. I have learned a lot about nursing in Japan. Furthermore, I also gained a lot of cultural experience in Japan. I took part in a tea ceremony, had ikebana lessons, bathed in the onsen, saw a dance of Arima Geiko, and spent a night at ryokan. Moreover, I visited different prefectures in Kansai for sightseeing. I was deeply impressed by the intensity of Japanese culture and the beauty of Japanese nature.

9. Adviser's remarks (if any):

I sincerely appreciate Sabrina's active participation in our lab activities during her stay at Kyoto University. In particular, her passionate attitude toward nursing research and her encouragement to support junior colleagues gave great courage and inspiration to the members and was very precious experience for young researchers in our lab.

JSPS Summer Program 2023 Research Report

1. Name: Sarah von Löhneysen	(ID No. SP23313)
2. Current affiliation: Bioinformatics group, University of Leipzig	
3. Research fields and specialties: Biological Sciences	
4. Host institution: Earth-Life Science Institute - Tokyo Institute of Technology	
5. Host researcher: Liam M. Longo	
6. Description of your current research Integrating Experimental Data into Computational Approaches for Predicting RNA Secondary Structures The accurate prediction of secondary structures of RNA molecules solely from their sequences remains an enduring challenge in bioinformatics. To bridge this gap between sequence and structure, collaborative efforts have emerged at the intersection of laboratory experimentation and computational analysis. I am engaged in a collaboration with a biochemistry group in Leipzig on the new methodology “Led-Seq” that combines experimental insights with structure prediction algorithms. My primary role is to orchestrate the bioinformatics analysis and integration of structure probing data into a computational framework. Our protocol harnesses structural information for the full spectrum of cellular RNA molecules. This vast repository of data enables the exploration of intriguing research questions. Central to my research is the assimilation of external information into the computational RNA structure prediction. This external data, often from structure probing experiments or phylogeny, enriches our predictive models. Phylogenetic information, for instance, entails the study of evolutionary relationships among organisms, yielding insights into conserved RNA motifs and structural features.	
7. Research implementation and results under the program Title of your research plan: Exploring Early Protein Evolution through Bridging Themes Analysis	

Proteins play a vital role in the functioning of living organisms, and understanding their evolution provides crucial insights into the history of life on Earth. In this study, we explore early protein evolution using an innovative approach known as "bridging themes," a method used by Prof. Longo. Bridging themes are short segments of sequence similarity among seemingly unrelated proteins and offer a unique perspective on events in protein evolution.

Our investigation hinged on the concept of bridging themes, which reveals hidden connections among diverse protein families. To identify these themes, hidden Markov Model (HMM) comparisons were used, a powerful tool capable of detecting sequence similarities even in distantly related proteins. Our analysis began with an existing set of bridging themes, which acted as a starting point to explore the evolutionary links between different protein families. Central to our approach will be the reconstruction of ancestral protein sequences. By reconstructing the sequences of ancestral proteins, we aim to trace their evolutionary path. By comparing these ancestral sequences between two protein families, we sought to ascertain whether the bridging segment displayed even greater similarity in the past. Such enhanced similarity could indicate an evolutionary relatedness between the families.

During my research stay, I deeply evaluated several candidates for this analysis. My focus encompassed not only the amino acid sequences but also the three-dimensional structures of proteins and the bridging themes within them. This comprehensive evaluation significantly advanced our understanding of the dataset, showing its potentials and limitations. While some instances proved to be artifacts stemming from inadequate database annotations, we eventually concentrated on two interesting connected protein families. We collected sequences from these two families across the entire Genome Taxonomy Database (GTDB). Subsequently, we generated multiple sequence alignments for both families, aiding in the visualization and comparison of their evolutionary trajectories.

Our collaboration will continue as we maintain the project's current momentum. Our upcoming steps involve the finalization of ancestral protein sequence reconstruction. This aspect of our work holds the potential to offer more profound insights into the evolutionary history of the identified protein families. It may reveal new connections and provide clarity on ancient evolutionary events.

In summary, our research investigation focusing on early protein evolution through bridging themes analysis has yielded promising outcomes.

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

9. Advisor's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Scarlet STADTLER	(ID No. SP23314)
2. Current affiliation: Jülich Supercomputing Centre, Forschungszentrum Jülich, Jülich, Germany	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: The University of Tokyo	
5. Host researcher: Assistant Professor Dr. Kana Moriwaki	
6. Description of your current research <p>Dr. Scarlet Stadler's principal research interest is applying explainable machine learning (XAI) to gain a deeper understanding of data-driven models based on atmospheric data. In her interdisciplinary research, she combines her expertise in atmospheric physics and chemistry with state-of-the-art data-driven machine learning methods to use these novel methods for data exploration. She is currently working on the “Atmospheric Representation Learning” (AtmoRep) research project.</p> <p>The atmosphere is a complex dynamical system that plays a critical role in how climate change will develop and impact humanity in the coming decades. The goal of AtmoRep is to leverage the latest advances in large-scale machine learning techniques, in particular self-supervised representation learning, to develop a model of the atmosphere trained directly on petabytes of pre-processed Earth observations.</p> <p>Stadler's tasks involve to disentangle the representation of atmospheric dynamics in a large, self-supervised transformer network. In representation learning, the machine learning model is trained to represent the data's features properly. Stadler's goal is to explain the learned representation. Does the representation learned by the model follow our physical understanding? How can we ensure the model is accurately predicting for the right reasons? Moreover, she focuses on statistically proper evaluation of the model's precipitation forecasts, adhering to meteorological standards.</p>	

7. Research implementation and results under the program

Title of your research plan:

Explaining the Generative Deep Neural Network capable of disentangling the Line Intensity Mapping H α and OIII Observations of the Universe

Description of the research activities:

Assistant Professor Dr. Kana Moriwaki aims to understand the components and evolution of the Universe to get a deeper understanding of, for example, dark matter and dark energy. The key to achieving this understanding is by measuring the large-scale structure of the Universe, i.e., the distribution of galaxies over a large volume. The measurements of the Universe carry several signals simultaneously, challenging the data analysis. Thus, Moriwaki uses machine learning to solve the critical problem of signal confusion in volume measurements of the Universe.

The goal of the summer research stay is to explain how Moriwaki's machine learning model succeeds in separating the mixed hydrogen line (H α) and oxygen line (OIII). As deep learning approach she uses a conditional generative adversarial neural network (cGAN). The input is an image of the mixed signal and the outputs are two generated images with the pure H α and OIII signals respectively.

To understand how the cGAN disentangles the signals, Stadler and Moriwaki developed several experiments perturbing the mixed input and monitoring the performance of the resulting separated samples. For the evaluation, Moriwaki introduced Stadler to the correlation coefficient based on the power spectrum of the signals. Given the correlation coefficient for different astronomical distances, it becomes possible to evaluate the performance of the model on the small and large scale structures of the Universe.

The main result of the study is the understanding how the cGAN disentangles the signals. First, the generator "memorizes" the mixed signal. Then, it mainly uses the brightness to identify the H α signal. Finally, it "subtracts" the bright H α signal from the "memorized" mixed signal and assigns the difference to the OIII signal. From a machine learning point of view this is a valid strategy producing good results. Nevertheless, it limits the model to reconstructing the "memorized" mixed signal, making it unable to identify non-physical inputs such as random numbers or a uniform, average field. Moreover, the reliance on the brightness makes the model not easily applicable to data where the ratio brightness of the signals is uncertain.

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

The working culture in Moriwaki's group impressed me. The professors have an extremely broad knowledge and are encouraging while asking deep questions during seminar talks and commenting on the results and methods. Especially fascinating is the open communication of negative results, i.e. the hypothesis could not be proven. Moreover, the group takes considerable amounts of time in keeping up with the latest research, new research methods and communicate these to each other to increase everyone's knowledge.

Besides the experience of a different working culture, I met with Japanese friends in Tokyo, Saitama, and Aichi. We cooked and ate great vegan, Japanese food together. My friends took time to make it by themselves, because it is difficult to find vegan food in restaurants. We also went to a traditional Japanese house and had matcha with wagashi. Moreover, I enjoyed karaoke with friends from Okinawa and we sang together in Japanese.

9. Adviser's remarks (if any):

**JSPS Summer Program 2023
Research Report**

1. Name: Dr. Arvid KRÜGER	(ID No. SP23315)
2. Current affiliation: Kassel University	
3. Research fields and specialties: Urban Planning (Interdisciplinary: Engineering and Social Sciences)	
4. Host institution: Tokyo University	
5. Host researcher: Prof. Fumihiko SETA	
6. Description of your current research	
<p>The one starting point of the research is what German Administration calls “services of general interest” (Daseinsvorsorge), the responsibility of the public sector to maintain the living conditions in town and country equally stable by means of a socio-infrastructural supply. Several administrative levels implement this by the provision of public, mostly social, infrastructure. From a scientific point of view, the term social infrastructure goes beyond the administrative understanding of anchoring it only in the social departments. It goes beyond the mere purpose of providing a specific service (e.g. library, train station) and inherently has an additional function: namely social cohesion – from an urban design perspective, this can be translated as a neighborhood-oriented public space or urban street life.</p> <p>This task faces demographic challenges. In many parts of Germany and Japan, both of which are mature Western societies, not only the population declines (without replacement migration), but there is also migration within the country, causing some regions to suffer greater population losses while metropolitan areas in particular are gaining. From a geographic perspective, spatial inequalities arise that can be analyzed spatially as a center-periphery problem.</p> <p>The second starting point is accessibility by train – something of growing importance in times of climate change and the transformation of mobility away from car-dependency. Germany and Japan are among the leading nations in (high-speed) rail systems; however, differences between both systems are obvious. Nevertheless, linking rural and metropolitan areas with each other by train, high-speed as well as local and suburban systems may show rather similarities between Germany and Japan, both favoring integrated systems (e.g. in Japan with Akita Shinkansen).</p> <p>The research questions are therefore</p> <ol style="list-style-type: none"> I. What different roles do the station areas in Japan and Germany play in peripheral small towns in terms of a central node function and as a spatial cluster of services of general in-terest? II. With what differences do clusters of these services of general interest arise in Central Nodes (Germany) or within the framework of Transit Oriented Development (Japan)? How does the governance of the planning of such clusters look like? Are there comparable insights into "third places" and the social meaning of infrastructure (see above)? 	

【SP23315】

7. Research implementation and results under the program

Title of your research plan: Governance in and for the peripheries: Transit-Oriented-Development and Integrated Urban Development as schemes to develop rural municipalities in the peripheries of Germany and Japan

Description of the research activities:

Due to the changed bureaucratic framework, which not led not only to missing almost all JSPS activities (scheduled in the first week) also the research had to be reorganized. From the beginning (since the first application) it was stipulated that a JR Rail Pass renders the visit of the case studies in rural Japan possible. That was unilaterally changed by the host institutions (other Visa requirements). Hence, we managed to alter the research plan and divided it into smaller sub-research projects:

- 1) Connections between urban and public transit planning in demographically challenged rural areas with touristic potentials: the cases of the Chiba peninsula and the district of Mecklenburgische Seenplatte
- 2) Evaluation of Public Space in small-town station areas in Northern Honshu to be compared with suitable examples in East Germany (based on the eligibility of the JR East Tohoku and Niigata/Nagano pass)
- 3) Comparison of the recent planning of bringing high-speed-rail to a rural big city in context of a well-respected sustainability approach within municipal development strategies – Looking for governance connections (Toyama and Erfurt)
- 4) HSR-stop as an incentive of urban development, comparing Bad Hersfeld with smalltowns long the northern Shinkansen lines (Yamagata, Joetsu, Hokuriku) [with Frankfurt and Tokyo as relevant metropolitan cores]
- 5) Side-Project: A photo-essayistic review of parking solutions in a small-townish urban environment in Tokyo's low-rise wards

Projects 1-4 base on the original research plan, but where separated because of necessary different methodic approaches (e.g. the intended interviews with municipal planners happen in project 1, the Toyama case appeared to be of its own relevance by established contacts to fellow professorial colleagues to be able to talk to in person) and the different framework of travelling (e.g. the ad-hoc developed on-site-analytic approach for projects 2+4 after recognizing JR East Tohoku and Niigata/Nagano passes). Projects 1-4 will be pursued with German counterpart cases in the similar four methodic approaches that have been developed during the first weeks of the JSPS stay in Tokyo. They will result in separate scientific articles that shall be able to be submitted in early 2024. Project 5 goes back to a former idea of the home lab to curate a photo exhibition on research in Asia of different lab members. Additionally, Dr. KRÜGER can contribute to the work of the Prof. SETA's lab with some open access publications about German governance questions.

8. Please add your comments, including any cultural experiences during your stay in Japan (if any): None

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

JSPS Summer Program 2023
Research Report

1. Name: Timo SEWTZ	(ID No. SP23316)
2. Current affiliation: University of Cologne	
3. Research fields and specialties: Law	
4. Host institution: Keio Law School	
5. Host researcher: Prof. YAMAMOTO Hajime	
6. Description of your current research My PhD project is about a newer development in the European Court of Human Right's case law. The Court increasingly assesses the quality of domestic processes (rather than the substantive outcome of the process) to decide whether there has been a violation of the European Convention on Human Rights (procedural review). Within this context, I analyze the use of procedural review in the Court's judgments that challenge politically sensitive laws concerning for example abortion, euthanasia or religious symbols and clothing.	

7. Research implementation and results under the program

Title of your research plan:

Asian perspectives on the universality of human rights

Description of the research activities:

My PhD project is about a newer development in the European Court of Human Right's case law. The Court increasingly assesses the quality of domestic processes (rather than the substantive outcome of the process) to decide whether there has been a violation of the European Convention on Human Rights (procedural review). Within this context, I analyze the use of procedural review in the Court's judgments that challenge politically sensitive laws concerning for example abortion, euthanasia or religious symbols and clothing. Noteworthy, the UN Human Rights Committee tends to decide these matters differently. This could be an obstacle for the notion of universalism of human rights.

