JSPS Summer Program 2019
Research Report

1. Name: Victoria SHARP （ID No. SP19001）

2. Current affiliation: Pennsylvania State University, Pennsylvania, United States

3. Research fields and specialties:

Biological Sciences

4. Host institution: University of the Ryukyus, Okinawa, Japan

5. Host researcher: James REIMER

6. Description of your current research

I am performing DNA extractions, PCR, and sequencing of *Palythoa tuberculosa* samples collected from New Caledonia in 2017. These samples have been analyzed for stable isotope composition, and I am supplementing this data with specific information of the algae in symbiosis with these cnidarians, individuals in the family Symbiodiniaceae. My project looks at two major genes, the internal transcribed spacer 2 (ITS2) and and the non-coding region of the plastid mini-circle ($psbA^{ncr}$), used to identify the symbiont as specifically as possible. Once identified, the species data will be analyzed against environmental conditions of the sampling sites to see if there is a correlation between any abiotic factors and dominant symbiont, following a previous study that saw significant results in the Red Sea. This information combined with the stable isotope analyses will give a comprehensive view of the algae consumed by and uptaken by cnidarians in different environmental conditions.

7. Research implementation and results under the program

Title of your research plan:

Symbiont associations in zoantharians across the Indo-Pacific

Description of the research activities:

- DNA extraction performed on approximately 200 samples.
- Nanodrop utilized to check DNA quality/concentration. Dilutions performed as needed.
- PCR (polymerase chain reaction) performed on samples for the genes ITS2 and psbA^{ncr}.
- Gel electrophoresis conducted to check success of PCR amplification.
- PCR product cleaned and sent for sequencing.
- Resulting sequences cleaned and checked against a database for genus identification.

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

Okinawa is a completely different place from mainland Japan, and everything I've experienced here has been a completely new cultural experience. It's been so interesting and I'm going to miss it here.

9. Adviser's remarks (if any):

Victoria was a pleasure to have in the research group and fit in well with our international team. She worked diligently on her research project, and we anticipate a scientific paper from this work will result. Victoria is always welcome back to our lab and Okinawa, and I would like to thank JSPS for this excellent research program.

JSPS Summer Program 2019
Research Report

1. Name: James Scott Lyons （ID No. SP19002 ）

2. Current affiliation: University of California Berkeley

3. Research fields and specialties:
Social Sciences

4. Host institution: Archaeological Institute of Kashihara, Nara Prefecture

5. Host researcher: SAITO Kiyohide

6. Description of your current research

In order to assess the character of human-environmental interaction, specifically human impacts on and management of Japanese forest landscapes, I have been examining the archaeological traces of ironworking practices and vegetation change on the Osaka Plain in the fifth and sixth centuries. How did ironworking influence the extent and composition of local forests, and how did the forests mediate the relationship between the ironworkers and their products? The interface between the ironworkers and the forest landscape is the practice of harvesting wood to make charcoal fuel for the forges, so I have approached these questions by investigating (1) what changes in the landscape's vegetation occurred, (2) the extent to which those changes can be attributed to human activities, particularly ironworking, and (3) how ironworking technology changed with respect to fuel use.

To answer these questions I have mobilized a combination of new analyses of ironworking residues and iron artifacts, and the synthesis of legacy paleoenvironmental and other excavation data. The first two questions are best answered by mobilizing legacy data in the form of pollen, diatom, and phytolith, and wood identification analyses conducted on excavated materials from across Osaka Prefecture, as well as recent fine-grained paleoclimate data and an understanding of Japanese temperate forest dynamics gleaned from ecological research.

7. Research implementation and results under the program

Title of your research plan:
Historical Ecology and Ironworking on the 5th and 6th Century Osaka Plain

Description of the research activities:

Much of my research was conducted in the Archaeological Institute of Kashihara, Nara Prefecture's library, extracting all paleoenvironmental data collected from archaeological excavation reports from Osaka Prefecture. This data is slowly providing a richer picture of the ancient woodland landscapes of the Osaka Plain and how they changed over the course of a few centuries.

I was also able to take charcoal samples from ironworking slags unearthed at the Ogata site in Kashiwara City and the Mori site in Katano City. These samples provide material for dating, allowing for the construction of a finer grained chronology for ironworking activities. When submitted for AMS radiocarbon dating, these samples returned dates in the 6th century. These samples proved challenging for radiocarbon dating due to their small size and unavoidable contamination from the surrounding ironworking slag matrix. The largest charcoal samples were reserved for charcoal species identification. That work is ongoing, but will provide a dataset to compare to the reconstructed woodland composition as well as charcoal recovered from other a pyrotechnological feature at the Ogata site.

Finally, I submitted ironworking slags themselves for mineralogical and chemical characterization, providing insight into the specific technical processes conducted by ironworkers at these two sites.

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

Dr. Saito and the other researchers at the Archaeological Institute of Kashihara, Nara Prefecture were extremely friendly and accommodating, providing not only an excellent work environment but encouragement, advice, and camaraderie. They even re-worked the institute's August schedule so that I could present on my research at the monthly research colloquium!

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Heather Lawrentz （ID No. SP19003 ）

2. Current affiliation: Kent State University

3. Research fields and specialties:
Biological Sciences

4. Host institution: Kyoto University

5. Host researcher: Dr. Masato Nakatsukasa

6. Description of your current research

The lineages of *Ateles* and *Colobus* have been separate for over 40 million years, yet they share unique forelimb morphology as a result of convergent evolution. Each has extremely long forearms and posterior digits, accompanied by the near, or entire, loss of the first digit. It has been argued that this morphology enhances their "hook grip", a posture utilized during brachiation and suspension. Through this project, we seek to understand the relationship between these forelimb structures and the *Hox* genes underlying limb patterning. Knock-out experiments have shown that *Hoxd11* is largely responsible for growth of the distal zeugopod, *Hoxd13* influences growth of the autopod, and the two compete for overlapping expression territory across the posterior digits. By analyzing size correlations among forelimb elements, we aim to elucidate the boundaries of these expression territories, as well as confirm the detectability of these growth modules in the adult skeleton. Another facet of the present study involves *Hox* gene expression and the pisiform. Due to the known involvement of *Hox* genes with growth plate formation, it was once considered that the carpals lack growth plates because they form in a region between two *Hox* modules. However, a study by Reno et al. (2016) found the presence of *Hoxd11* products near the region of the developing pisiform in murine embryos. Additionally, the pisiform in non-human primates is elongate and forms from two centers of ossification (another indication of a growth plate). Therefore, we seek a correlative relationship between size of the pisiform and posterior metacarpals, to confirm that the pisiform falls within the expression territory of *Hoxd11*. Additionally, given that some of the same *Hox* genes are employed during forelimb and hindlimb development, some researchers (Rolian et al. 2009) argue for the coevolvability of the fore- and hindlimbs. Their argument is framed in the context of human evolution, and posits that selection for large hallices and short posterior pedal digits provided a mechanical advantage for upright walking. By modifying the underlying *Hox* genes to produce this phenotype, selection, in turn, altered the forelimb in a similar fashion, and pre-adapted human hands for tool use. Thus, we are also comparing forelimb and hindlimb patterns in search of such a trend.

7. Research implementation and results under the program

Title of your research plan:

Analysis of the Metacarpals and Distal Forearm in *Ateles* and *Colobus*.