At Keio University, my aim was to deepen my knowledge of human rights law, especially by discovering perspectives on the idea of universalism from other parts of the world. I conducted research on human rights in Japan and the Far East in general. I was particularly interested in the question of why the region – unlike Africa, Europe and Latin America – has not developed a regional human rights system and what the significance of the region is in the development of human rights in the Post-World War II order.

Therefore, I researched about topics like Japanese constitutional law after WWII, the influence of religion (Buddhism especially) for the understanding of Human Rights in the Far East and the influence of Asian jurists on the establishment and furtherance of the international legal order of the past 70 years. It was a particular delight to discuss these topics with Japanese scholars and students at Keio University.

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 2023 Research Report

1. Name: HOELZEL, David J.	(ID No. SP23317)
2. Current affiliation: TU Dortmund University, Department of Spatial Planning, Urban Development Group	
3. Research fields and specialties: Social Sciences	
4. Host institution: University of Tsukuba	
5. Host researcher: Prof. Ayako Taniguchi	
<p>6. Description of your current research</p> <p>Independent mobility affects both cognitive development and physical activity of children. However, against the background of increased motorization and demographic change, Children's Independent Mobility (CIM) has declined in recent decades. These trends not only negatively affect Children's Health and Development, but also contribute to sustained car use among younger people.</p> <p>From the perspective of spatial planning, I am particularly interested in the role of the built and transport environment for children's travel behavior. Research from various countries has shown that different social and environmental factors influence CIM, but there is still a lack of findings from Germany. Therefore, my current research focuses on children in elementary school as this is an important time in life, where people learn how to behave in traffic, gradually get more independent in their mobility and begin to form opinions about mobility. My studies aim at identifying elements of the transport and built environment which promote or inhibit independent and / or active mobility of children while also incorporating social influences (especially their household) and other aspects of mobility (e. g. recreational activities). The results will generate basic knowledge for transport planning and policy in order to promote active and safe mobility among children.</p> <p>For my analysis, I use data gathered in a questionnaire survey (conducted in autumn 2020) with parents of children in twelve elementary schools in the city of Dortmund, Germany (n =1220). Based on a home address which 792 parents voluntarily provided, we calculated shortest paths between the respective residential and school locations and collected data on the transport and built environment along these paths.</p> <p>This study is supported by the Karl-Vossloh-Foundation (Project Reference: S0047/10061/2021) and is part of an ongoing PhD project at TU Dortmund University, Germany.</p>	

7. Research implementation and results under the program

Title of your research plan:

Identifying Factors of the Built and Transport Environment for Studying Children's Independent Mobility

Description of the research activities:

My research activities mainly focused on reducing the number of available variables by principal component analysis and additional cluster analysis in order to identify categories of street sections and nodes. Preliminary results of my analysis suggest that speed limits, land use, possibility of mode passage and right of way might be main variables for structuring the built environment along the school routes of the sample. This information is used in subsequent regression analysis for investigating the impact of the transport and built environment on children's travel behavior.

Besides, Prof. Taniguchi helped me get in touch with other researchers from the Universities of Kyoto and Tokyo as well as researchers from other countries who were also present in Japan. I was able to present and discuss my research two times. The insights I gained on those meetings as well as Prof. Taniguchi's advice helped me improve my research by considering my methodology, including additional secondary data and calculating additional variables.

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

Beyond my dedicated research tasks, simply living in Japan, a country with a somewhat different transport environment, has helped me reflecting the German transport system through comparison. Some elements of the Japanese transport environment might be helpful for Germany as well (e. g. additional lines and lights for cars approaching a street crossing). At the same time, I was surprised to see how many streets do not feature pavements or streetlights.

The JSPS summer program was a very valuable experience to me, regarding both life inside and outside academia.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Philipp Kaese	(ID No. SP23318)
2. Current affiliation: Technical University of Darmstadt, Department of Mathematics	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Kobe University, Graduate School of Science	
5. Host researcher: Prof. Wayne Rossman	
6. Description of your current research	
<p>Natural forces always tend toward stable structures. For example, a soap film is pulled tight by the force of surface tension. The soap film finds a stable equilibrium where it has the least area of any nearby surface with the same boundary. Therefore, it minimizes area for fixed boundary. Soap bubbles, on the other hand, minimize area for a fixed enclosed volume. In mathematical terms these surfaces can be characterized by their mean curvature. Soap films are given by so-called minimal surfaces with vanishing mean curvature and soap bubbles by surfaces of constant mean curvature (CMC surfaces).</p> <p>Moreover, minimal and CMC surfaces occur in many ways in nature and technical contexts, e.g., as fluid interfaces. They are given as solutions to a variational problem and therefore as the solutions to a differential equation. The arising nonlinear elliptic partial differential equation is impossible to solve in generality, so it is common to make simplifying assumptions in order to arrive at solutions. For example, assuming invariance by a 1-parameter group reduces the problem to an ordinary differential equation for a generating curve.</p> <p>Rotationally invariant CMC surfaces in Euclidean space were fully characterized by Delaunay in the 19th century. I studied these surfaces and their screw-symmetric generalization in families of ambient spaces in a modern setting, namely contained in homogeneous 3-manifolds. A unified description integrates the previously isolated results of the recent three decades. It further allows for the study of families of solutions. Thus, I was able to show that in certain cases new classes of surfaces exist which differ from the well-known Delaunay surfaces. In particular, the existence of new embedded topological cylinders ("tubes") comes unexpected: It is impossible in the Euclidean case by a classification result of Korevaar, Kusner and Solomon obtained in 1990.</p>	
7. Research implementation and results under the program	
Title of your research plan: Minimal surfaces and surfaces of constant mean curvature in homogeneous 3-manifolds	
Description of the research activities: Another way to describe surfaces is the so-called Weierstrass representation. This is a method to describe Euclidean minimal surfaces and their associated families by	

holomorphic functions. The loop group method introduced by Dorfmeister, Pedit, and Wu extends this complex representation to Euclidean CMC surfaces. This method gave rise to numerous new examples of minimal and CMC surfaces. Dorfmeister, Inoguchi, and Kobayashi managed to adapt the method to minimal surfaces in Heisenberg space.

My host Wayne Rossman works on minimal and CMC surfaces and is an expert for the loop group method. During the JSPS summer program I have been working on applying the loop group method in Heisenberg space and other homogeneous 3-manifolds with the postdoc Thomas Raujouan. A research visit at Hokkaido University and discussions with Shimpei Kobayashi and Jun-ichi Inoguchi gave new insights on this topic. Some further changes to the method allowed us to find new examples of minimal surfaces.

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

During my participation in the program, I gained valuable insights into the Japanese research landscape while making new contacts. The work has advanced my research as well as my PhD project. The program also gave me the opportunity to get to know the country and its culture. I would like to thank JSPS as well as my host and his group for the valuable experience.

9. Adviser's remarks (if any):

It was a pleasure to have Philipp in Kobe these last two months. He gave us informative explanations of his research, and he became involved in using loop group methods to study particular surfaces in Heisenberg space, which will likely lead to a joint research project with the postdoc Thomas Raujouan in Kobe. He also visited Shimpei Kobayashi and Jun-ichi Inoguchi at Hokkaido University for fruitful research discussions. In summary, he made very good use of his time in Kobe.

JSPS Summer Program 2023 Research Report

1. Name: Gabriel Gandubert	(ID No. SP23401)
2. Current affiliation: École de technologie supérieure (ÉTS)	
3. Research fields and specialties: Engineering Sciences	
4. Host institution: Nagoya University	
5. Host researcher: Kodo Kawase & Kosuke Murate	
6. Description of your current research	
<p>In my home university, I have researched THz waves, which are electromagnetic radiation (i.e. radio waves, infrared, visible light, UV, X-ray, etc.) used for radio-imaging for quality control inspection or security applications, spectroscopy for material analysis, medical applications and more. There are multiple different approaches to generate and detect those waves but, since they are hard to generate, some methods are more efficient for some applications than others.</p> <p>In my home university, I work with different emitters such as photoconductive antennas (PCA), nonlinear crystals and spintronic emitters, all of which require a femtosecond laser (laser with ultra short pulses of light) to generate pulses of THz waves. The method I need to use to detect those waves are based on nonlinear crystals which only react when a strong enough THz wave is present. My master's degree project consists of a compact THz emitter/detector for microscopic imaging using THz waves. The only problem is the emitted THz is too weak to detect with the nonlinear crystal by our conventional method. A potential solution to make the detection more sensitive is parametric detection, which is sensitive enough for potential quantum detection (sensing one photon at a time).</p> <p>In Nagoya University, the generation method of injected seed terahertz parametric generation (is-TPG) was mostly developed by our professor Kodo Kawase in the 1990s, which makes his laboratory the leading expert in this field. Compared to our approach, they use picosecond laser (almost 1000 to 10 000 times longer than our laser) to generate and detect THz waves. To increase the efficiency of our research in Canada, my objective was to improve my understanding of this generation and the associated detection method (parametric detection) to improve my knowledge in the field and to potentially find a solution to my current problem. The secondary goal is to research a potential method for single photon detection for quantum applications of THz waves in communication and astrophysics research.</p> <p>To deepen my understanding of this method, I accompanied a doctoral student throughout his experiments to understand the basics of the methods and afterward, I built a detection system on my own, which will be used by the research group for a future experiment.</p>	

7. Research implementation and results under the program

Title of your research plan: High sensitivity electro-optic terahertz pulse detection

The detection of terahertz (THz) waves was successful with THz heterodyne electro-optic sampling. The intensity of the wave was relatively weak, but strong enough to proceed to the next step of the experiment. The alignment of the second part of the experiment with a smaller waveguide was completed, but the time required to complete the second experiment is longer than the time allowed. A detailed report was written to share all the important information about the system to the next researcher.

Description of the research activities:

For the first week, I accompanied the PhD student of the laboratory to understand the important steps of this generation and detection method. He also gave me historical information about the detection method and the different improvements made throughout the years. After the introduction, I spent approximately one month on a different system with a DAST crystal (type of organic crystal used for THz generation) and an heterodyne electro-optic sampling detection method. The first part of the experiment used a bulk lithium niobate crystal, which is usually used in this laboratory. The second part of the experiment was to detect the same THz wave with a ridge waveguide of $3\mu\text{m}$ by $3\mu\text{m}$ (approximately 30 times smaller than the width of a human hair) with a length 2 cm. The alignment took less time than expected, but no result on THz detection so far. The completion of the research will be done partially in Canada and by some students from Kawase's group. Overall, I consider this research project a partial success, since the experiment is not over, but all the skill required to finish the project has been acquired and has high potential to reach completion.

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

I enjoyed every part of the internship on a professional and personal level. I took most of my weekends to visit multiple cities in Japan to learn about the culture and the life here. The integration in the research culture was easy to adjust to and I think it has a lot to do with some of the researcher's international experience. Even if I had an amazing experience, I heard different feedback from other JSPS students near my laboratory where the work pressure was intense. I would see myself come back to Japan for further collaborations, but I would be selective about the kind of research group to join.

9. Adviser's remarks (if any):

Mr. Gabriel worked on the development of heterodyne terahertz wave electro optic (EO) detection. He was well qualified for this project because of his expertise in EO detection for broadband terahertz pulse, which is lacking in our laboratory. In fact, he worked very diligently on the experiments and succeeded in detecting terahertz wave using heterodyne EO detection technique. He even set up a system using a nonlinear optical waveguide for further efficient detection. In such a short time, he achieved more than we expected, and we are eager to continue our research together."

JSPS Summer Program 2023 Research Report

1. Name: Kieran BHASKARA	(ID No. SP23402)
2. Current affiliation: McMaster University	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Osaka University	
5. Host researcher: Dr. Akihiro HIGASHITANI	
6. Description of your current research <p>My research is in combinatorial commutative algebra, an area of math which attempts to use ideas and tools from combinatorics to answer questions about algebraic objects, and vice versa. In particular, one can study properties of algebraic objects known as ideals by relating them to combinatorial properties of graphs. I am currently interested in toric ideals of graphs, and their invariants. These invariants, such as regularity, projective dimension, and (degree of) the h-polynomial, are quantities associated to the toric ideal that encode much information about the algebraic structure of the ideal and the structure of the corresponding graph. During my master's degree, I studied invariants of toric ideals for the class of bipartite graphs, and was able to fully characterize the possible values of the above invariants for this class. I am interested in studying similar problems for other families of graphs. The nature of these problems means that techniques from the theory of lattice polytopes are often useful, so I am learning the foundational knowledge needed to employ these techniques in my research. Studying such problems also leads naturally to purely graph-theoretic questions whose resolutions are of important practical use in this field, and so I am also interested in these sorts of questions as independent avenues for exploration.</p>	

7. Research implementation and results under the program

Title of your research plan: Investigating properties of toric ideals of graphs

Description of the research activities:

Once I arrived at Osaka University, Dr. Higashitani organized a research seminar for the students in his lab to present their research interests. This was very helpful for giving a basis to spur further discussion with my fellow lab members.

During my stay in Japan, I was able to conjecture a formula for the h-polynomials of a certain family of toric ideals that generalizes the work of Dr. Higashitani and his student. Dr. Higashitani's student and I are continuing to work on proving this formula under his guidance, and will continue working on this project once I return to Canada.

I have also spent my time here learning the background necessary to study my research questions from the perspective of lattice polytopes. Dr. Higashitani specializes in this subject, so it was really helpful for me to be able to talk with him and his students and get recommendations about how to continue learning this material in the future.

I was able to travel to Tokyo and Sapporo for two research visits. In Tokyo, I gave a presentation on my research at Waseda University that sparked a lot of discussion about related research questions to pursue. In Sapporo, I was able to meet with a frequent collaborator of my supervisor in Canada for a multiple day discussion. We discussed an interesting problem analogous to one I studied during my masters, and several graph-theoretic conjectures that we made some progress on. We both found this meeting very fruitful, and plan to continue our collaboration in the fall to prove our conjectures.

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

My lab was extremely welcoming, and it was really great to have the opportunity to see how math research is done overseas. With my lab colleagues or other JSPS fellows, I was able to see much of the beauty of Japan; in particular, the many impressive shrines and temples stand out. I also really enjoyed my homestay weekend, as it was a great chance to practice my Japanese and see what home-cooked Japanese food is really like. I even got to try playing the shamisen!

9. Adviser's remarks (if any):

【SP23】

JSPS Summer Program 2023 Research Report

1. Name: Charlie Gauthier	(ID No. SP23403)
2. Current affiliation: PhD student at Mila (University of Montreal)	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Kyoto University - Ishii Lab.	
5. Host researcher: Prof. Shin Ishii	
6. Description of your current research	
<p>Motor adaptation refers to a biological process by which organisms adapt their muscles to changing environmental conditions. This includes adapting to changing frictions (walking on ice, etc), adapting to new tool weights (picking up a hammer and finding it heavier than expected), or adapting to unforeseen physics (trying to write on a tablet instead of paper).</p> <p>In current state of the art robotics, motor adaptation can be done using a neural network that predicts current environment conditions. This works, but it doesn't match what actually happens in animal brains, wherein adaptation information is carried over from task to task. In other robotics works, a Particle Filter or Black Box Optimizer is used to infer the environment parameters. This is more akin to the biological motor adaptation process, but in most of these works, the environment parameters are assumed to be fixed, or smoothly varying (and these filters are slow and cumbersome to implement). This again does not match the behaviour of the brains of real animals.</p> <p>In the work that I did at Kyoto university, we laid the groundwork for a robotic motor adaptation strategy that more closely matches animal behaviour than the prior works. We do so by adapting a Particle Filter to use gradient information from a differentiable environment. While the work is not yet complete, we believe that our method will match performance of the state of the art, while also offering additional desirable properties such as providing uncertainty estimates over the motor adaptation parameters to the robotic policy.</p>	

7. Research implementation and results under the program

Title of your research plan:

Particle Filtering for Time-Varying System Identification

Description of the research activities:

- Met weekly with assistant professor at Kyoto University
- Met biweekly with professor at Kyoto University
- Wrote ~2000 lines of code and thoroughly tested them
 - Implement Domain Randomization in Brax
<https://github.com/google/brax>
 - Implemented the framework for a Particle Filter over Domain Randomization parameters for Brax
 - Implemented evaluation and training pipelines for Reinforcement Learning tasks that leverage both of the above code items

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

I loved this trip!!! The research experience went very well, and I got along well with my co-workers. The cultural exchange was great. Japanese cities are incredibly clean and beautiful, and it was a delight to visit Japan's many temples and shrines. I also loved going to Osaka and Tokyo and visiting famous areas such as Nipponbashi, Americamura, Shinjuku, Shibuya, and Harajuku.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Benjamin BLANCHETTE	(ID No. SP23404)
2. Current affiliation: Université de Sherbrooke	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Kobe University	
5. Host researcher: Emerson G. ESCOLAR	
6. Description of your current research	
<p>I work on algebraic aspects of persistent homology. Currently my main interest is the concept of approximation. The core principle of approximation is to understand complicated objects through their similarity to simpler objects that we understand a lot more. To improve these types of tools, one can work on effectively three levels.</p> <p>First, one can understand more aspects of the ‘known’ objects used to approximate. This is reflected in results and theorems on special objects. Secondly, one can try to grow the set of ‘simple’ objects that are understood enough to make approximations useful. This is reflected in generalizations and larger classifications. Last but not least, one can study and try to improve the process of approximating itself. Given a ‘complicated’ object, choosing the appropriate ‘simple’ object in a way that preserves certain properties but not others can be done in a variety of ways. Therefore, understanding which properties are preserved and which are not is very important. Moreover, one has to determine which properties are more important to preserve through these approximations.</p> <p>While I am interested in all three of these ways to improve approximations, my previous works were mostly concerned with the third one. In my paper <i>Homological approximations in persistence theory</i>, my co-authors and I pushed forward the idea that preserving homological information is crucial for an approximation in a persistence setting. More recently, the questions I investigate are more aligned with the first. It is in that context that I came to study a few families of posets and modules here in Kobe with professor Escolar as well as the post-doc and Ph.D student he is supervising.</p>	

7. Research implementation and results under the program

Title of your research plan: Combinatorial aspects of persistence theory

Description of the research activities:

Along with Toshitaka Aoki and Shunsuke Tada, we investigated the notion of interval global dimension for arbitrary posets. We computed a lot of examples to find patterns and have made significant progress towards new results. Namely,

- We can now compute the interval global dimension of any tree.
- We have descriptions of projective resolutions of simple modules over the endomorphism ring of interval modules, as well as descriptions of interval resolutions for Auslander-Reiten translations of interval modules, for a few important and interesting families of partially ordered sets. Among these are trees, $2n$ cycles with alternating orientation as well as the two-dimensional grid. While we have a lot of experimental computations that provide significant evidence for the validity of these descriptions, full proofs are still being worked on.
- We have full descriptions and proofs for irreducible morphisms in many families of posets, including those mentioned above.

We had the opportunity to participate in the conference 'TDA week' in Kyoto, organised in parts by our supervisor professor Escolar. The meeting welcomed around 150 participants from all over the world, experts in a variety of fields related to topological data analysis, with a focus on persistent homology. This was a fantastic opportunity to have interesting discussions with the speakers as well as the people who presented in the massive poster presentation. In total, there were above 70 posters and we had plenty of time to ask questions, discuss and talk about further collaborations with the participants.

Professor Escolar made the stay in Kobe University comfortable and provided everything needed for the research to go well. It's safe to say our collaboration was successful and I am glad to have been able to come work with him and the group.

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

I had the chance to visit quite a few cities during weekends. I visited a lot of temples and shrines, but my favorite activities were gardens and music shows. I enjoyed the food and the trains. They make quick trips so much easier!

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Samuel Aucoin	(ID No. SP23405)
2. Current affiliation: Dalhousie University	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Research Institute for Humanity and Nature	
5. Host researcher: Prof. Makoto TANIGUCHI	
6. Description of your current research	
<p>My research in the department of Oceanography at Dalhousie University is centered around small-scale ocean turbulence and mixing. Specifically, I study the physical effects of submarine groundwater discharge (SGD) on the ocean environment. SGD is the phenomenon where water moving through the ground, which is generally fresh, discharges directly into the ocean. Importantly, not only does this discharge contain the nutrients, metals, and pollutants present in the ground, but the freshwater acts as its own mechanism to mix these tracers. Generally, SGD exists in two categories; the discharge can either be slow and spread out, such as over kilometers of coastline, or fast and concentrated, known as submarine springs.</p> <p>Groundwater is ubiquitous across coastlines around the world; thus, SGD is known to be an important water pathway to the global ocean. While much of the research into this phenomenon has focused on determining estimates of its volume of discharge over large areas, very little effort has been centered on investigating where the discharged water goes, and how it mixes with ambient seawater. This not only determines where the benefits/negative effects of nutrients/pollutants in the groundwater occur, but the dilution through mixing determines their magnitude. It is therefore an important aspect of SGD to understand.</p> <p>In my research, I use different techniques to study the physical effects of SGD; one method is by using acoustic oceanographic instruments, which allow me to see underwater with sound, and measure its velocity. This method works off the idea that the discharging water has different properties to its surroundings, and thus will look different when sound is bounced off of it. Another is with computer simulations, which I can use to extend the measurements to extract more information from them. This technique is common for understanding complex processes that are very difficult to directly measure, such as with turbulence. Finally, I compare these methods to theoretical predictions to determine if they agree.</p>	

7. Research implementation and results under the program

Title of your research plan:

The Relative Importance of Recirculated Seawater on Submarine
Groundwater Discharge

Description of the research activities:

While SGD does contain fresh groundwater, a large portion of it is seawater that has infiltrated the ground and mixed with the freshwater before being discharged. What the relative composition of each component is, is both largely unknown, and highly dependent on many factors. The idea behind this project was to get a better understanding of the controls of this mixture. A major driver of SGD is the tides, which control the amount and composition of the discharge. One of the ways I approached this problem was by developing theory to predict the response of SGD to tidal forcing, which can be separated into the fresh and saline components which are affected differently. This theory can be validated against existing measurements, then used to simulate realistic discharge with a computer model. The theory and computer model that I developed during my research in Japan will help inform my measurements and interpretation of results as I continue my research in the future. In addition, I also made use of known SGD locations in Hiji, Oita to deploy my acoustic instruments, which allowed me to not only take novel measurements of the ocean side of SGD, but also to discover new SGD sources in the area.

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

The JSPS summer program was an amazing opportunity to experience Japan and to create international connections with researchers in similar fields. Not only was I able to travel to incredible places as part of my research, such as Beppu, Oita, and Obama, Fukui, but I also had the opportunity to meet other researchers that I hope to collaborate more with in the future.

9. Adviser's remarks (if any):

JSPS Summer Program 2023

Research Report

1. Name: Jonathan KONG	(ID No. SP23406)
2. Current affiliation: University of Toronto	
3. Research fields and specialties: Engineering Sciences	
4. Host institution: The University of Tokyo	
5. Host researcher: Prof. Yuichi IKUHARA	
6. Description of your current research	
<p>A new nanocrystalline NiCo alloy (grain/crystal size: 18 nm, sulfur impurities: 0.06at%S) is currently being developed with Integran Technologies Inc (Mississauga, ON, Canada) based on a unique electrodeposition process originally developed at the University of Toronto. In a first application, this material is already used in making stencil foils for the manufacturing printed circuit boards. Other applications which may involve elevated temperatures are now being investigated in joint research between Integran and the university. It is known that conventional polycrystalline NiCo alloy has a good combination of strength and wear resistance properties. By reducing the grain size of NiCo to the nanoscale (<100 nm), the hardness and strength will increase even further due to Hall-Petch strengthening. However, many of the structure-property relationships of the nanocrystalline alloy remain unknown.</p> <p>For the past few years, I studied in detail the effect of annealing on the microstructural changes (e.g. grain boundaries, other defects, sulfur segregation and grain growth), mechanical properties (hardness and tensile properties). It was observed that by annealing some nanocrystalline materials at moderate temperatures, the strength of material can be further improved. An increase in hardness was observed in nanocrystalline NiCo alloy annealed at 225 °C and below. Theories such as grain boundary relaxation have been developed to explain this phenomenon which describes reordering at boundaries leading to higher stress required to emit new dislocations. Different characterization techniques have been used in the past to confirm the grain boundary relaxation mechanism such as strain rate sensitivity tests and transmission electron microscopy (TEM) cross-sectional analysis beneath the deformed region after indentation tests.</p> <p>Sulfur segregation to grain boundaries was found in the NiCo alloy that exhibited grain growth after the annealing at high temperatures >225 °C. This led to a drop in the ductility of the material due to grain boundary embrittlement. Therefore, it is of scientific interest to explore the sulfur segregation mechanisms at atomic resolution for the annealed materials. Such measurements can be done by advanced electron microscopy which is available at The University of Tokyo.</p>	

7. Research implementation and results under the program

Title of your research plan:

The effect of annealing on the sulfur segregation mechanism in electrodeposited nanocrystalline NiCo alloy

Description of the research activities:

The sulfur (S) segregation mechanism of the electrodeposited nanocrystalline NiCo alloy was examined using scanning transmission electron microscope (STEM). The samples were first annealed at temperature range between 200 – 400 °C inside the furnace. The annealed samples were then cut and thinned to electron transparency using focused ion beam (FIB) so the structure of the material could be observed under the STEM. The STEM study showed that the S atoms were originally uniformly distributed inside the NiCo alloy in the as-deposited state. However, when grain growth (increase in crystal size) took place at elevated temperatures (>225 °C). S atoms were segregated to the boundaries of the crystals/grains. This led to a drastic decrease in ductility under tensile load where the material failed/fractured with less than 1% elongation compared to 8% elongation in the as-deposited state. The S segregation at the boundaries was revealed through elemental mapping of the crystals in STEM.

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

I attended the IAMNano conference which was held in Matsue. Matsue was a wonderful place with beautiful Japanese gardens and castles. I also got a chance to watch the dance performance and attended a traditional Japanese banquet during the conference. It was a unique and enjoyable experience. Another memorable part of the trip was the home stay program where I experienced different local culture from visiting temples to going to a summer festival at the shrine. I spent a wonderful weekend with the host family, and I love their cooking very much. I would like to express my thank to JSPS for giving me this amazing opportunity to experience different local cultures and perform excellent research.

9. Adviser's remarks (if any):

JSPS Summer Program 2023
Research Report

1. Name: Cliff Ng	(ID No. SP23407)
2. Current affiliation: Simon Fraser University	
3. Research fields and specialties: Mathematical and Physical Sciences Chemistry Interdisciplinary and Frontier Sciences	
4. Host institution: Hokkaido University	
5. Host researcher: Prof. Jian Ping Gong	
6. Description of your current research In Canada, my research is focused on materials and surface science. Broadly, I create micro- and nanostructures on the surfaces of materials. I also study interfacial phenomena, such as wettability and adhesion. Micro- and nanostructures allow for the modification of such properties. Materials science is highly interdisciplinary, and the goals in my current research are often accomplished through both physical and chemical means, such as coatings and lithography techniques. However, the current methods which we use are not applicable to all materials. One such type of material is hydrogels. Hydrogels, which are a leading candidate for human tissue substitutes, are an attractive material due to their soft and wet nature. However, they suffer from some issues, such as undesirable durability and swelling. Hydrogels, in theory, could greatly benefit from principles of the techniques which I have worked on in the past in my research. Controlling their wettability and friction, for example, would lead to a wider range of applications. However, the techniques which I have studied are not suitable for direct application onto hydrogels. Thus, in my research in Japan, we are examining techniques to modify these properties through the introduction of surface micro- and nanostructures.	