Description of the research activities:

My host institution was Kyoto University, but for part of the summer I traveled to Inuyama, to the Primate Research Institute and the Japan Monkey Center, and stayed there for several weeks. During my tenure at the PRI and JMC I collected over 6,300 forelimb and hindlimb measures from 129 individuals spanning 35 taxonomic groups. Forelimb measurements included: total lengths of all long bones (including metacarpals), placement of the nutrient foramina in the humerus, radius, and ulna, weights of the metacarpals and various carpals, as well as other aspects of the humerus to be used for data normalization. Precise care was taken to ensure proper identification of the metacarpals and carpals, for as in many primate species, these elements can be very small. Hindlimb measures included total lengths of all long bones (including metatarsals), placement of the nutrient foramina in the femur, tibia, and fibula, weights of the metatarsals and talus, as well as other aspects of the femur and tibia, again, to be used for data normalization. Although the focus of the study was *Ateles* and *Colobus*, I measured many other primate species for comparison, starting with those most closely related to *Ateles* and *Colobus*. I also examined species more distantly related that are known to have similar locomotor repertoires. My time at Kyoto University was spent conducting a literature review, performing preliminary data analysis, preparing and delivering a research presentation, and beginning manuscript composition.

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

My host researcher was very kind, and he showed me many temples and shrines around the city of Kyoto. He took me to the Higashi-Honganji Temple, the Toji Temple, the Fushimi Inari Shrine, Monkey Park Iwatayama, and to the top of Mt. Hiei. Also during my stay in Japan I was able to visit the Heian Shrine, Kiyomizudera, Nijo Castle, and the stunningly beautiful Kinkaku-ji. This was a wonderful experience!

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Rose S. Leach （ID No. SP19004 ）

2. Current affiliation: Kent State University

3. Research fields and specialties:
Biological Sciences

4. Host institution: Kyoto University

5. Host researcher: Dr. Takeshi Nishimura

6. Description of your current research

My current research as a PhD student at Kent State University in the Human Evolutionary Biology Program is broadly focused in functional morphology, skeletal anatomy, and developmental biology. I am interested in the biological processes that underlie phenotypic changes in primate skeletal anatomy and how this information can be used as a model to make inferences about how modern humans evolved from their ancestors that they shared with extant primates. Specifically, I am examining if clinal differences in long bone and thorax development in Japanese macaques (*M. fuscata fuscata*), as outlined by Bergmann and Allen, occur as a response to a temperature gradient or gradation due to gene flow. The developmental underpinnings of these changes will help elucidate the mechanisms giving rise to the robust somatotypes of Neanderthals.

7. Research implementation and results under the program

Title of your research plan:

Examining Long Bone and Thorax Phenotypic Plasticity: A Case Study of Skeletal Differences Between Northern and Southern Japanese Macaques

Description of the research activities:

While at Dr. Nishimura's lab in the Primate Research Institute, I spent the first 3.5 weeks gathering osteometric data for over 90 adult individuals of *M. fuscata fuscata* and *M. fuscata yakui*, which included 85 different measurements in order to not only examine growth of long bones using the nutrient foramen but also thorax plasticity. The StraTec pQCT scanner was used for the next 2.5 weeks to scan the femora of each individual. Two slices, 5 mm apart, were taken of each femur at the mid-shaft region. Once scanning was completed, the data were collected from the database and converted for use in Image J.

Climate data from the Japan Meteorological Agency from nearby locations of where the macaques were found, controlling for the estimated years of growth of each macaque, were obtained for use in statistical analysis using IBM SPSS. Initial bivariate plots show an overall positive relationship between average annual temperature and radial length. This same relationship was seen between average annual temperature and cranial capacity. Some of the other bivariate plots did not show as clear of a relationship with average annual temperature, which could be due to the generally more temperate climate of Japan, relative to sub-tropical climates south of Japan, or to many other factors that can influence phenotype, such as gradation of gene flow.

In-depth statistical analysis based on the results of the bivariate plots will be done at my home institution, and a manuscript will be prepared in conjunction with Dr. Nishimura and the Primate Research Institute to publish in a peer-reviewed journal.

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

The JSPS summer program was an incredible opportunity to experience Japan by really immersing into the work-life routine, while traveling around on the weekends. My research incorporated traveling to different regions to observe Japanese macaques in the wild, including the cities of Beppu, Nagano City, and Kyoto. While in these areas, I was able to experience not only the traditional shrines and temples that Japan is known for, but also the regional cuisines and taking in natural beauty through hiking! The relationships I have forged with the researchers at the Primate Research Institute are invaluable, and I look forward to future collaboration with them.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Jackson Johnstone (ID No. SP19005）

2. Current affiliation: Graduate Student/ University of Texas Rio Grande Valley

3. Research fields and specialties:

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

4. Host institution: Hokkaido University

5. Host researcher: Dr. Jorge Garcia Molinos

6. Description of your current research

Climate warming is having an increasing impact on marine environments. Sea urchins are ideal model organisms to focus on, as they are excellent indicator species with regard to their response to climate change. They are also ancient and relatively simple species, meaning that there are fewer internal mechanisms to deal with when observing responses. In this study, we tested the effect of increasing temperatures on reproductive functions, heat shock protein expression, and ceolomic fluid (CF, a body fluid that regulates important physiological processes) conditions in Atlantic sea urchin at three different temperatures. The results suggest that elevated water temperature decline/acidify CF pH which might be involved in the impairment of reproductive functions and cellular apoptosis in Atlantic sea urchin.

7. Research implementation and results under the program

Title of your research plan: The effects of rising water temperatures on stream communities in Japan.

Description of the research activities:

My assigned work had both desk-based and field components. First, using GoogleEarth and aerial imagery, I generated a data base of existing dams and water diversions across some of the study catchments that will be monitored in the project. I also gathered information on fish and macroinvertebrate species occurrence data across Japan from public reposiotires (GBIF). Second, I took part in the field campaign conducted to establish the monitoring network in one of the study catchments (Sorachi River) to collect biological (macroinvertebrate, fish) data. To do so, we used different sampling techniques such as aquatic macroinvertebrate sampling (Surber sampler) and electrofishing. All these data will be used together for calibration of the species distribution models.

I also assisted for two weeks at a field experiment conducted at the Tomakomai Experimental Forest looking at how varying trophic structure in stream communities (presence/absence of fish) can modulate the effects of heatwaves on the stability of ecosystem processes, functions, and community composition. My work consisted in helping generating experimental heatwaves mimicking both local present and future resulting from projected climate change. To do so, I manipulated and monitored hourly the rate of warming using a valve-regulated flow system heated up by a boiler. The experimental work is funded by a National Geographic Society grant awarded to Ph.D Smauel R.P-J. Ross (Trinity College Dublin, Ireland) who is also supervised by Dr. Garcia Molinos as host supervisor. This experimental work is important to understand the effects of changes in climate and put in perspective the changes predicted by the models described above.

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

I had an excellent time performing this research, in particular the work done in the field or in the Tomakomai experimental forest. I learned a great deal under my supervisor, Dr. Molinos. I believe that this will be excellent experience that will help greatly in gaining admittance into a good PhD program and project. I was able to live in the wonderful island of Hokkaido and get to see the beautiful regions of Furano and Hakodate. I attended a natural onsen in Furano, which was a great experience.

9. Adviser's remarks (if any):

Over the period he has been with us, Jackson has made an important contribution to our work, delivering timely on the assigned tasks, learning quickly new sampling and research techniques, and with an open disposition to help whenever and where needed. We are all pleased to have had him with us and look forward keeping contact with him in the future.