7. Research implementation and results under the program

Title of your research plan:

Force-induced hydrophobic nanostructure formation on hydrogel surface

Description of the research activities:

Building off a previous project from Prof. Gong's lab in which hydrophilic microstructures were created on a hydrogel surface by applying force,* we followed a similar procedure with modifications. First, we used a different polymer as the starting material, which, based off computational predictions, should generate ten times the concentration of radicals upon fracture resulting from chain scission due to mechanical force. This allows us to create structures with finer resolution than previously reported. To facilitate more effective radicals, we also added an enzyme which can reduce oxygen concentrations. This material is then polymerized with a hydrophobic monomer, which is normally difficult to accomplish due to the hydrophilic nature of hydrogels. After fabrication of the materials, we plan to characterize them with several techniques. For imaging these fine nanostructures, we will use atomic force microscopy. For mechanical characterization, the tensile strength of our materials will be tested with a universal testing machine. Changes in wettability of the hydrogel surface will be detected through contact angle measurements.

* Mu, Q. *et al.* Force-triggered rapid microstructure growth on hydrogel surface for on-demand functions. *Nat. Commun.* **13**, 6213 (2022).

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

I very much enjoyed my stay in Japan. My colleagues have been friendly and helpful in our discussions. I felt that the lab environment is facilitative of scientific productivity. Outside of work, I visited several smaller cities in Hokkaido, and those were fun trips! I particularly enjoyed exploring the more rural areas of Japan, as they are less commonly depicted in media, but are home to beautiful nature. I greatly enjoyed learning more about Japanese culture, and I appreciate everyone's hospitality despite my limited language abilities.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Pouriya Bayat	(ID No. SP23408)
2. Current affiliation: University of Toronto	
3. Research fields and specialties: Biological Sciences	
4. Host institution: Okinawa Institute of Science and Technology	
5. Host researcher: Prof. Yohei Yokobayashi	
6. Description of your current research <p>Therapeutic peptides, a class of drugs composed of small chains of amino acids, have played a significant role in medicine since the discovery of insulin. However, discovering new peptides and improving existing therapeutics is a highly specialized domain that remains cost-prohibitive. To address this challenge, this research proposes a machine learning-guided platform for the computational design of functional analogs of high-value peptide therapeutics. The platform combines cell-free protein synthesis, high-throughput droplet microfluidics, and machine learning to establish a high-throughput, data-driven, computational molecular evolution approach. The proposed approach involves establishing molecular tools and a biochemical system for peptide testing, performing parallelized assays for massive peptide evaluation using droplet microfluidics, developing an AI model for interpreting the data, and extending the computational platform to therapeutic peptides. By implementing this approach, it is possible to reduce the cost and time required to discover and improve therapeutic peptides, thus facilitating the development of new drugs and treatments.</p>	

7. Research implementation and results under the program

Title of your research plan:

A Machine Learning-Guided Platform to Engineer Functional Analogues of Therapeutic Peptides

Description of the research activities:

During my tenure at OIST, I had the privilege of being mentored by an exceptional postdoc from Dr. Yokobayashi's lab, who introduced me to a high-throughput technique for peptide library screening. This training encompassed the design of a mutant library for a split protein system and the use of OIST's advanced droplet microfluidic facilities. With these, I was able to encapsulate peptides within picoliter-sized water-in-oil droplets. Following this, I learned to operate a specialized device at OIST that enabled the sorting of droplets based on peptide activity at an impressive rate of ~10,000 droplets per second. This hands-on experience equipped me to gather the mutation data necessary to train an AI algorithm, which in the future, could be instrumental in producing innovative functional sequences.

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

Before participating, Japan was never on my radar as a potential location for future employment. However, this journey has been transformative for me. The insights, exposure, and learnings I've gleaned have reshaped my perspective. I now find myself seriously considering Japan as a potential workplace in the coming years. Thank you for introducing me to this unique opportunity and broadening my horizons. I'm excited to see where this new perspective leads.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: GILL, Lauren	(ID No. SP23409)
2. Current affiliation: University of British Columbia	
3. Research fields and specialties: Biological Sciences	
4. Host institution: Kyoto University	
5. Host researcher: Dr. Hiroko Udaka	
6. Description of your current research	
<p>Land-dwelling slugs are routinely exposed to cold or freezing temperature during the winter. Some species of slugs can even survive partial ice formation within their bodies. How they survive low temperatures is largely a mystery as ice formation is damaging, and they lack external protection like shells. For this project, we examined the cold and freeze tolerance mechanisms of the terrestrial slug <i>Ambigolimax valentianus</i>, which is indigenous to Europe but has since been introduced widely throughout many regions of the world including North America, South America, the United Kingdom, and Japan (Satoh & Yamazaki, 2020; Kurozumi, 2002; Waldén, 1961). This species of slug lowers the value of horticulture and agriculture products, by feeding and leaving mucus trails (Satoh & Yamazaki, 2020). Terrestrial slug species like <i>A. valentianus</i> are susceptible to fluctuating air temperatures as they do not have shells or epiphragms like land snails, and thus their body is always exposed to both hot temperatures during the summer and freezing temperatures during the winter (Udaka et al., 2008). During the winter, the moist skin on their body surface can come in direct contact with ice crystals, initiating inoculative freezing (Udaka et al., 2008). Udaka et al. (2008) found that the cold tolerance of <i>A. valentianus</i> is enhanced by low acclimation temperatures and short day conditions, but whether this species is freeze tolerant is yet to be confirmed. The aim for our project was to determine <i>A. valentianus</i>' tolerance to freezing, the environmental factors that influence its cold hardiness, and finally to prepare samples to conduct a preliminary investigation into its low weight molecular cryoprotectants which will provide the first mechanistic explanation for freeze tolerance in this species. With this information, we can determine the factors that influence the lower temperature tolerances of <i>A. valentianus</i>, which if remarkable, would be a property that could allow them to outcompete native species. This project will help us further understand the factors that allow invasive molluscs to establish and proliferate – which is the first step in creating management plans that prevent these exotic species from damaging agriculture products and altering biodiversity in their introduced environments.</p>	

7. Research implementation and results under the program

Title of your research plan: Investigating the freeze tolerance of *A. valentianus*

Description of the research activities: In order to investigate the freeze tolerance of *A. valentianus* we first needed to collect specimens. Between June and July, I collected 180 *A. valentianus* slugs from around the Kyoto University campus, and then placed them in incubators where they were acclimated to lab conditions. After one week of lab acclimation, they were then placed in one of four acclimation conditions: long day at 20 °C, short day at 20 °C, long day at 15 °C, or short day at 15 °C. Slugs acclimated at long day conditions were exposed to 16h light and 8h darkness, and slugs at short day conditions were exposed to 12h light and 12h darkness. Slugs were kept in these new conditions for 21 days before sampling. During the time in which they were acclimating, I conducted several pilot experiments to determine the degree of freeze tolerance that this species possessed (full vs partial freeze tolerance). I found that although these slugs could survive low temperatures at length, they could only survive a very minimal amount of ice formation, if any (Figure 1). I then exposed the acclimated slugs to subzero temperatures in a freezing bath and recorded their body temperature using thermocouples. Once the slugs had frozen, they were removed from the cooling bath, and then immediately placed in a 15 °C incubator and allowed to recover for 24 hours before survival was determined. I found that slugs acclimated to winter conditions (short day, 15 °C) exhibited a higher super-cooling point and survived better than those that were acclimated to summer conditions. This suggests that these slugs may become partially freeze-tolerant in the winter. I then acclimated several more slugs to the same conditions and freeze-dried them and crushed them to a powder. I am planning to transport these samples back to Canada where I will determine if small molecules, called cryoprotectants, play a role in their freezing tolerance as they do in other species of molluscs.

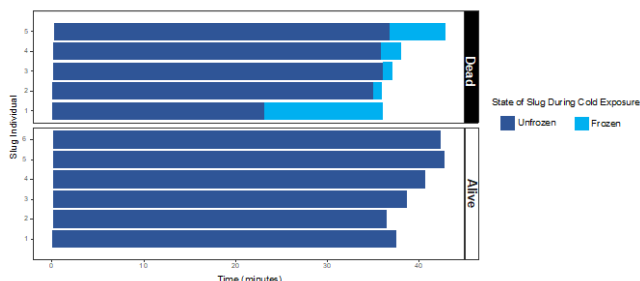


Figure 1: The survival of slugs exposed to -6 Celsius (just below their super-cooling point), and whether or not they froze during the cold exposure. Slugs were kept under long day conditions at 15 °C

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

I enjoyed my cultural experience in Japan very much. My supervisor was very supportive and lab mates were welcoming – we had many fun lab outings such as eating yakitori and going to a barbeque restaurant. I appreciated experiencing the respectful Japanese lab culture and learning about academia in Japan. On the weekends, I was able to see much of the Kansai region including Himeji castle, Osaka’s Dotonburi district, Kinosakionsen, and Okayama’s Korakuen gardens. As part of the JSPS program, I also attended a home-stay weekend, where my host family and I made udon, visited a shrine, and ate homemade Japanese cuisine. I found this experience very valuable.

9. Adviser’s remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Sharon Chee Yin HO	(ID No. SP23410)
2. Current affiliation: Concordia University	
3. Research fields and specialties: Social Sciences and Engineering Sciences	
4. Host institution: The University of Tokyo	
5. Host researcher: Dr. Arisa Ema	
6. Description of your current research	
<p>Text-to-image generative AI models for AI art is gaining extensive media coverage and is having a significant impact on Japanese art communities and Japanese digital content sites. Such technologies are also generating increased discussion on its impact on living or contemporary artists, the automation and commodification of art production, the frequent non-consensual collection and usage of sensitive and copyrighted images as training data, and the routinely exhibited cultural and social biases in their generated outputs.</p> <p>We will investigate its social and ethical issues in Japan by interviewing various Japanese experts and professionals in the field to understand the current impacts and implications of the technology in Japanese society. In addition, we will also investigate the degree of ethical awareness held by Japanese computer science (CS) and software engineering (SE) graduate students on ethical issues embedded in the technology necessary to create AI-generated art. This is because these students are the primary demographic hired to work at research and development (R&D) labs at the forefront of such innovations. By understanding the extent of ethical values held by these students, or lack thereof, there will be a clear understanding of the gaps in CS or SE higher education that can be addressed to increase critical thinking towards the technological development, creation, dissemination, evaluation, and moderation of AI-generated content and related technologies.</p>	

7. Research implementation and results under the program

Title of your research plan:

Ethical Awareness of Japanese Computer Science and Software Engineering Graduate Students on Text-to-Image AI-Generated Art

Description of the research activities:

The JSPS Summer Research Program provided me with the opportunity to learn about Japan's perspective on the social and ethical issues arising from text-to-image AI-generated art and the ethical awareness held by prospective researchers of AI-generated art technologies in Japan (i.e., Japanese computer science and software engineering graduate students).

During my two months in Tokyo, Japan, I was able to interview 9 computer science and software engineering graduate students on their perspective and opinions towards the social and ethical issues with text-to-image generative AI models for creative purposes. These students were asked to discuss their knowledge and opinions of the domain. They were also able to share their reactions and opinions after having interacted with different implementations of the technology, i.e., DALL-E 2, Midjourney, Stable Diffusion, and NovelAI Diffusion. These interviews uncovered the values and ethical awareness brought by prospective researchers towards the research, development, and usage of text-to-image generative AI technologies.

I was also able to conduct 3 interviews with experts in various academic fields and professional industries, i.e., experts in AI law and policy, Japanese media studies, and professionals in Japan's creative arts industry. These experts were asked to provide insight into the current state of text-to-image generative AI technologies in Japan and to discuss potential use cases, benefits, risks, and challenges of using such technologies for creative purposes on a legal, social, and ethical level.

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

Outside of my research activities and during my free time, I was able to explore various parts of Tokyo and visit many landmarks and attractions in the city, such as Senso-ji Temple in Asakusa, Ameyoko Shopping District in Ueno, Nakano Broadway in Nakano, Tokyo Disney Sea, teamLab Planets TOKYO, Ghibli Museum, and Shibuya Sky to name a few. I also saw one of Tokyo's best fireworks festivals, Sumidagawa Fireworks Festival near Asakusa and Tokyo Skytree. In Osaka, I visited Universal Studios Japan and Hiraakata Park, the city's oldest amusement park.

9. Adviser's remarks (if any):

N/A

JSPS Summer Program 2023 Research Report

1. Name: Krischanda BEMISTER	(ID No. SP23411)
2. Current affiliation: Toronto Metropolitan University	
3. Research fields and specialties: Social Sciences	
4. Host institution: Hokkaido University	
5. Host researcher: Prof. Johan Richard EDELHEIM	
<p>6. Description of your current research</p> <p>For decades, the influence of human-animal interactions (HAIs) on well-being (or <i>iyashi</i>) has been a topic of scientific inquiry. Research indicates that understanding animal sentience may promote tolerance of a variety of beliefs in a classroom context, and that there are links between empathy towards non-human animals and empathy towards humans. However, prior to the current project, the potential impact of a short-term educational program on students' beliefs, attitudes, and empathy towards animals had yet to be experimentally investigated. This project aimed to discover whether a summer course, specifically designed to: (1) examine the roles of non-human animals in Japanese wellness industries; (2) examine the commodification of cuteness in tourism and hospitality; and (3) analyze ethical dimensions of <i>iyashi</i> (well-being) experiences and services, could significantly impact students' perceptions of, and empathy for, non-human animals. An educational context, such as the intensively academic environment of a graduate-level classroom, provided a unique opportunity in which to examine the influence of content on attitudinal change. My hope is that this project will contribute to literature in the domain of educational impacts on attitudinal change and the importance of human-animal bonds. Given that research conducted in Canada often samples, and draws conclusions from, WEIRD (Western, Educated, Industrialized, Rich, Democratic) populations, there is a significant gap in understanding and studying the experiences of those outside of these demographics. Cross-cultural research is one way to address this pitfall as such an approach allows scholars to advance knowledge in a particular field while also moving beyond the confines of their existing context. Through the dissemination of these research findings via scholarly publications and conferences, Canadians will learn more about teaching strategies in Japanese post-secondary education, the impact of non-human animals on human health, the use of non-human animals in the tourism industry in Japan, as well as the impact of short-term educational interventions on attitudinal change. The goal is that this information furthers the Canadian public's understanding and appreciation of the roles of non-human animals in the everyday lives of humans as well as develops a greater appreciation for the diversity of global teaching strategies.</p>	

7. Research implementation and results under the program

Title of your research plan: Bright Minds & Bushy Tails: How education impacts animal-related attitudes in Japanese graduate students

Description of the research activities: In June 2023, I travelled to Sapporo, Japan to begin my project, under the supervision of Prof. Johan Edelheim. From June 26 to July 8, I attended all classes of “*Feline Tourism*”, an undergraduate course led by 3 professors (including Prof. Edelheim) and took extensive ethnographic field notes on professors’ teaching practices. From July 3 to July 16, I attended all classes of “*Animal-based iyashi and wellbeing in tourism, recreation and hospitality*”, an HAI-related graduate course led by 3 professors (including Prof. Edelheim) and took extensive ethnographic field notes and photographs (after obtaining all appropriate consents) on student behaviour and professors’ teaching practices. From July 10 to July 14, I attended 3 of 5 classes of “*The effect of indoor air quality on elderly health*” a non-HAI-related graduate course led by 5 professors and took extensive ethnographic field notes and photographs (after obtaining all appropriate consents) on student behaviour and professors’ teaching practices. From the middle of July, I began data organization and analysis. Data analysis is currently ongoing, thus final results are not available. The analysis has several parts: I have completed recording and transcribing all field notes. Next, I will compare student scores on 5 primary questionnaires (Use of Animals in Society Scale, Ethics Position Questionnaire, Animal Attitude Scale, Animal Empathy Scale, Questionnaire for the measurement of emotional empathy) at 3 time points in each graduate level course (before, immediately post-, and 2 weeks post-course), using a within-subjects analysis of variance (ANOVA). Next, I will complete thematic open and focused coding of all observation notes (undergraduate and graduate courses), to identify common themes. I expect that students in HAI-related graduate course, but not the non-HAI-related graduate course, will show significantly different pre- and post-course attitudes towards the use of animals in society, attitudes for animals, empathy for animals, and empathy for humans. Further, I predict that an ethical tendency towards idealism, but not relativism (the extent to which one does not base their moral philosophies on ethical rules), will be positively associated with scores on the above measures. Once coding and statistical questionnaire analysis is completed, I will prepare a summary booklet of results to share with all participating professors and students. This handout will include a description of the identified themes, a summary of the statistical results, and a selection of photographs taken during classroom attendance. Prof. Edelheim and I will also continue to meet upon my return to Canada, to discuss next steps in sharing the research outputs.

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

Japan (if any): Throughout this project, I had the opportunity to conduct and run an independent mixed-methods study in partnership with Hokkaido University and Prof. Johan Edelheim. This experience has greatly contributed to my professional development as a graduate student and junior scholar. I was able to live and work in a new and unfamiliar setting and made professional and personal connections with amazing colleagues and students. I also furthered my training and experience using qualitative and quantitative methods, both of which I plan to employ in my graduate work. I also had many enriching experiences during my stay in Japan. For instance, I attended a Taiko drum concert with my advisor and watched a Sapporo firework festival. I was also invited by my advisor to attend a symposium on research methodologies, which I found very enjoyable and informative. Further, I took some time to travel throughout Japan in August, and visited Tashirojima cat island, Zao fox village, several Tokyo animal cafes, Nara deer park, and Okunoshima rabbit island, to further explore human-animal interactions in Japan and to enhance my learning and travel experience. My JSPS summer fellowship has been an absolutely life-changing experience and I am very grateful to JSPS, Mitacs, my home institution supervisor, and Hokkaido University. I am especially grateful to Prof. Edelheim, who made it a priority to ensure that I felt prepared, comfortable, and supported throughout this experience.

9. Adviser’s remarks (if any): As a Teaching and Learning Scholar I always enjoy participating in research projects that takes as their focus how, what, and why different kinds of learning experiences are having an impact on learners. As teachers we are often tied to our syllabi and class operational issues, and we do therefore not have the time (or energy) to analyse our own classes in the detail they deserve. I have therefore been very happy hosting Krischanda here at our institution, and supporting her research project which I ultimately expect will help me develop my own teaching further. She has a positive ‘can do’ attitude, and she has flexibly adjusted her plans to suit the requests of my colleagues and myself when conducting her study. I foresee several joint Japanese - Canadian publications in the future, Krischanda’s expertise in quantitative psychology-based methods will complement my own qualitative didactic research focus suitably.

JSPS Summer Program 2023 Research Report

1. Name: ELGADI, Seja	(ID No. SP23412)
2. Current affiliation: The University of British Columbia	
3. Research fields and specialties: Chemistry	
4. Host institution: Kyoto University	
5. Host researcher: Prof. Takuji HATAKEYAMA	
6. Description of your current research <p>My research at the University of British Columbia focuses on the design, synthesis, and photophysical characterization of organic thermally activated delayed fluorescence (TADF) materials. These materials emit light through a specific mechanism of fluorescence that makes them suitable for use in a variety of applications including organic light emitting diodes, bioimaging probes, and photocatalysts.</p> <p>My research so far has covered the conventional twisted donor-acceptor design for TADF materials, focusing on structure-property relationships to improve the performance of these materials. In particular, I have worked on the incorporation of planar, rigid donor and acceptor groups such as azatriangulene derivatives into TADF emitters. My work mainly involves organic synthesis of target emitter molecules, photophysical characterization of their properties using fluorescence spectroscopy, and time-dependent density functional theory calculations for predicting or rationalizing the properties of the emitters.</p>	

7. Research implementation and results under the program

Title of your research plan:

Synthesis of multi-resonant thermally activated delayed fluorescence materials

Description of the research activities:

Multi-resonant TADF (MR-TADF) molecules have a different molecular design in which donor and acceptor atoms are patterned into a planar, aromatic framework. This design for TADF materials was first introduced by the Hatakeyama group and has several desirable properties compared to conventional TADF materials including high brightness and color purity.

At Kyoto University, I have worked on the synthesis of two novel multi-resonant TADF materials containing sulfur and selenium atoms through a variety of techniques including one-shot and one-pot borylation strategies. I've also conducted density functional theory calculations to predict the properties of these materials and the spin-orbit coupling constants resulting from the sulfur and selenium heavy atom effects. Finally, as a part of my project I visited the Kaji lab at Kyoto University to fabricate an organic light emitting diode using an MR-TADF material and measured the properties and efficiency of the device.

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 2023 Research Report

1. Name: Vanessa Chan	(ID No. SP23413)
2. Current affiliation: University of British Columbia	
3. Research fields and specialties: Medical, Dental and Pharmaceutical Sciences	
4. Host institution: Tokushima University	
5. Host researcher: Prof. Tatsuhiro Ishida	
6. Description of your current research <p>Every year, 730 000 patients worldwide die from liver cancer. Many cases in Canada are diagnosed at advanced stages where surgery is no longer possible, and many patients survive less than one year after diagnosis. Current treatments for advanced liver cancers include chemotherapy, immunotherapy, and its combinations, but these methods are only effective in ~30% of patients. Cancer cells can make themselves invisible to the immune systems by expressing a protein on their surface that can turn off the activity of immune cells. The approved immunotherapy (atezolizumab) uses a protein that can block the negative interaction between the liver cancer cell and immune cells, stopping the inactivation from occurring. One reason for this treatment's lack of efficacy is the tumor microenvironment, this is the surrounding region created by chemicals secreted by the tumour. Some of these chemicals can also inactivate immune cells and make it challenging for them to infiltrate and kill cancer cells. To address this issue, we are developing a treatment called LNP-IMQ. IMQ is a drug that can stimulate immune cells to produce a protein called interferon-α, this primes the environment around the tumor, making it more favorable for the immune system to enter and attack. As uncontrolled immune activity can be dangerous for the patient, we use a lipid nanoparticle (LNP) to deliver our drug to the liver tumor, making the treatment safer, and more effective when combined with atezolizumab. The goal of this project is to determine whether the survival of liver cancer-bearing mice will improve when given the combination treatment of LNP-IMQ and the approved immunotherapy. The aims of the project will include identifying the optimal dose and dosing regimen for LNP-IMQ, characterizing the immune tumor microenvironment post-treatment, and assessing combination treatment survival. As the prevalence of liver cancer in Canada is increasing rapidly, the need for novel treatment methods increases. We hope the development of LNP-IMQ can address the issues missed by our current treatment, and to increase the rates of long-term patient survival.</p>	

7. Research implementation and results under the program

Title of your research plan:

Development of an in vivo liver cancer metastasis model for immunotherapy validation.

Description of the research activities:

Three iterations of our tumour mouse model were developed during my time at Tokushima University. Our formulation was also successfully manufactured at the Ishida Lab and was found to remain stable throughout the experimental timeline. Mice given a combination of chemotherapy and our immune-stimulating formulation saw significant reduction in tumour size compared to mice given no treatment and mice only given chemotherapy. Some mice saw complete eradication of tumour.

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

I was able to participate in the Awa Odori festival in Tokushima with my labmates, which was a major highlight. I also went to a conference in Chiba with my labmates! Overall I had a great time.

9. Adviser's remarks (if any):

File name : SP23414_research report

**JSPS Summer Program 2023
Research Report**

1. Name: Deepak TIWARI	(ID No. SP23414)
2. Current affiliation: University of Regina, Canada	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Kavli IPMU, University of Tokyo	
5. Host researcher: Patrick de Perio	
6. Description of your current research: The next generation neutrino experiment Hyper-Kamiokande (Hyper-K) will have statistical power, but the presence of detector systematics will limit the discovery potential of the experiment. The uncertainties due to construction tolerances, support frame shift from photomultiplier tube (PMT) buoyancy, and the calibration source deployment system, combined with uncertainties in PMT angular response, and position-dependent water quality, can limit the precision of our final measurements. Through the application of photogrammetry, the position, and potential direction, of each PMT and deployed calibration sources can be calibrated, independently from all other degenerate detector parameters including those mentioned above. Furthermore, mitigating the water-related uncertainties requires R&D of gadolinium compatible water purification systems and water quality measurement apparatuses. As a postdoctoral fellow at the University of Regina, I am involved in various detector development efforts related to Hyper-K. There are two main components of the photogrammetry calibration systems. The first one being the use of drone, or a remote operated vehicle (ROV) to capture images of the detector and subsequently compare it with the designed detector values. The plans are to develop an automated navigation system so that the drone can navigate automatically and capture useful images in the water filled tank in the Cherenkov detectors. To achieve that, it's pertinent to understand the performance of the underwater navigation system well and quantify it through a dedicated measurement.	

7. Research implementation and results under the program

Title of your research plan: **Photogrammetry and water monitoring calibration efforts for the Hyper-K experiment**

Description of the research activities: Through this internship at Kavli IPMU, University of Tokyo, I contributed to the development photogrammetry calibration techniques with the goal of understanding and mitigating detector systematics. As described above, understanding the underwater navigation systems is crucial for developing an automated navigation system for an ROV. We carried out a detailed experiment at the Ocean Engineering Building in the Kashiwa campus of the University of Tokyo to test various components of the underwater navigation system. Through a detailed analysis we have quantified the performance of the system and will inform the systematic studies for the Cherenkov detector.

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

Japan has extensive hiking trails- an attraction for a nature lover like me. I could go out for shrine visits and hiking in the different regions and enjoyed them. Hiking Mt Fuji overnight was an unparalleled experience followed by a breathtaking sunrise from the top. I also visited several other cities/regions, and they had diverse things to offer. However, the visit to the Peace Memorial Museum in Hiroshima stands out as the most moving experience.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Ellinor Frank	(ID No. SP23501)
2. Current affiliation: Lund University	
3. Research fields and specialties: Biological Sciences	
4. Host institution: Nagasaki University	
5. Host researcher: Kei Nakagawa	
6. Description of your current research	
<p>My research is about bathing water quality in urban areas, and about the microorganisms in marine sediments and how they are connected to the microorganisms in the water. By analyzing the DNA sequences of the bacterial 16S rRNA gene in multiple samples we can get information about the structure of the microbiomes and spatiotemporal changes. The sediments are of interest due to the possibility of them functioning as a major reservoir for bacteria to survive in, and later get resuspended and travel with the water to the beaches. This is necessary work due to rising frequencies of high concentrations of fecal bacteria (specifically <i>E. coli</i> and intestinal enterococcus) in bathing water, which is not only a local problem, but a global one.</p> <p>This work is conducted through a series of methodologies, starting with enzymatic quantification of <i>E. coli</i> and extraction and quantification of DNA from all samples (sediment and water). After DNA sequencing, both DNA information and <i>E. coli</i> concentrations are analyzed using R language and statistical testing. In order to get a better understanding of the spreading of bacteria, source tracking is utilized using a customized curated approach.</p>	

7. Research implementation and results under the program

Title of your research plan:

Coastal sediment and water analysis for source tracking and contamination degree evaluation

Description of the research activities:

My research work during the summer of 2023 has been to do bioinformatic analyses of sediments and water, and to evaluate the bacterial contamination. Core communities of the sediments have been established, and the connection to the water microbiomes and the *E. coli* concentrations have been explored. The work was mainly focused on the sediments, as it is important to learn about the structure of this bacterial community and its changes over time and space before being able to establish how, and to what degree, the sediment microbiome is affecting the water's. *E. coli*'s presence, along with the curated source tracking results, indicate that the bacterial spread is complex and multiple sources are most likely contributing fecal indicator bacteria into this environment.

Additional activities performed at my host division at Nagasaki University has been joining lab work with the group also investigating fecal pollution, specifically during sample concentration processes and GC/MS analysis for coprostanol/corestanol measurements. Three fieldtrips/excursions have been conducted, one to Kumamoto/Aso to learn more about groundwater and spring water resources in this area. Further, two fieldtrips have been made to Takashima for work regarding preserving the marine environment.