JSPS Summer Program 2019
Research Report

1. Name: Beatriz GAMEZ （ID No. SP19006）

2. Current affiliation: University of Texas Rio Grande Valley

3. Research fields and specialties:
Chemistry and Pharmaceutical Sciences

4. Host institution: Osaka University

5. Host researcher: Prof. Mitsuhiro ARISAWA

6. Description of your current research

Natural products (NPs) and natural product derivatives obtained from plants, animals, and microorganisms have been the focus of many studies due to their molecular scaffolds essential for new drug discovery. Diversity-oriented synthesis of NP extracts have led to the addition and conversion of functional groups and new molecular scaffolds that can be screened for biological activities. Creation and discovery of brand new biologically active unnatural compounds from NP extracts, a combination of NP chemistry and diversity-oriented synthesis using a highly reactive sulfur-modified glass-supported palladium (SGlPd) nanoparticle catalyst may be efficient in catalyzing cross-coupling to give other scaffolds via carbon-carbon and/or carbon-heteroatom bond formation.

A natural product is chemically converted by cross-coupling with a boronic acid functional group. Suzuki-Miyaura cross-coupling reaction was employed using an SGlPd catalyst that allows for the reaction to proceed without the use of a ligand, results in low palladium leaching, and is reusable over ten times.

The proposed approach through the utilization of an environmentally-friendly metal nanoparticle catalyst is paramount to chemically diverse libraries of NP-like compounds with potential to lead to the discovery of new pharmacologically active compounds.

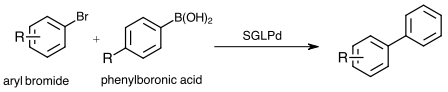
7. Research implementation and results under the program

Title of your research plan:

Advanced exploitation of natural resources for drug discovery: Diversity-Oriented synthesis using metal nanoparticle catalyst

Description of the research activities:

Prior to attempting coupling reactions, I had to test the SGlPd catalyst reproducibility following previously reported methods. SGlPd was then used to catalyze Suzuki-Miyaura cross-coupling reaction (shown below) between aryl bromides or heterobicyclic compounds and phenylboronic acid derivatives.



My research focused on the optimization of the reaction methods. Once I obtained desired products in a high yield, the optimized reaction was applied to natural products. Chemical conversion of estrone, atropine, and berberine chloride was attempted, with a focus on estrone.

I also had the opportunity to subject Suzuki-Miyaura coupling of aryl bromides and estrone derivatives to continuous microwave irradiation. Successful developments of this methodology will be utilized to synthesize new bioactive compounds.

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

My research experience was just as enjoyable as the cultural experiences. I was pleasantly surprised by how different the research environment in Japan is compared to the labs I have worked at in the U.S. It wasn't difficult to adapt, and I believe that I will adopt many of these practices as they improve my work efficiency. Japan has left a wonderful cultural imprint on me. I have met wonderful people during my visit that I will cherish many of these experiences and places.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Arturo Javier MARTINEZ （ID No. SP19007）

2. Current affiliation:

University of Texas-Rio Grande Valley

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Osaka University

5. Host researcher: Dr. Susumu ARIKI

6. Description of your current research

A symmetric polynomial is called Schur positive if its expansion to linear combination of Schur polynomials has nonnegative integer coefficients. A directed graph is a Kashiwara crystal if we have a weight function mapping vertices to d-dimensional vectors with integer entries and a coloring for the edges, which labels them with an element from the set $\{1, 2, 3, \cdots, d-1\}$. For any matrix M with entries in $\{0, 1, -1\}$, let $\mathcal{G}_n(M)$ be the set of permutations in S_n that can be obtained by placing n dots on the segments of the grid corresponding to M, labing the dots 1 through n by increasing *y*-coordinate and then reading them by increasing *x*-coordinate.

Given a Schur positive symmetric polynomial, constructed from a set A, we can find a bijection from A to a set of standard Young tableaux. This allows us to make a crystal, from elements in a set B that are related to elements in A, denoted by $B_{n,d}$ in hopes that it is isomorphic to a set of Kashiwara crystals of semi-standard tableaux.

Currently my research focuses on the Schur positive polynomials

$$\mathcal{Q}\big(\mathcal{G}_1(M_2)\big) = s_1,\ \mathcal{Q}\big(\mathcal{G}_2(M_2)\big) = s_2 + s_{1,1},$$

$$\mathcal{Q}\big(\mathcal{G}_3(M_2)\big) = s_3 + 2s_{2,1} + s_{1,1,1} \text{ and } \mathcal{Q}\big(\mathcal{G}_4(M_2)\big) = s_4 + 3s_{3,1} + 2s_{2,2} + 2s_{2,1,1}.$$

Here the sets $\mathcal{G}_1(M_2)$, $\mathcal{G}_2(M_2)$, $\mathcal{G}_3(M_2)$ and $\mathcal{G}_4(M_2)$ are defined to be the grid classes where M_2 is the 4×2 matrix whose odd-numbered rows are (1,0) and whose even-numbered rows are (0,1). The s_λ are the characters of the crystals of semi-standard Young tableaux of shape λ when $n = 1,2,3,4$. Looking at the increasing factorizations of the elements of the sets in $\mathcal{G}_1(M_2)$, $\mathcal{G}_2(M_2)$, $\mathcal{G}_3(M_2)$ and $\mathcal{G}_4(M_2)$, we attempt to find an isomorphism of crystals.

7. Research implementation and results under the program

Title of your research plan:

The Lifting of Schur Positive Polynomials to Kashiwara Crystals

Description of the research activities:

We look at the following Shur positive polynomial:

$$\mathcal{Q}\left(\mathcal{G}_3(M_2)\right) = s_3 + 2s_{2,1} + s_{1,1,1}$$

The elements of $\mathcal{G}_3(M_2)$ are $\{123, 312, 132, 231, 213, 321\}$. The set of increasing factorizations $B_{3,3}(M_2)$ of the elements of $\mathcal{G}_3(M_2)$ can be mapped to semi-standard Young tableaux by considering the Robinson-Schensted-Knuth correspondence. The following algorithm gives crystal structure to the set of increasing factorizations by adding arrows colored i: (1) of the 3 brackets in an increasing factorization, consider two adjacent ones denoted L and R, where L is the i^{th} bracket and R is the $(i+1)^{th}$ bracket. (2) If $R = \emptyset$, then we send the largest entry in L to R and rewrite R in increasing order. (3) Otherwise we set $b = \max R$ and $a = \min\{a \in L | \, a > b\}$, if a is defined. We rewrite L and R without b and a and return to step (2). If at any point L is empty, there is no arrow colored i.

This gives $B_{3,3}(M_2)$ crystal structure. In fact, the Robinson-Schensted-Knuth correspondence is an isomorphism of crystals,

$$B_{3,3}(M_2) \simeq \bigoplus_{k=0}^{2} \mathrm{SST}_3((n-k, 1^k))^{\oplus f^{(n-k,1^k)}}$$

where $f^{(n-k,1^k)}$ is the number of standard tableaux of shape $(n-k, 1^k)$, which is computable by the Frame-Robinson-Thrall hook formula. This method also works for $\mathcal{Q}\left(\mathcal{G}_1(M_2)\right)$ and $\mathcal{Q}\left(\mathcal{G}_2(M_2)\right)$.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): During my stay, I explored the city of Osaka. Some of the activities include visiting shrines, attending the Tenjin Festival, seeing The Tower of the Sun and walking around Osaka Castle.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Ursula Addison （ID No. SP19008 ）

2. Current affiliation: CUNY

3. Research fields and specialties:

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

4. Host institution: Kyutech

5. Host researcher: Dr. Taisuke Akimoto

6. Description of your current research

Currently we are investigating various reinforcement learning algorithms that might provide guidance on updating the weights for an implementation of the real-time recurrent learning algorithm created by Zipser and Williams.