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

I have learned more about the Japanese language and the rhythm of life here. I really enjoyed this opportunity!

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Gustav Joas	(ID No. SP23502)
2. Current affiliation: Karolinska Institute	
3. Research fields and specialties: Medical Sciences	
4. Host institution: Tokyo University	
5. Host researcher: Prof. Kei Sato	
6. Description of your current research	
<p>The innate immune response plays a critical role in determining the efficacy of vaccines. However, despite its importance, the underlying mechanisms governing these responses remain largely unknown. Alongside my medical studies, I conducted research at the Lore lab at Karolinska Institute in Stockholm, where I aimed to characterize the early innate immune response following mRNA vaccination in SARS-CoV-2 infected and uninfected individuals. To do this, I used bioinformatic methods such as transcriptomic analysis using RNA-sequencing to detect differences in gene expression and enrichment of molecular pathways.</p> <p>Going forward I to seek out new ways to better understand the innate immune response and its implications for vaccine efficacy. After working with systems virology this summer, I am eager to gain a deeper understanding of host response to viral infection, epidemic dynamics and how artificial intelligence could be used for development of viral therapeutics and pandemic prevention.</p>	

7. Research implementation and results under the program

Title of your research plan:

Monitoring and prediction of SARS-CoV-2 variants using protein language model

Description of the research activities:

The continuous evolution of SARS-CoV-2 variants has highlighted the need for ongoing genomic surveillance and risk assessment of emerging strains. Building upon the extensive genomic sequence database for SARS-CoV-2 and the rise of rapidly developing AI tools like large language models trained on protein sequences, the Sato lab at Tokyo University is exploring the use of protein language models to forecast viral fitness of future variants. This capability could significantly enhance our ability to predict potential outbreaks. Over the summer, supervised by Associate Professor Ito, I worked on developing a model designed to predict the transmissibility of SARS-CoV-2 Omicron variants.

Large protein language models are pre-trained on an extensive database of protein sequences. However, these so-called transformer models are generally designed for broad applications and require modification for the specific area of interest. This customization process, also known as domain adaptation, has been my primary area of focus. By further training the pre-established model on datasets containing viral protein sequence related to SARS-CoV-2, its ability to forecast characteristics of future viral variants can be improved.

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

9. Adviser's remarks (if any):

【SP23504】

JSPS Summer Program 2023 Research Report

1. Name: Phil Aupke	(ID No. SP23504)
2. Current affiliation: Karlstad University	
3. Research fields and specialties: Engineering Sciences	
4. Host institution: University of Tokyo	
5. Host researcher: Prof. Akihiro Nakao	
6. Description of your current research <p>An accurate prediction of time series data and reliable estimations of the prediction uncertainty is critical for resource allocation, optimization problems, and other related tasks. Forecasting such tasks is challenging, because of the high variance in the data caused by human behaviour (e.g., during holidays or weekends). Additionally, external factors like weather characteristics or marketing changes contribute to the uncertainty of the forecast performance. Time series prediction and uncertainty estimation can be applied to many different fields. One use case is the prediction of PV (Photovoltaic) power and energy consumption. Precise forecasts in combination with efficient large-scale integration of PV energy from multiple sources into the global energy system, which requires intelligent decision-making, leads towards smart energy microgrids. Indeed, by using enabling techniques such as Internet of Things (IoT), Machine Learning (ML), Block Chain, or Cloud Computing, energy prosumers aim to reduce the stress on the main grid by making intelligent decisions about when to store, consume or sell locally produced PV energy. However, optimized energy transactions in Smart Grids (SG) require reliable prediction of produced and consumed energy, which is difficult to achieve due to the uncertainty in the predictions of supply and demand. Imprecise forecasting might lead to less optimal decisions, which in turn limits the exploitation of the full potential of PV systems toward green transition. Consequently, several works have aimed to predict solar power output using ML-based techniques. My current research involves increasing the prediction quality from ML approaches and the estimation of uncertainty for PV power generation and consumption of prosumers to perform an accurate energy exchange within a smart energy grid.</p>	
7. Research implementation and results under the program <u>Title of your research plan:</u> Federated workload prediction and uncertainty estimation for Mobile Edge Clouds <u>Description of the research activities:</u> My research under Prof. Nakao involved the development and evaluation of a federated machine learning framework for the workload prediction of Mobile Edge Clouds (MECs) and the estimation of the uncertainty of the forecast. The development of machine learning models requires reliable time-series datasets, which are in the best-case retrieved from a real-life scenario. But since real-life datasets for the computational load of MECs are not publicly available we had to simulate these with an existing simulation framework for the simulation of scalable IoT devices which features realistic infrastructure models.	

I developed an extension for the simulator to import datafiles with longitude and latitude information for the positioning of the MECs as well as mass people movements, which are critical to simulate realistic computational demands. To compare different scenarios, we used two datasets of mass people movements: one real-life one from San Francisco and a simulated one from Tokyo.

The next step, after the extension of the simulation framework, was the development of the workload predictor that aims to estimate the required MECs compute demand and the uncertainties. For this, I have used my machine learning framework, which I have developed in my former studies. It trains and evaluates multiple predictors and selects the best performing one. Afterwards, I have developed a federated learning approach, which is an enhancement of my beforementioned ML framework. I have combined the existing federated learning framework Flower with my approach to simultaneously select the best performing algorithm in a distributed way.

The evaluation was setup with three Nvidia Jetson Xavier's, which ran multiple clients (MECs) and an independent server for the aggregation.

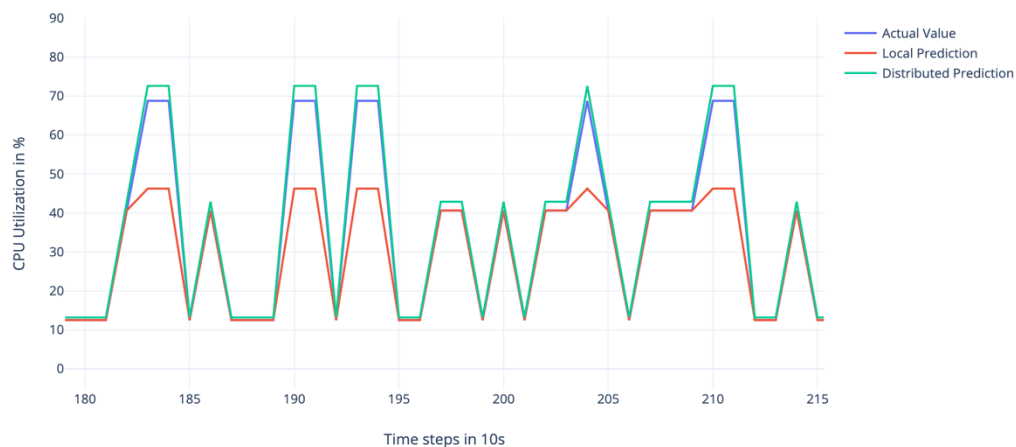


Figure 1 - MEC CPU Utilization prediction

Figure 1 presents a small example of the performance differences between the local approach and the distributed one. It is clearly visible, that the distributed one outperforms the local approach. This is also visible in the overall results of the evaluation. The overall Mean Absolute Error (MAE) of the local forecast is 3.48%, while the distributed one reaches 0.83% in total.

The evaluation shows, that the distributed framework outperforms the local approach in terms of prediction quality. This approach can be used in the next step to distribute the computational demand of MECs in a more efficient way.

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

I am really grateful, that JSPS gave me the possibility to live and work in Japan. In the first place, it was especially astounding to live in Tokyo, since I only lived in small cities beforehand. However, my international and Japanese co-workers helped me a lot during my stay, which reflects the overall hospitality of the Japanese culture. But the most impressive experience I had living in Japan was the ascending of Fuji-san.

9. Adviser's remarks:

My adviser did not provide any remarks.

JSPS Summer Program 2023 Research Report

1. Name: Agnieszka Backman	(ID No. SP23505)
2. Current affiliation: Uppsala University	
3. Research fields and specialties: Humanities	
4. Host institution: Keio University	
5. Host researcher: Professor Keiko Okawa	
6. Description of your current research	
<p>In my current project, The Materialities of Medieval Manuscripts in Digital Repositories, funded by the Knut and Alice Wallenberg Foundation, first at Stanford University and now at Uppsala University, I study the losses, changes and gains digitization and representation of medieval manuscripts in a digital repository lead to. Digitizing cultural heritage materials, including medieval manuscripts, is often seen as a solution to the problem of access. There is an assumption that anyone with an internet connection is able to view the digitized materials. However, digitization is not a perfect copy nor is it a process completely transparent to the user. As digitization schemes are often text-centric many material aspects of manuscripts are lost in translation from material object to digital image, as for example size or texture.</p> <p>The purpose of this project is to make a critical analysis of digitized medieval manuscripts, focusing on the digital objects themselves. Material philology and social semiotics form the theoretical basis of investigation. In material philology the emphasis is on texts in context – societal, historical and material. Part of it is paratext, the textual devices used to frame texts into books. In this project paratext is used to investigate the framing of manuscripts on digital platforms. Another core concept for the project is <i>affordance</i>, the “potentials and limitations for representation” used in multimodal, social semiotic theory (Kress, 2005:12). Affordances describe what a design allows a user to do. These potential uses can also include incorrect or disruptive ones.</p>	

7. Research implementation and results under the program

Title of your research plan:

The Materialities of Medieval Manuscripts in Digital Repositories

Description of the research activities:

I conducted research at Keio Media Design at Keio University's Hiyoshi Campus in professor Okawa lab, with the main research focus on Global Education but also develops online classes for the FutureLearn platform. I collaborated with the creators of the Japanese Culture through Rare Books course to understand the process of presenting the books as material objects online. I also had the privilege of participating in a workshop on *ukiyo-e*, using Object Based Learning as an approach to museum objects.

I also planned and carried out a two-day workshop on Latin Medieval Paleography together with JSPS postdoctoral fellow Manuel Muñoz García at Keio's Mita Campus. We showed 35 medieval objects, mostly fragments of books but also a beautiful Book of Hours and a roll to 25 participants. Getting to know the collections at Keio has opened up a new research collaboration avenue – looking at fragment collections from Keio University, Stanford University and University of Virginia procured from the same bookseller, which I plan to pursue together with Dr. Muñoz.

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

Everyone has been very welcoming and gone out of their way to help and show me what they're working on. I have felt very included at the university, both in meetings and more casual meet ups, which has been really nice and made this stay a very good experience.

In my free time, it has also been very interesting to be able to compare figure skating coaching styles and the ways skills are taught in Japan in comparison to Sweden and the US.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: HERRERA SARRIAS Marina	(ID No. SP23506)
2. Current affiliation: Stockholm University	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Tokyo Institute of Technology – Earth-Life Science Institute	
5. Host researcher: LONGO Liam	
6. Description of your current research <p>My current research concerns the study of small-scale structural duplication dynamics, in particular exon duplications. Exons are DNA fragments characterized by being the coding regions of a gene, whereby, through the process of mutually exclusive splicing, exon duplications within the same gene can give rise to a more functionally diverse protein repertoire and potentially leading to evolutionary innovations. Although the genomic origins of most evolutionary innovations are not yet fully understood, gene duplications and mRNA transcript diversity are thought to be the main driving force behind them. Therefore, the study of mutational dynamics in evolution is a key component in the complex task of understanding gene functionality. In the context of small-scale mutation, no computational tools have been developed for studying said dynamics, and most research in this area has simply aimed to demonstrate that these dynamics exist and occur with a certain frequency. Hence, in view of these limitations my work back home has mainly focused on the development of a tool for first, identifying tandem exon duplications, and second, the development of a framework for statistical analysis.</p>	

7. Research implementation and results under the program

Title of your research plan:

Domain Duplications as a Driver of Protein Innovation

Description of the research activities:

During my time at the Longo Lab over the course of the JSPS summer program, I was able to enhance the tool I had been developing at home. The new version we developed is more sensitive and proficient in identifying a wider range of events, a notable improvement from its previous iteration. Another significant achievement during this period was the formulation of a classification schema, a novel approach that allows us to accurately tally these events—something we had not undertaken before. Additionally, we conducted an in-depth analysis on various primate species, shedding light on the dynamics of these events. Looking forward, in the upcoming two weeks, we are poised to investigate these events at the protein level, marking an exciting progression in our research.

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

While we have achieved a substantial amount over the past two months, it is clear that there is more ground to cover in order to fully meet our objectives. Hence, I am truly glad that I had the opportunity to extend my stay.

I would like to express my deep gratitude to the JSPS organization for providing me with this incredible opportunity. This experience has been truly enriching, not only in terms of academic growth but also on a personal and cultural level. I have had the privilege of meeting exceptional individuals and exploring a vibrant city like Tokyo, which has been an eye-opening and fulfilling journey. This program has undoubtedly broadened my horizons and left a lasting impact on both my academic and personal development.

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Hongrun Chen	(ID No. SP23507)
2. Current affiliation: Chalmers University of Technology	
3. Research fields and specialties: Chemistry	
4. Host institution: The University of Tokyo	
5. Host researcher: Akira Isogai	
6. Description of your current research: Since I am now a master's student of Chalmers University of Technology, Sweden, I do not hold any research projects currently. However, in my bachelor research thesis, I worked on the synthesis of β -O-4 linkage-containing lignin compounds by improving an existing route. Lignin is a potentially renewable source of aromatic natural compounds but has been used as fuels (i.e., not chemicals) in the pulp and paper industry. During my bachelor research, I succeeded in improving the synthesis route by some modifications based on organic chemistry. In addition, one step in the synthesis route was replaced by a one-pot Wittig reaction which improved reaction time and yield sufficiently. During my bachelor thesis, I am interested in biomass-related materials science like cellulose nanofibrils (CNFs).	