7. Research implementation and results under the program

Title of your research plan:

Reinforcement Learning Based Algorithms Applied to Recurrent Neural Network Weights for Online Internalization of Temporal Signals

Description of the research activities:

Behavioral studies in cognitive learning have shown that rats can learn how to time events when they are given continuous tones or flashes coupled with a food reward at a certain time. Work in the laboratory has shown that this learning can be modeled by recurrent neural nets. Our research explores how this recurrent neural net model can learn its parameters using reinforcement learning (RL), which would give fundamental insight into how the brain learns to time events. The current RL approach of interest is Temporal Difference (TD) which updates the learning at each time step. A range of RL algorithms are applied to investigate the viability of using TD learning to learn at each time step and in turn adjust network weights at each time step. The feedback loop system between a TDL subsystem is designed to use RNN output as data and RNN weights are adjusted as needed. A key challenge considered is how to adjust the RNN given TD learning output.

The Zipser-Williams real-time recurrent learning algorithm and the policy gradients algorithms are useful for learning at each time step. As fully functional algorithms, merging them created a number of redundancies while resulting in a clumsy, piecemeal procedure. A better approach is to take the concepts from both algorithms and create a new technique. The Zipser-Williams algorithm can be used with arbitrary architectures and was specifically created to work with RNNs. While policy gradients has a "trial and error" nature of generating samples; this is the same mechanism the test rats and humans would use to learn time intervals. With these new insights, the research will continue; not with the goal of merging functional algorithms, but to find ways of capturing their useful features and integrating them into a new algorithm.

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

I stayed in a lush and beautiful area of Fukuoka. My favorite activity was taking long evening walks and bike rides. During those times I was always surprised to experience the exquisite flora and fauna of my host region. Before leaving Fukuoka, I had developed a hobby of taking pictures and videos of any new butterflies that I saw, my favorite sighting was of a large black butterfly with iridescent rainbow splashes on its wings.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Alison Clare DOMZALSKI （ID No. SP19009）

2. Current affiliation: CUNY The Graduate Center/CUNY Hunter College

3. Research fields and specialties:

Chemistry/Biochemistry

4. Host institution: Osaka University

5. Host researcher: Prof. Michio MURATA

6. Description of your current research:

Our work is dedicated to the discovery and characterization of novel chemical signals produced by microbial communities. Due to ubiquity of microbes in our natural world, we are beginning to discover that their presence has great impact on biological processes as wide-ranging as bioremediation, plant growth, antibiotic resistance, digestion, neurological function and immunity. For instance, our laboratory has found that the symbiotic bacteria living on immune-stimulating herbal medicines helps to modulate their activity. Bioinformatic analysis of bacterial genomes predicts that these organisms are programmed to produce chemicals that have yet to be found. This implies great potential for discovery! Thus, we want to identify and understand more about the chemical language of microbes, specifically bacteria. Through studying mixed microbial cultures obtained from over twenty different natural environments, such as wheatgrass and ant mound, we have isolated and characterized several microbially-produced chemicals from different classes, namely fatty acids and their derivatives. Through collaborations with microbiologists and molecular biologists we have learned of their bacteriostatic activity and ability to affect biofilm formation. Thus, we want to gain a deeper understanding of their biological modes of action by opening our exploration into other areas, such as biophysical chemistry.

7. Research implementation and results under the program:

Title of your research plan:

Revealing the Biological Insights of Bacterial Natural Products

Description of the research activities:

Murata-sensei studies model membrane systems in concert with naturally-produced chemicals such as toxins and antibiotics to gain a greater understanding of their biological mode of action. In his lab, our research plan was three-fold, to determine: *1. 12-HSA's effect on a membrane, 2. stereochemical configuration of the hydroxy group on 12-HSA, and, 3. location of 12-HSA in the membrane*. 12-hydroxystearic acid (12-HSA) is a bacterial natural product that we have isolated from various mixed microbial cultures. It is a known organogelator at low concentrations, thus causing hydrophobic solvents to turn into gels. The cell membrane is dominated by a hydrophobic region. Important biological processes depend on a fluid cell membrane to occur. We hypothesized that 12-HSA maybe acting to rigidify or gel the cell membrane. Biophysical assays were conducted to test this idea by administering 12-HSA to model membranes. While our preliminary results suggest that rigidification of the membrane may not be occurring, we have found that disruption of the membrane is. Moreover, stereochemical analysis suggests R configuration of 12-HSA. The location of 12-HSA in the membrane is ongoing and will be completed in future studies.

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

I attended/photographed a Japanese wedding party and went to a traditional onsen in Fujino, I hiked the sacred Kumano Kodo pilgrimage route, and I visited the ancient pottery town of Sasayama with a master potter and attended his tea ceremony.

JSPS Summer Program 2019
Research Report

1. Name: Johnny Ademir Lopez （ID No. SP19010）

2. Current affiliation: Queens College: The City University of New York

3. Research fields and specialties:

Biological Sciences

4. Host institution: Toyohashi University of Technology

5. Host researcher: Professor Sachiko Yoshida

6. Description of your current research

Neurodevelopment during gestation is a time of vast changes for the fetus and plays a significant role in a child's genetic susceptibility. The Stress in Pregnancy (SIP) Study is a longitudinal study investigating the effects of psychosocial stress during pregnancy. The study is observing various outcomes in children's neurodevelopment and psychological disorders including features of psychopathology, neurodevelopmental delay, hypothalamic-pituitary-adrenal (HPA) axis functioning, and gene expression. Additionally, a subset of the participants are pregnant women who were exposed to Superstorm Sandy, that affected the New York City/New Jersey tri-state area. These women were exposed to a host of environmental and socioeconomic stressors during different periods of their pregnancy. Thus, this portion of the SIP study is investigating the effects of catastrophic events and how it relates or interacts with different stages of pregnancy. The goal of the study is to identify potential biomarkers that promote poor neurodevelopment during early childhood and to apply these findings in order to increase the body of knowledge for treatment plans and intervention strategies.

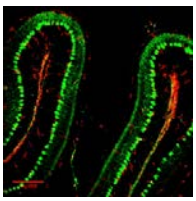
7. Research implementation and results under the program

Title of your research plan:

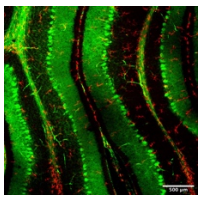
Prenatal Exposure of Glyphosate and Acetamiprid on Neurodevelopment and Reproduction

Description of the research activities:

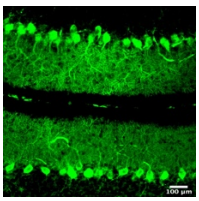
My research in Dr. Yoshida's neurodevelopmental lab investigated the effects of pesticides on cerebellar development using a rat Autism Spectrum Disorder (ASD) model. Previous work in the lab established an ASD model using VPA (sodium valproate) and LPS (Lipopolysaccharide). Thus, my intended goal is to establish an ASD model using acetamiprid and comparing these findings with data for glyphosate. Oral administration of 40mg/kg of acetamiprid and 250mg/kg of glyphosate was conducted on Embryonic day 16 (E16). By using confocal microscopy, it was observed that acetamiprid and glyphosate caused Purkinje cells growth abnormalities and increased presence of microglia in the Purkinje and Molecular layers. Additionally, abnormal dendritic growth was seen in the presence of acetamiprid (see images).



Glyphosate P14



Acetamiprid P14



Clumping of Purkinje cells

When comparing behavioral data, glyphosate is shown to facilitate withdrawal behaviors whereas acetamiprid facilitates anxious behaviors, in particular during the open field task or in the presence of a toy snake (fear stimulus). In acetamiprid, there was a considerably higher rearing time (exploratory behavior) for the toy snake. These results provide support that pesticide exposure during the prenatal periods can interact with normal neurodevelopment. Future research should consider increasing the dosage for acetamiprid in order to provide clearer results indicating its precise effects.