7. Research implementation and results under the program

Title of your research plan:

Preparation and Characterization of Chemically-pretreated Cellulose Nanofibrils

Description of the research activities:

Cellulose is the most abundant material on Earth, and cellulose nanofibrils (CNFs) are prepared from cellulose fibers. Thus, accurate characterizations of plant cellulose fibers are significant for CNF research. However, a surprising observation of cellulose fibers was found in Prof. Isogai's lab. The molecular weights (MWs) of cellulose fibers prepared from softwood was much lower than those from hardwood, contrary to conventional data or literature, in which softwood cellulose fibers should always have higher MWs. So, I started, in my JSPS Summer Program, to solve this scientific problem based on a hypothesis that the current elemental chlorine-free bleaching sequence (used as environmentally friendly system) of wood cellulose fibers results the above unexpected MWs. This fundamental research project is a significant initial stage for my future CNF research. Based on the above hypothesis, I prepared post-oxidized and post-reduced softwood and hardwood cellulose fibers. The MWs of these cellulose fibers were measured, and compared with the original cellulose fibers. The post-oxidation can convert aldehyde groups in the cellulose fibers to carboxy groups, and the post-reduction can convert aldehyde groups to alcoholic hydroxy groups. The MWs and carboxy group contents of the cellulose fibers were measured by viscosity method and conductivity titration, respectively. The result showed that a significant increase in carboxyl content was observed for the post-oxidized wood cellulose fibers, demonstrating that aldehyde groups are present in the original cellulose fibers. However, the MWs were almost the same as those before post-oxidation or post-reduction. Therefore, the aldehyde groups present in cellulose fibers were not the primary factor influencing the low MWs, when measured by viscosity method. I am now considering other mechanisms for explaining the unexpected MW data during my experiments.

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

It is not the first time I have lived in Tokyo. When I lived in Tokyo last time, I had already experienced a lot. So, there was not much new cultural experience for me this time. However, there are still a lot of cities I have not gone to yet, scenery I have not seen yet, and food I have not tasted yet.

9. Adviser's remarks (if any):

During these two months of JSPS Summer Program, Mr. Hongrun Chen has worked very hard to tackle his research interest for his future CNF research. Consequently, he decided to continue his research in our laboratory for additional 5 months, after discussing his supervisor in Charlmers University of Technology. I accepted his and his supervisor's proposal to continue his CNF-related research in our laboratory. I believe that his extended staying in our laboratory as a visiting graduate student will be a good initial stage for mutual collaboration between our and his laboratories for future CNF research.

JSPS Summer Program 2023 Research Report

1. Name: Julie Sylvie Evelyne Guerreiro (ID No. SP23508)
2. Current affiliation: Umeå Plant Science Centre, Dept. Plant Physiology and Forest Genetics, SLU (Swedish University of Agricultural Sciences)
3. Research fields and specialties: Biological Sciences
4. Host institution: Hokkaido University, Dept. Biological Sciences
5. Host researcher: Prof. Naramoto Satoshi
6. Description of your current research <p>The major aim of my PhD project conducted in Peter Marhavý's lab is to investigate the molecular mechanisms controlling defence responses at the cellular level in plants.</p> <p>Plant growth and development is controlled by a complex hormonal regulatory network. Discoveries from last decades clearly demonstrated that hormones do not only act in an inert linear pathway, but are interconnected by a complex network of interactions and feedback circuits, which determine the final outcome of the individual hormone actions (Abeles <i>et al.</i>, 1992; Vanstraelen and Benkova, 2012; Van de Poel <i>et al.</i>, 2015). In higher plants ethylene as a gaseous hormone has been shown to mediate processes such as seed dormancy, germination, vegetative growth, flowering, climacteric fruit ripening, and senescence. Ethylene represents one of the key regulators of root growth (Cary <i>et al.</i>, 1995; Stepanova <i>et al.</i>, 2005; Swarup <i>et al.</i>, 2007). Additionally, ethylene was shown to play an important role in the plant's defence against biotic and abiotic stress factors (Lin <i>et al.</i>, 2009; Van de Poel <i>et al.</i>, 2015; Wen, 2015; Marhavy <i>et al.</i>, 2019) as well as lignin deposition (Campbell <i>et al.</i>, 2004, Moura <i>et al.</i>, 2010).</p> <p>My project aims to investigate the wound damage response in roots and its connection to the activity of <i>ACS2-5</i>, <i>7</i>, <i>8</i> and <i>ACO1-5</i> genes in <i>Arabidopsis thaliana</i> and to uncover their role during evolution of plants. Our recent findings reveal that in <i>Arabidopsis</i>, ethylene regulates quick accumulation of lignin deposition in cells adjacent to wound, as a local defence response to injury.</p> <p>We hypothesize that this lignification process may enhance the mechanical strength of the cells against pathogen infection. Our next step is to investigate the evolutionary breakpoint of ethylene induced lignin and plant immune system in <i>Marchantia polymorpha</i>. This will provide a deeper understanding of the lignification processes and its significance in plant evolution and immune response.</p>

7. Research implementation and results under the program

Title of your research plan:

Ethylene as a Key Regulator in the Defense Mechanisms of Plants: Insights into Wound Response and Lignin Deposition.

Description of the research activities:

During my stay in prof. Naramoto Lab, I have learned new techniques of cultivation and genetic transformation of *Ceratopteris richardii*, *Marchantia polymorpha* and *Physcomitrium patens*. I have also learned how to store and maintain the different stains.

Then, I also selected the line of *Arabidopsis thaliana*, mutant of *sgn3* gene and containing *Marchantia polymorpha* SGN3 gene fused with GFP. Confocal imaging of the lignin deposition was performed after sequential staining of the plant roots, revealing the lignin deposition at the casparian strip level.

I also grew *C. Richardi* and performed root staining to do confocal imaging of the root structure and especially the lignin deposition.

During this project, I also learned how to study the conservation of ethylene genes as well as jasmonate genes in *Marchantia p.* and *Arabidopsis t.*

I have also participated in the various lab activities that allowed me to learn even more about moss physiology. I had a seminar presentation where I could present the professor and student of the lab, my work done during my PhD. I also attended seminars of lab members, seminars of visiting professors at Hokkaido University and journal club presentations.

We also had recurrent meeting between my host lab and my former lab in Sweden to discuss the work and the future work that will be done to maintain this collaboration.

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

During my stay in Sapporo, I had the chance to do many activities with the lab members and other lab members from the department. I've tried various traditional dishes that were amazing and visited many areas of interest as well as traditional onsen. I had the chance to visit the new AOAQ Aquarium that recently opened in Sapporo, visited Otaru the neighboring city, Asahiyama memorial parc, hike to see the Heiwa No Taki waterfall and the Takino Suzuran Hillside parc were I've seen the beautiful Hill of the Buddha.

9. Adviser's remarks (if any):

As it has been written above, Julie worked very hard in my lab. She could learn many techniques. She could also get some important experimental data. From my side, I could have also a good feedback after the discussion with her. My lab member could also have a good discussion. Overall, I believe that JSPS summer program provide benefit to both Julie and me.

JSPS Summer Program 2023 Research Report

1. Name: Veronica LIZANO-FALLAS	(ID No. SP23509)
2. Current affiliation: Linköping University	
3. Research fields and specialties: Medical, Dental and Pharmaceutical Sciences	
4. Host institution: The University of Tokyo	
5. Host researcher: Prof. Shigeo Murata	
6. Description of your current research <p>Chemicals are widely used and offer significant benefits to our daily lives. However, the risk to human health and the environment of many of these compounds is still unknown and their assessment through the available methodologies is challenging. In my current PhD project, we proposed the proteome integral solubility alteration (PISA) assay as an alternative solution to this challenge. Within this project, we identified in zebrafish embryos the proteins Trap1, Calr3b, and Calr as targets of TCDD, a chemical of high concern for human and environmental health. Particularly, in humans, TRAP1 interacts with the proteasome subunit TBP7/Rpt3 at the endoplasmic reticulum (ER) for ubiquitination of mitochondrial proteins. This antiapoptotic activity should reduce the proteotoxic stress generated by the accumulation of misfolded proteins. We hypothesized that the interaction between TCDD and these targets contributes to the alteration of mitochondrial integrity and apoptosis, and compromise ER functionality decreasing protein folding efficiency and calcium homeostasis.</p>	

7. Research implementation and results under the program

Title of your research plan:

TCDD effects on the proteasome activity

Description of the research activities:

At The University of Tokyo, the aim was to validate if the toxic compound TCDD has a negative effect on the proteasome activity.

The following molecular assays were performed:

1. Proteasome activity assay to the crude proteome extracted from HEK293 cells exposed to TCDD (toxic compound) and to the corresponding proteome fractions obtained by glycerol density gradient centrifugation.

2. Western blott to the crude proteome extracted from HEK293 cells exposed to TCDD to test if the proteasome's assembly was affected by the toxic compound.

3. Monitor the proteasome activity through the MODC substrate (ubiquitin-independent degradation) in U2OS cells.

4. Monitor possible additive effects of TCDD to the proteasome inhibitor activity of Bortezomib on U2OS cells through the MODC substrate.

The results showed that TCDD did not affect the proteasome activity and assembly in HEK293 and U2OS cells. However, it showed an additive effect to the proteasome inhibitor activity of Bortezomib on U2OS cells. Other types of cells, more suitable for toxicity evaluation, such as hepatocyte cell lines, could be used in future studies.

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

Participating in the JSPS summer program has been a great experience for my academic career. At the cultural level, I would advise future fellows to be prepared regarding the difficulties socializing and interacting with the group members, especially if there are no other international members in the group.

Could be important to recommend the host to introduce all the group members to the JSPS fellow since the first day, as well as giving practical information (for example where is the office material— pens, pencils, paper, etc., if available for the group members).

9. Adviser's remarks (if any):

JSPS Summer Program 2023 Research Report

1. Name: Vijay Kumar	(ID No. SP23510)
2. Current affiliation: University of Borås, Sweden	
3. Research fields and specialties: Engineering Sciences	
4. Host institution: Shinshu University	
5. Host researcher: Prof. Hideaki MORIKAWA	
6. Description of your current research <p>My current research is focused on analytical modelling of fiber and textile assemblies. I have an emphasis on random fibrous structures – such as paper yarns, textile nonwovens, glass mats, and CNT buckypapers to name a few. In the past, I have contributed to the development of theoretical models for a range of properties such as tensile and compression properties, auxetic behaviour and wicking characteristics of random fibrous materials, piezoresistive nature of the conductive fibrous assemblies, and percolation of nano-fillers based nanocomposites. Beyond that, I have been actively working within the area of textile management, where I have been focusing on supply chain traceability, circular business models and the application of AI within the field of textiles.</p>	
7. Research implementation and results under the program <p>Title of your research plan: Investigation of the structural mechanics of paper yarns</p> <p>Description of the research activities: The focus of the research activities was to investigate the structure of cellulosic paper yarns that help to develop an understanding of their structural mechanics. The structure of a cellulosic paper consists of randomly oriented cellulosic fibrils, therefore it is generally characterized as a planer random network of cellulose fibers, where the inter-fiber interaction plays a role in development. While the orientation of cellulose fibers in a paper structure is often considered uniformly random, the formation of paper yarn (primarily twisting of the paper strips) exerts various levels of deformation within the paper strips, which is expected to develop in anisotropic fiber orientation along the twisted helix. In this context, the X-Ray microCT (μCT) analysis was carried out with four yarns samples (two Japanese paper yarns (J1, J2) –which are hemp-based, one Swedish paper (S1) – which is wood-based, one two-ply yarn with Swedish paper yarn and Linen yarn (S2)). The μCT analysis reveals that the fibers in paper yarns possess an anisotropic structure. For example, Fig. 1(a) shows the orientation vectors on paper yarn and linen yarn for S2, where linen yarn being a regular yarn shows the narrow distribution of angle (Fig. 1(b) whereas paper yarn shows a broader distribution with weak preferential orientation distribution between 20°-25°.</p>	

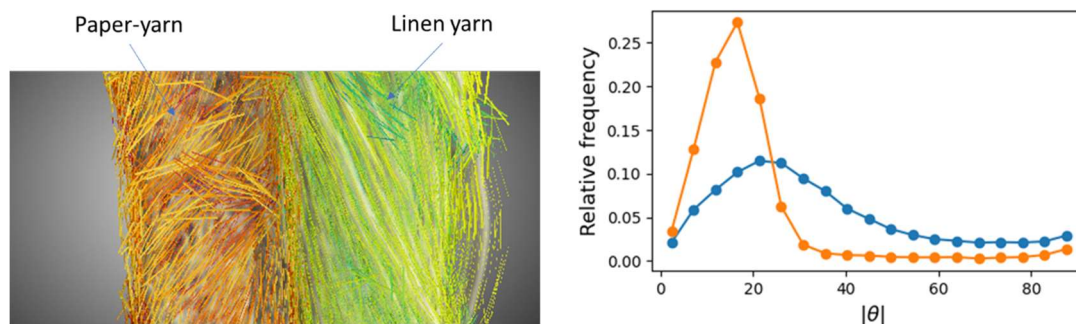


Fig 1. (a) μ CT image of paper yarn and linen yarn with orientation vectors of fibers/fibrils, (b) the relative frequency of angle (θ) of fiber orientation vectors from yarn axis. $|\cdot|$ represents the absolute value.

Beyond the μ CT investigation, the yarns were tested for stress-strain characteristics for yarn samples, where J1 and J2 (Japanese) yarns show less variability, whereas S1 and S2 show high variability in initial modulus calculated from stress-strain characteristics. Further, the incorporation of orientation distribution in fiber bending-based theoretical model reveals that the relative young's modulus (ratio of yarn to fiber modulus) of the paper yarns increases as more fibers are aligned toward the loading axis (ie. the yarn axis). However, as the paper yarn is a highly packed structure, tensile mode deformation of the cellulose fibers needs to be further investigated for theoretical modelling.

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

It has been a wonderful experience to conduct research in Japan and experience the research and social cultures. While the research visit has helped in realizing important research results, I am grateful to Prof. Morikawa for introducing the research carried out in his research group which has helped me to broaden my knowledge horizon and opened the scope for further collaboration. In addition, the homestay organized by JSPS was very helpful to understand Japanese culture closely.