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

My time in Japan has been fruitful scientifically and culturally. I am impressed by Japan's hospitality and conscious understanding of respecting one another. This was to me when traveling to cities like Nagoya, Niigata, Tokyo, Osaka, and Kyoto, where the subway systems were always on time, clean, and easy to follow. My lab mates showed me that a clear language barrier does not prevent social understanding. We had great times going to dinner, going out for drinks after a long week of work, going to the gym, and playing mobile phone games. Additionally, everyone is very friendly and eager to get to know you. This was clear to me when I visited a dog café in Nagoya where several of the customers and I bonded over our love of dogs and were interested in hearing stories about my home in New York City. Overall, my impression of Japan and the Japanese people is great. I would like to learn Japanese in the future with the hopes of returning very soon.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Shamraze Ahmed （ID No. SP19101）

2. Current affiliation: University of Nottingham

3. Research fields and specialties:

Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Masanori Kunieda

6. Description of your current research

In die-sinking electrical discharge machining (EDM) graphite is the most commonly used electrode material. Graphite electrodes are characterised by particle size and vary in terms of porosity and uniformity. It is these characteristics which determine performance in EDM. While more economical grades with larger particle size are used for rough machining and fine particle size for finishing, the influence of this structure on EDM has not been explored in depth. It is often thought that the ‘best’ grade of graphite for use in EDM is one with the smallest particle size, which is of greater cost compared to larger particle size grades, and little is understand of the effect of graphite structure on EDM. My current research centers around understand the differences between grades, and the effect of its structure on EDM.

7. Research implementation and results under the program

Title of your research plan: Observing gap phenomena in electrical discharge machining with graphite electrodes using the branched wire and transparent electrode methods

Description of the research activities:

To understand the fundamental effects of electrode structure on wear and material removal mechanisms, a single spark was ignited on a cone electrode to observe the resulting debris and craters. This was recorded with a high-speed camera and illuminated with a laser source. Graphite wear mechanisms were observed and compared between grades and materials. It was shown that graphite electrode wear always occurs before the ejection of work piece debris. Graphite electrode wear via spalling was clearly observed and confirmed via video, which has not been done previously. The wear mechanism of metallic electrodes also clearly demonstrated the difference between graphite and metallic electrodes. The reduced MRR of copper electrodes compared to graphite electrodes was also confirmed visually. Progress was made towards using the branched electric wire method, which uses the current ratio from four connected wires, to detect EDM spark location. Transparent SiC and high-speed imaging will also be used simultaneously to observe debris and bubble characteristics. This method was then utilised to locate discharge sites to compare between different tool electrode materials. Different grades of graphite, and a copper electrode, were used to compare the discharge distribution/localisation and the effect of flushing.

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

I have enjoyed my time in Japan both in and out of the lab. Prof. Kunieda has been very helpful, and the lab has been very welcoming. I have learnt a great deal in my research topic, and I believe this will help me greatly when I return to the UK. The challenge of acclimatizing to the small differences in work culture and expectations has developed my skills and broadened my views, which will surely help me in the future. Although the weather has been challenging, I have enjoyed both the culture and attractions across Japan. I hope to visit Japan again and continue the collaboration, hopefully not in summer!

9. Adviser’s remarks (if any):

Professor Kunieda is currently attending a conference abroad.

JSPS Summer Program 2019
Research Report

1. Name: Zaki AHMAD （ID No. SP19102）

2. Current affiliation: Royal Holloway, University of London

3. Research fields and specialties:
Biological Sciences

4. Host institution: Kanazawa University

5. Host researcher: Prof. Masaki ITO

6. Description of your current research

My PhD research project focuses on understanding the molecular basis of plant organ growth. There are two fundamental cellular processes which determine growth of any organism, these are cell division cycle (whereby cells increase in number) and cell growth (whereby cells increase in size). I work on the primary root meristem of *Arabidopsis thaliana*, a plant model system where the cell cycle and cell growth are developmentally well-defined and can be easily observed under a microscope. Cell cycle involves doubling of the genome during S phase and equal distribution of the duplicated chromosomes in mitosis. S phase and mitosis are separated by two gap (G) phases. There are two main checkpoints termed G1/S and G2/M where cells ensure optimal conditions for passage through S phase and entry into mitosis, respectively. Two families of transcription factors regulate these checkpoints; the E2Fs regulate the G1/S transition and MYB3Rs regulate the G2/M. Another very important cell cycle protein is called RETINOBLASTOMA RELATED (RBR). Together, RBR E2Fs and MYB3Rs can interact and form complexes called DREAM which act as either transcriptional activators or repressor of cell cycle genes.

In context of the core cell cycle regulators mentioned above, the central question of my project is to understand how cell cycle-driven meristem activity is tuned to match the information about the internal and external environmental factors such as sugar availability and light intensity. As cell cycle is energetically very expensive, it is dependent on sugar-sensing pathways such as TARGET OF RAPAMYCIN (TOR) signalling. Thus far, I have shown that RBR is under TOR control, and that plant cells perceive nutritional information to set the cell cycle activity accordingly. Further, I have found that there is a diurnal behavior to the cell-cycle progression, and I am currently exploring whether this is connected to the circadian clock.

7. Research implementation and results under the program

Title of your research plan:

Cell cycle control by DREAM complexes in the *Arabidopsis* root meristem

Description of the research activities:

I have previously found that TOR signalling is involved in G2/M regulation, and here I explored whether TOR is functionally connected to MYB3Rs to regulate G2/M transition and found that it is independent of MYB3Rs.

Although, the cell cycle roles of E2Fs and MYB3Rs are well-established, it is not known whether these regulators affect cell cycle length and/or size of cell cycle pool in the meristem. To this end, I carried out time-course S phase (EdU) labelling to measure cell cycle duration in the *e2fa/b/c* and *myb3r1/3/5* triple mutant.

Prof Ito has recently identified new components of the DREAM complexes and I began the work to characterise the knock-out mutants available. To this end, I scored germination rate, carried out S phase labelling, and PI-Schiff labelling (which I learned here) for meristem cell number and cell size measurements. The data is being processed but thus far has revealed interesting candidates for further investigation.

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

As this was my first time in Japan, I wanted to see as much of it as possible and thus made few day trips to other prefectures. Besides seeing scores of local temples, shrines, gardens, and castles, the most moving experience was seeing the Atomic Bomb Dome and the exhibits at the Hiroshima Peace Memorial Museum.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Charlotte Huggins (ID No. SP19103）

2. Current affiliation:
University of Aberdeen

3. Research fields and specialties:
Social Sciences

4. Host institution: Kyoto University

5. Host researcher: Dr Wataru SATO

6. Description of your current research

My current research focuses on how people identify and understand their own emotions, and the implications this ability has for mental health and autism. Emotional self-awareness is increasingly recognized as an important predictor of mental health outcomes and social success, particularly in autistic populations. Despite this, most research relies upon self-report methods to measure this outcome. Subsequently, existing data may be biased by self-belief and more general meta-cognitive awareness. This is particularly important in autism, as autistic people are shown to have more negative self-beliefs, and greater difficulty accurately assessing their own skills.

In my research in the UK, I developed implicit behavioural methods to assess emotional self-awareness. I developed the Emotional Consistency task (EC-task), in which emotional self-awareness is assess through consistency in emotional decision-making. We demonstrated that poorer EC-task performance was associated with greater anxiety and depression, but not with autistic traits. However, autistic traits were associated with greater discrepancy between EC-task performance and self-reported emotional self-awareness. In particular, those with high autistic traits underestimated their emotional abilities. This has implications for current findings on emotional self-awareness in autism.

An important aspect of method development in psychology is validating them in cross-cultural samples. During my time in Japan, I replicated the above study with Japanese adult populations. This first tested the validity of the EC-task, and then examined whether emotional self-awareness differed across cultures, and if this has any implications for mental health.

7. Research implementation and results under the program

Title of your research plan:

Exploring cultural differences in emotional self-awareness.

Description of the research activities:

Over the summer, we completed the Japanese translation of the EC task, validating it in 29 Japanese adults and comparing this to mental health outcomes and autistic traits. We first replicated the validity findings of the EC-task in Japanese populations. The EC-task is easy to understand and complete for Japanese populations, and demonstrates validity as a measure of emotional self-awareness.

Notably, consistency was significantly lower in Japanese compared to UK participants, suggesting Japanese populations may tend to have lower awareness of their own emotional experiences. This was further evidenced by the greater level of alexithymia in this population. Moreover, depression and anxiety scores were lower in the Japanese sample, indicating that this was not the product of greater mental health symptoms in this population.

As with the UK sample, autistic traits did not predict EC-task performance. Moreover, we again found that greater discrepancy between EC-task performance and self-reported emotional self-awareness was significantly associated with higher autistic traits. Those with higher autistic traits were more likely to underestimate their emotional self-awareness abilities. This further evidences that autism may not be directly associated with poorer emotional self-awareness, but instead with negative self-belief.

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

During my stay, I was lucky enough to see the Gion Festival in Kyoto, as well as visiting onsen in Kurama, the traditional tea shops of Uji, and Nara deer park. I also enjoyed many smaller festivals, as well as going to local Japanese language classes and exchanges. The Fellowship gave me an excellent opportunity to immerse myself in another culture and learn many new things outside of the lab!

9. Adviser’s remarks (if any)

JSPS Summer Program 2019
Research Report

1. Name: Thomas M. McGuire （ID No. SP19105 ）

2. Current affiliation: University of Bath

3. Research fields and specialties:

Chemistry

4. Host institution: Nagoya University

5. Host researcher: Prof. Masami Kamigaito

6. Description of your current research

My research at the University of Bath is focused on sustainable polymer (plastic) synthesis, specifically those derived from sugar-based starting materials. This involves both synthetic and theoretical study.

Synthetically, we have developed a method for monomer (the building blocks of polymers) synthesis which relies on benign reagents (including CO_2), as an alternative to traditional, toxic routes. This method has been successfully applied in the synthesis of a series of novel polymers which exhibit interesting thermal properties and show promise as potential sustainable thermoplastic elastomers (rubbery and processable materials). We have also synthesized a series of novel molecules in the hope of developing organocatalysts (catalysts with no metal atoms present in the molecule) for polymerizations.

We also use computational calculations to understand the reaction mechanisms of polymerizations and screen prospective target-molecules for their suitability as monomers.

It is hoped that the work carried out as part of my PhD will lead to the development of alternative sustainable materials for a variety of commodity and specialty applications.

7. Research implementation and results under the program

Title of your research plan:

Sustainable polymers derived from lignin, glycerol and maleic acid.

Description of the research activities:

Professor Kamigaito and his team are world leaders in synthetic polymer chemistry research. This includes synthesizing polymers derived from bio-based and sustainable feedstocks. Recently, they have published several papers on the polymerization of 4-vinyl guaiacol (4VG), a rice-bran derivative, which contains an activated alkene (carbon-carbon double bond), enabling it to act as a monomer.

For my research project, we functionalized 4-vinylguaicol (4VGEP) with a glycerol derivative in high yield. We then polymerized 4VGEP by reversible addition-fragmentation chain transfer (RAFT), a technique used in Professor Kamigaito's lab, in which I had no experience.

Once polymerized, we studied 4VGEP's copolymerization (polymerizations with two or more different monomers) with styrene and diethyl acrylamide to produce novel hydrophobic and hydrophilic polymers. The copolymers (polymers made with two or more different monomers) were successfully synthesized and their thermal properties evaluated.

Finally, by utilizing the chemistry that the glycerol derivative imparts on the copolymers, we synthesized star-polymers (star-shaped polymers) through further polymerization with a maleic acid derivative (TA). In choosing TA as the final comonomer, we successfully synthesized macromolecules with a degradable and functionalizable core. We also evaluated polymerization catalysts which would form non-toxic residues as we hope to target biomedical applications with these materials.

All materials synthesized have been fully characterized and we aim to complete the project by studying the degradation of the star-polymers in-vitro.

Following completion of the project, I will share my knowledge of RAFT-polymerization with colleagues at Bath and I hope the project will precipitate further collaboration between the Buchard and Kamigaito research groups.

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

Professor Kamigaito and his team, especially his Phd student, Masato Miyajima , have been wonderful hosts. I am very grateful to them for welcoming me into their lab and their willingness to support my research. I particularly enjoyed our group meals together.

I have also had an excellent time exploring Japan with other JSPS fellows who have become good friends. Highlights include visiting the Kiso Valley and climbing Mount Fuji. I also plan to meet up with my host family again following completion of the program.

The project has provided a fully immersive cultural experience and significantly broadened my scientific outlook. I would strongly recommend any prospective candidate to apply.

9. Advisor’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Rachel Pooley （ID No. SP19106）

2. Current affiliation:

University of Manchester

3. Research fields and specialties:

Chemistry/ Physical Sciences

4. Host institution: Kanazawa University

5. Host researcher: Professor Takeshi Fukuma

6. Description of your current research

I am a PhD student in the department of Chemistry at the University of Manchester, studying the crystal growth of nanoporous crystalline materials via atomic force microscopy (AFM). Nanoporous crystalline materials are 3D frameworks with nano-sized pores running through them. There are two main types: zeolites and metal-organic frameworks (MOFs). Zeolites are very stable crystals made only from silicon, aluminium and oxygen, whereas MOFs are a relatively new class of hybrid crystalline material, made from metal nodes and organic linker molecules, which are in general less stable.

Studying the crystal growth of these materials helps us to understand how their shape and surface influence their properties, and ultimately to understand their formation and behaviour at a molecular level. Crystal growth is difficult to control and predict due to the vast number of factors at play. This is what makes it both complicated and exciting to study; understanding how these crystals grow at a molecular level is key to unlocking their full potential in applications such as gas storage, separations and drug delivery.

I use AFM as my main method to study the growth of crystalline nanoporous materials. AFM is ideal for the study of crystal growth because, unlike other high resolution imaging techniques, it can be operated in ambient and liquid conditions, allowing us to ‘watch’ the crystal surface grow in real time.

7. Research implementation and results under the program

Title of your research plan:

Investigation of the surface structure of silicalite nanoporous crystals.

Description of the research activities:

Professor Fukuma's lab has been at the forefront of developing atomic force microscopes which can perform at atomic resolution even in liquid conditions. They use frequency modulated AFM where the probe is oscillated, and the change in the frequency of the oscillation due to the tip-surface interaction is measured. This method means that the probe is sensitive enough to changes in the surface that it can detect individual atoms.

My crystal samples are different from the usual samples which are measured by this method so firstly it was necessary to find a method for fixing the crystals onto a mica surface without contaminating the crystal surface with glue. This was achieved by treating the crystals with acid and depositing them on the mica surface, then evaporating the acid in a reduced pressure oven to adhere the crystals. When done at the right concentration, this provides a surface with many flat crystals adhered to the surface which do not float when liquid is added (which can interfere with the approach of the probe to the surface). It was found that the surface of silicalite has a sub-structure, which was not visible in previous investigations, of amorphous features approximately 32 nm in size extending over the top of the ordered crystalline terraces (figure 1).