9. Adviser's remarks (if any):

The research theme of Dr. Kumar is the structural analysis and characterization of Paper Yarns. Paper yarns are expected to become a new fiber material that can solve sustainability issues internationally.

Despite his short stay in Japan, Dr. Kumar conducted numerous experiments using the X-ray microCT, yarn tensile tester and other evaluation equipments at our Shinshu University in accordance with his research plan, and also analyzed the obtained data and discussed the results. He also visited and exchanged opinions with companies in Japan that manufacture and sell Paper Yarns, exchanging information on research and development and discussing future collaboration. Dr. Kumar also actively attended seminars in my laboratory and actively asked questions and made useful comments and suggestions on the research progress reports of doctoral and master's course students who were working on different themes.

Although his stay was short, it was a very useful opportunity for both Dr. Kumar and me and my laboratory. I would like to thank JSPS for your generous support.

**JSPS Summer Program 2023
Research Report**

1. Name: Margot Clauss	(ID No. SP23511)
2. Current affiliation: Lulea University of Technology	
3. Research fields and specialties: Engineering Sciences	
4. Host institution: Kyushu Institute of Technology	
5. Host researcher: Pr Mengu Cho	
6. Description of your current research	
<p>Space debris is the main challenge the space community must face. The solutions currently investigated to assess this issue often consist of the launch of a spacecraft to capture another for them to deorbit i.e., reenter the Earth's atmosphere, resulting in the demise of both spacecraft along with their components, materials, and funding. Nonetheless, Space debris has the potential to bring value to space missions as available material resources in space. The ability to reuse them is crucial for the implementation of circularity in-space economy. My research focuses on the feasibility of the reuse of spacecraft solar arrays. Solar arrays are common to most modern spacecraft to provide energy to the components. Their use started with the satellite Vanguard I launched in 1958. Reusing solar arrays presents some challenges, the first one being the solar cells degradation within the space environment mostly due to radiation, temperature change, arc charging, and the impact of micrometeoroids and/or space debris. The second challenge concerns the design of solar arrays themselves that are not thought to be reused, repaired, or dismantled. Few exceptions exist as the Hubble Space Telescope and the International Space Station. Another challenge is finding the process to reuse the solar array in space. This challenge has been investigated during the stay at the Kyushu Institute of Technology. Processes to recycle solar panels on Earth are investigated in Europe and Japan. Those processes are usually composed of 5 steps: disassembly, delamination, materials sorting, and materials extraction/purification. Delamination is the focus of the research conducted at the Kyushu Institute of Technology. Delamination is the separation of the different layers of the solar cell. Of course, the solar panels used for spacecraft are different from the ones used on Earth because they need to endure tests, launch, and space environment. Kyushu Institute of Technology's Department of Space Systems Engineering investigates the Lean satellite project: a satellite promoting a non-traditional, risk-taking development and management is considered a lean satellite. A good example of a lean satellite is the Joint Global Multi-Nation Birds Satellite project where student design, develop, and operate an entire 5 units of identical 1U satellites mission for 2 years. Thus, the solar cells used for the CubeSat developed by the Kyushu Institute of Technology are body-mounted i.e., they are fixed directly to the satellite skin or to light metallic sheets that are then attached to the satellite. This method is mainly used by CubeSat missions due to its low cost. Nevertheless, deployable solar cell structures are investigated for CubeSat structures due to the increasing energy demand of their missions. Deployable solar arrays are paddle-mounted solar cells, if they are controlled to minimize the shadows on the cells their efficiency is much higher than body mounted. Deployable solar arrays have more potential to be designed to be reused since a releasing system could be implemented. Body-mounted cells will be more difficult to reuse since they are directly on the satellite structure. Moreover, the volume of deployable solar array is significantly higher than its counterpart. Thus, they present a better target to be reused. The Kyushu Institute of Technology provided a solar array from a flight model. Its structure composition is like the deployable solar arrays used in space. It was composed of different layers: an aluminum honeycomb layer, a glue (probably epoxy) layer, a Carbon fiber reinforced polymer (composite), a Kapton layer, an RTV-S691 (silicon rubber) layer, and the cells. The objective is to separate the different layers and recover the cells. The board was cut into smaller parts, and the process permitted us to easily remove the aluminum honeycomb by hand. Nonetheless, some of the solar cells were damaged i.e., cracks appeared. The next step was to separate the cells from their support. As said before the cells are fixed to the Kapton with an adhesive called RTV-s 691, which is an elastomer. RTV-s 691 is space certified and was used for EURECA and Hubble solar arrays. As a space-certified adhesive RTV-s 691 has UV resistance and good mechanical and thermal properties. Two methods are possible to delaminate RTV from the cells: a chemical and a thermal method. A chemical method was already tested with cells fixed on an aluminum plate; The arrays were soaked into an acetone bath for several days to detach the RTV from the aluminum. The process often results in the propagation of cracks within the cells since they are very brittle. The thermal concept for Earth application solar panels consists of the heating of the solar array at a temperature</p>	

between 500°C and 600°C to thermally decompose the adhesive and thus separate the layer of the panels. The chemical method was investigated within Kyutech, the cells were soaked in commercially available acetone. One soaked sample, sample 1, has the Composite layer removed by abrasion; the process also resulted in the propagation of cracks already present due to the cutting process. The other sample, sample 2, was composed of two one cracked and one non-cracked. After two days, the cell of sample 1 could be removed entirely despite the cracks. The cells of sample 2 were only partially removed. The chemical method can be a possibility to delaminate solar cells in space. Nevertheless, today chemical processes are rare even non-existent in space due to safety reasons and to the fact that chemicals must be brought to space. During the stay, a visit to the solar panel recycling plant of Shinryo Corporation based in Kitakyushu was planned. The company used a thermal delamination process, consisting of the heating of the solar arrays from 500°C to 1000°C. The arrays are then cooled down and an operator removes the glass from the cell. Then, the resultants of the delamination are sorted via a wind sorting machine and an air table machine. Those machines permit to separate of the remaining silicon from the glass, the silicon being very light is blown in the air as the glass falls into a dedicated collector the silicon falls into another one. Then the resulting glass part further goes through the air table machine to remove the remaining silicon. The objective of the process is to recover the glass of the solar panel since it is the main component in terms of quantity. Thus, it needs a certain quality for it to be reused. The silicon part is sent to another company. A second experiment aiming to test the thermal process for spacecraft solar panel delamination has been discussed. To delaminate the cells considering RTV-s 691, RTV-s 691 is an elastomer which means it does not melt, it only burns. According to its supplier RTV starts decomposing at temperatures superior to 200°C, has a flash point at 250°C, and an ignition temperature of >400°C. Thus, the thermal delamination process will require a high-temperature oven to decompose RTV-s 691. Moreover, RTV-s 691 toxicity when burning is not provided by the supplier, RTV-s 691 has cancerogenic elements within its composition. Thus, safety measures must be implemented. Due to time and materials constraints, the experiment might be pursued at the Luleå University of Technology. Of course, close collaboration will be maintained between the Kyushu Institute of Technology and Luleå University of Technology.

7. Research implementation and results under the program

Title of your research plan:

Reuse of Spacecraft solar cells: A planned experimental research approach.

Description of the research activities:

- ISTS paper
- Meeting with Professors regarding the feasibility of the reuse of spacecraft solar cells
- Workshop on Thermal Vacuum Chamber Test
- Experimentation to verify the states of the given solar cells.
- Experimentation of chemical process for cells delamination
- Visit of solar cell recycling company Shinryo Corporation in Kitakyushu
- Research seminar presentation
- Seminar/class from visiting Professor

Possible Outcomes/Future Research

- IAC23 paper
- Experimentation of thermal process for solar array delamination
- Future research collaboration between LTU and Kyutech
- Future research collaboration between LTU, Kyutech, and the University of Stuttgart

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

- Japanese language classes
- Cultural meeting to help Japanese students to speak English with foreigners.
- Japanese student tutor to help you with Japanese administration and to orient yourself around the city and university.

9. Adviser's remarks (if any):

JSPS Summer Program 2023
Research Report

1. Name: Leonardo Colombo (ID No. SP23512)
2. Current affiliation: Lund University
3. Research fields and specialties: Engineering
4. Host institution: Nagoya Institute of Technology
5. Host researcher: Prof. Wataru Kitagawa
6. Description of your current research <p>The present research, I (Leonardo Colombo) am focusing on, deals with core loss (also referred as iron loss) assessment on laminated steel samples, which are magnetically characterized via standardized measurements procedures apt to quantify the material's magnetic performance. Such results are then implemented into Finite-Element Analysis models of electrical machines to have an improved understanding of the device's working principles and performance. Ultimately, the purpose of this research is to build more efficient and reliable electrical machines by understanding the material's properties and optimized shapes to increase the device's power density and efficiency.</p>
7. Research implementation and results under the program <p>Title of your research plan: Flux barrier shape optimization of a PMSM (Permanent Magnet Synchronous Machine) for vehicular application.</p> <p>Another aspect worth considering when designing and simulating an electrical machine is how the magnetic flux path can be improved to achieve a smoother and more stable torque production. In this specific case, the shape of the rotor's magnet flux barrier is iteratively changed using the genetic algorithm optimization routine developed at NiTech and a simplified version of it coded in MATLAB during this fellowship. The results of the two algorithms are then compared. The machine geometry is taken from Dr. Rasmus Andersson's PhD thesis [1] and scaled up. More precisely, one of the machine's operating points is here considered for the optimization, whose purpose is to increase the average torque, reduce the ripple (i.e., oscillation) and generally improve the cogging (i.e., torque due to the interaction between rotor magnets and stator slots). Fig. 1 reports one of the models computed via Finite-Element Method by the optimization algorithm. Starting from the top, we have the geometry of the model and the coordinates of the flux barrier contour, followed by the steady-state and cogging torques.</p>

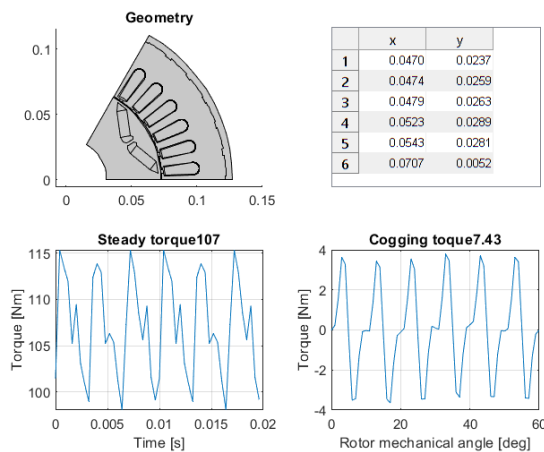


Figure 1 - FEM model result

A total of about 1400 models are simulated using Genetic Algorithm and two different strategies are adopted in the optimization: randomized and space-constrained optimization. As for the former, the points defining the contour of the flux barrier are randomly assigned in the rotor space, while in the latter, there are coded constraints that prevent invalid solutions to be computed and analysed. Figure 2 shows the optimization results normalized to the original machine's and compares the two optimization strategies. The space constrained strategy produces a higher rate of satisfactory designs compared to the

randomized approach, but however, the constraints defining such methodology can be particularly limiting. On the other hand, the randomized strategy has a higher discard rate, but allows the algorithm to freely choose the value of the optimization variables. It has to be said that for this particular strategy, the size and angular orientation of the magnet are taken into account and therefore, the task's complexity and execution time increase. In general, since we are dealing with a minimization problem, the lower the *fit*, the better the solution is. The randomized approach has produced a more scattered dataset, while the space-constrained output is more localized around the original machine's solution and thus, more satisfactory. As part of the fellowship, the space constrained approach was coded and tested using MATLAB and COMSOL Multiphysics. Unfortunately, due to time constraints, no simulations with the data obtained from experimental measurements on laminated steel sample could be performed, which could perhaps represent the next time in this work.

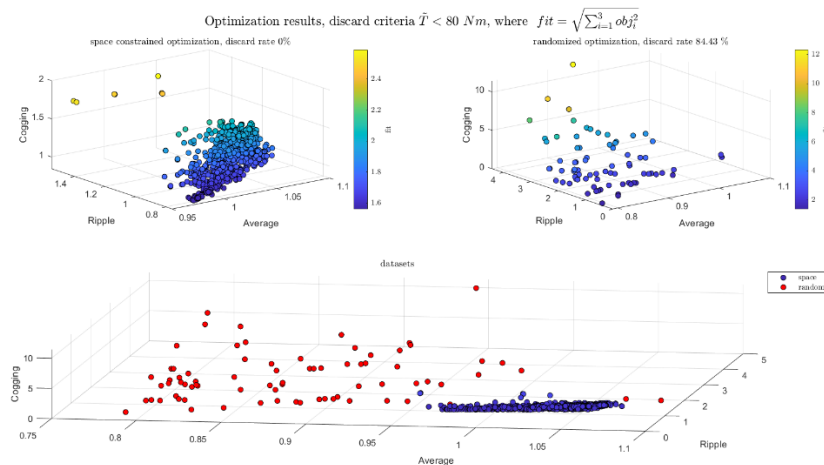


Figure 2 - Optimization results and comparison.

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

9. Adviser's remarks (if any): Mr. Leonardo Colombo learned optimization methods used in electrical equipment in this laboratory and adapted them to PMSM. From simulation results using an automotive motor, he was able to obtain the best geometry using the Pareto fronts. He achieved more than expected in two months. Further development is expected by integrating his research on magnetic material properties.

[1] Andersson, R. (2019). *On the Design of Electric Traction Machines: Design and Analysis of an Interior Permanent Magnet Synchronous Machine for Heavy Commercial Vehicles* (1 ed.). [Doctoral Thesis (monograph), Industrial Electrical Engineering and Automation, Faculty of Engineering, LTH]. Department of Biomedical Engineering, Lund university.