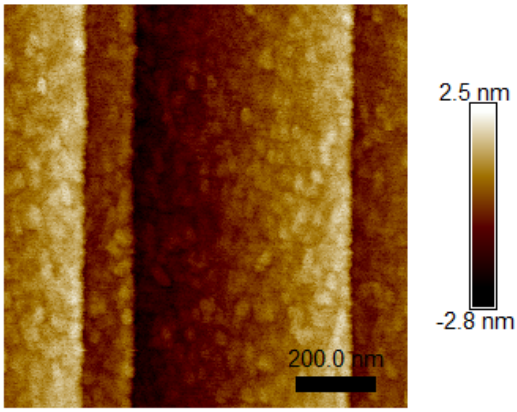


Figure 1: AFM height image of the surface of a silicalite crystal.

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

Living in Japan was an incredible experience. I really loved exploring Kanazawa, which has a lot of history and tradition, as well as delicious local sushi and sake! I particularly enjoyed exploring the local mountain areas, including cycling to local onsen towns and joining a group to climb Mt. Hakusan, one of Japans three sacred peaks.

9. Adviser's remarks (if any):

Rachel made huge efforts to find a right condition to prepare the samples appropriate for high-resolution imaging in liquid. This part of AFM research is most time-consuming and could be as long as a few years. Yet, she finally managed to get a new insights into the surface structure of the silicalite crystal. Considering the very limited time, she did a great job and hope that we can keep in touch to continue this collaborative project.

JSPS Summer Program 2019
Research Report

1. Name: Sam Paplauskas （ID No. SP19107）

2. Current affiliation: University of Stirling

3. Research fields and specialties: Biological Sciences

4. Host institution: Utsunomiya University

5. Host researcher: Assoc. Prof. Hitoshi MIYAKAWA

6. Description of your current research:

Environmental change influences disease ecology and evolution. The complexity of natural host-parasite populations – in terms of host genetics, parasite genetics and environmental conditions – has hampered our ability to predict the future of disease. My research combines field surveys, semi-natural outdoor experiments, and controlled lab experiments with the aim of building models to forecast disease in a naturally coevolving host-parasite system across multiple epidemics and under different ambient environmental conditions. The system comprises the invertebrate model crustacean *Daphnia magna* and its sterilizing bacterial parasite *Pasteuria ramosa*.

During my stay in Japan, I will develop technical skills which will allow me to pursue novel research directions in my current research. For example, a major objective of this field is to identify the genes underlying antagonistic coevolution to distinguish between different modes of coevolution (Ebert, 2018).

References:

Ebert, D. (2018) ‘Open questions : what are the genes underlying antagonistic coevolution ?’ BMC Biology, pp. 7–9.

7. Research implementation and results under the program

Title of your research plan:

The secret to shape-shifting: The genetic control of a predator-induced defence.

Description of the research activities:

The study organism was *Daphnia pulex*, which produces a morphological defence in response to chemical cues (kairomone) from its predator (*Chaoborus*). The experimental design consisted of one treatment, in which animals were exposed to kairomone, and a control, unexposed, that was crossed against one factor, developmental stage. Animals were from three developmental stages, including the embryo (pre-phenotype), the juvenile at the onset of the phenotype and the juvenile with the peak phenotype. This factorial design was used to provide robust insight into the role of the candidate genes in this inducible morphology.

The study animals (*D. pulex*), were grown in glass beakers and synthetic kairomone extract (*C. flavicans*) was added as appropriate. After sampling from relevant time points, animals were stored until RNA extraction. Primers for candidate genes (Armadillo, Sox2, Wnt ligands) were designed using Primer3. After submission of this report and before the project is finished, two-step qRT-PCR using the cDNA and primers will be performed with the qPCR system available at the Japanese lab and results will be available for dissemination.

JSPS Summer Program 2019
Research Report

1. Name: Conor MOLONEY （ID No. SP19108）

2. Current affiliation: Queen Mary University of London

3. Research fields and specialties:
Humanities, Social Sciences

4. Host institution: Rissho University

5. Host researcher: Professor Fumiko KOHAMA

6. Description of your current research

My doctoral research concerns the playful, performative and ritualised cultures of citizenship in contemporary cities. Today's cities are increasingly animated by different forms of play: product placements, street games, pop-up events and interactive installations all invite participation by constructing playful and performative atmospheres, experiences and lifestyles. Why have such approaches become so ubiquitous, and what do they tell us about contemporary cities and citizens? In The Presentation of Self in Everyday Life (1959) Erving Goffman proposed that social interactions are in themselves performative, and used the metaphor of theatre to understand them through 'dramaturgical' analysis: 'roles' taken up, 'onstage' settings and props, 'backstage' preparations, and presentation to 'audience'. My research adopts Goffman's dramaturgical analysis in a spatial perspective, which I tested in pilot research in the Tokyo 2020 Olympic & Paralympic Games Volunteer programme. Preliminary findings suggest that key aspects of the volunteer experience are decidedly dramaturgical - sometimes even literally so, with volunteers 'cast' into different roles. Furthermore volunteers repeatedly refer unprompted to affective and performative aspects of their expected Games experience. In addition, whilst the Games Volunteer programme has become a focus for anti-Olympic activism which interprets it as an exploitative work practice, such models of participation are typical of the more complex 'relational' practices increasingly common in the arts and creative sector more generally.

7. Research implementation and results under the program

Title of your research plan:

Tokyo 2020 Olympic & Paralympic Games Volunteer Programme
(This pilot research aimed to refine the research questions and methodology, as well as generate preliminary findings for potential follow-up post-Games in 2021. In addition, the volunteer programme provides a common point of reference for the volunteer programmes in the two other research cities, London and Rio de Janeiro.)

Description of the research activities:

Research activities involved two stages. The first focused on familiarization with the Tokyo 2020 volunteer programme through background research and meetings with key informants including Mr. Charles Nishikawa (writer, Olympic advisor and Fellow at Sasakawa Foundation) as well as critics such as Prof. Yoshihiko Onuma (Japan Women's University). Mr. Nishikawa kindly arranged permission to interview volunteers and organisers in person, which formed the second stage of the research at a Games Volunteer 'orientation event' over two days. At this event, 21 No. Games Volunteers were interviewed in short 'flash' interviews. Longer in-depth interviews were conducted with 5 No. volunteers and 5 No. organisers. Interviews were recorded through contemporaneous notes and sound recording. Research analysis will be completed on return to London, and further developed should it be possible to conduct follow-up research and interview the same participants post-Games.

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

The research provided unexpectedly rich material on the perceptions of the role of volunteers in Japanese society, and on the other hand a relative absence of reflection on the relational dimensions of participation in a 'mega event' such as Tokyo 2020. Supplementary research included playful and performative cultural experiences of traditional Japanese events including festival (Gion Matsuri, Oizumi), pilgrimage (Kumano Kodo), theatre (Noh, Kabuki, Bunraku), and sport (Sumo), as well as research in traditional and contemporary architecture and landscape design (Tokyo & Kyoto).

9. Adviser's remarks (if any):

During his stay in Japan, Conor successfully developed his research on the Tokyo 2020 volunteers using a snowballing method with semi-structured interview to key informants. With follow-up interviews with this cohort in 2021, this will constitute a robust social survey. Conor's lecture to the department on his research was also very well received.

JSPS Summer Program 2019
Research Report

1. Name: David G. HOPKINSON （ID No. SP19109）

2. Current affiliation:

The University of Manchester, Manchester, United Kingdom

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution:

The University of Tokyo, Tokyo, Japan

5. Host researcher:

Prof. Naoya SHIBATA

6. Description of your current research

My current research at The University of Manchester focuses on the characterization of defects within two-dimensional (2D) materials using atomic resolution imaging via transmission electron microscopy (TEM).

Point defects (missing, additional, or substituted atoms) and extended defects (edges, folds, stacking faults) play a critical role in device performance (such as the optoelectronic and electronic properties). Techniques such as transmission electron microscopy are required to spatially resolve these defects directly, due to their size which typically ranges from 10^{-10} m (point defects) to 10^{-7} m (extended defects).

Magnetic 2D materials have recently shown promise as model systems for the investigation of fundamental magnetic phenomena and in potential spintronic device applications. However, the role of defects in this class of materials is largely unknown, and the lower resolution of most magnetic field detection techniques prevents the analysis of magnetic defects with sufficient detail. Differential phase contrast scanning transmission electron microscopy (DPC-STEM) allows the measurement of electric and magnetic fields at nanometre and sub-nanometre resolution, thus enabling the direct measurement of the field vectors around defects and the determination of important magnetic structures, such as domain walls.

7. Research implementation and results under the program

Title of your research plan:

Magnetic Field Imaging of Defects within 2D Ferromagnetic Chromium Trihalides

Description of the research activities:

The original plans focused on the analysis of the magnetic field state defects around the ferromagnetic layer compound $CrBr_3$ using cryogenic DPC-STEM. However, due to experimental constraints, the domain structure of cross-sections of the related ferromagnetic layer compound Fe_3GeTe_2 was instead investigated at a temperature range of 95 – 300 K. The relationship between temperature, crystal thickness, and domain size was investigated, where the domain size displayed a direct dependence on the thickness of the crystal along the magnetisation direction, whilst the magnetic-nonmagnetic transition temperature was largely independent of thickness in the samples measured, possibly due to lateral confinement. The domains were observed to nucleate from the surfaces of the crystal and propagate along the easy magnetisation axis, and were able to couple along small cracks perpendicular to the easy axis due to the external magnetic fields generated at the interfaces.

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

9. Advisor’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Elliot Carter （ID No. SP19110）

2. Current affiliation: University of Manchester

3. Research fields and specialties:

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

4. Host institution: University of Tokyo

5. Host researcher: Dr Hirochika SUMINO

6. Description of your current research

My research is focused on using noble gases in ophiolites to understanding volatiles cycling by plate tectonics.

The alteration of oceanic crust at the seafloor and its eventual subduction into the mantle creates a major link between the surface and deep Earth. Understanding the magnitude of exchange for key species including CO_2, Cl and Ar has huge implications for past climate, habitability and the formation of our planet. However, quantifying these fluxes is difficult since the lower parts of altered oceanic plates cannot be sampled by current ocean drilling technology. Equally, as the plate descends it heats up and releases volatiles to the shallow mantle reducing the amount delivered to the deep Earth.

Ophiolites are intact sections of oceanic crust and mantle thrust onto the continental margin during tectonic collisions. They are our only directly accessible proxy for the deeper parts of the oceanic crust and the lithospheric mantle. Similarly, bodies of peridotite are occasionally exhumed from deep in the subduction zone and may give information about the processes occurring at depth.

By analyzing noble gases in samples from ophiolites (e.g. Oman Ophiolite) and exhumed peridotites (e.g. Horoman Peridotite) we can form a better understanding of the inputs to and losses from the subduction zone, respectively. Importantly, we can also fingerprint the sources of carbon and other volatiles to distinguish ancient seafloor processes from modern alteration at the surface.

7. Research implementation and results under the program

Title of your research plan:

Tracing carbon and volatiles through the global subduction system

Description of the research activities:

A suite of samples from the Horoman Peridotite were sectioned and bipolished. Raman spectroscopy of decrepitated fluid inclusions in olivine grains showed they host a suite of hydrous and carbonate minerals (serpentine, talc, brucite, magnesite). This suggests reaction between an original H_2O-CO_2 fluid and the host olivine. FTIR analysis of the same fluid inclusions showed water in several larger ones. However, the majority of inclusion were either too small or too opaque to quantify the amount of water and carbonate present. A field trip was made to the Horoman Peridotite, visiting key localities along the Horoman River and on Mount Apoi. This was very helpful in understanding the field context of different units and provided an opportunity to collect more samples. The full Horoman sample set and a set of serpentinites from the Oman Ophiolite were prepared for noble gas analysis by crushing to <1mm, sieving and washing to remove alteration minerals (e.g. serpentine). A set of 20 Horoman samples were crushed under vacuum and analysed in a VG5400 noble gas mass-spectrometer. The data show that they have mantle He signatures ($^3He/^4He \approx 8Ra$) but their Ar composition is close to that of air ($^{40}Ar/^{36}Ar$=300-400). This suggests the presence of recycled atmospheric volatiles in the mantle sampled by the Horoman peridotite. Ongoing step-crushing analysis of fluid-inclusion-rich olivines may help to more strongly tie this recycled noble gas signature to the CO_2 rich-fluids revealed by Raman spectroscopy. Oman serpentinites were analysed by leaching in phosphoric acid under vacuum at 55°C. This showed that the Ar of acid-leachable components (assumed to be carbonate) is atmospheric. However some samples have radiogenic He, suggesting that carbonate was not formed at the present day but may have been a product of seafloor alteration.

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

It has been wonderful to spend time living and working in Japan. I have had enormous fun visiting shrines and temples, eating and cooking Japanese food and singing karaoke. Having a large group of other JSPS fellows to share these experiences with has been particularly valuable and has greatly enriched my time here.

JSPS Summer Program 2019
SP19111 Research Report

1. Name: Emma Elizabeth Brock （ID No. SP19 111）

2. Current affiliation: The University of York

3. Research fields and specialties:

Mathematical and Physical Sciences, Biological Sciences, Interdisciplinary and Frontier Sciences

4. Host institution: Tohoku University

5. Host researcher: Dr Shuichi Nakamura

6. Description of your current research

My PhD is focused on investigating the life cycle and swimming behavior of the predatory bacterium *Bdellovibrio bacteriovorus*. *Bdellovibrio* is a small, highly mobile, gram negative bacterium that preys on other gram negative bacteria. They have been studied for a number of years, but key questions remain about their lifecycle. *Bdellovibrio* are particularly interesting bacteria as they have potential applications as a new antibiotic treatment that could help in the fight against antimicrobial resistance (AMR). AMR is a significant and growing issue; all seven major research funding councils in the UK are coordinating an approach to tackle it. *Bdellovibrio* offers an alternative treatment to traditional chemical treatments - an 'evolving antibiotic'. As it evolves along with its prey species it will intrinsically bypass the problem of resistance without the need for human intervention. My project uses two model 'prey' species: *E. coli* and a non-pathogenic Spirochete - *Leptospira biflexa*. *E. coli* is useful as it is a well-characterised model bacterium with plenty of scope for experimental manipulation using fluorescent staining etc. In contrast, spirochetes are a less well understood set of organisms. Pathogenic spirochetes are responsible for causing significant diseases such as Lyme disease, Weil's disease and syphilis. Investigating the ability of *Bdellovibrio* to destroy them could be useful in developing new treatments for these conditions. The key techniques I will be using are holographic microscopy and total internal reflection fluorescence microscopy (TIRFM). The lab in which I work at York has developed a world-leading implementation of holographic microscopy to image cells and cellular organelles at high speed －generating 3D tracks of swimming cells. I hope to use this to deepen understanding of how *Bdellovibrio* locates and infiltrates its prey. TIRFM will be used to study the method by which *Bdellovibrio* enter and reseal prey bacteria. Using novel protein labelling and single molecule imaging to investigate the impact of prey cell shape, outer membrane protein turnover and membrane re-modeling during *Bdellovibrio* attack.

7. Research implementation and results under the program

Title of your research plan:

A view to a kill: Using cutting edge microscopy to study predatory bacteria with potential clinical application in combating antibiotic resistance.

Description of the research activities:

I have cultured *Bdellovibrio bacteriovorous* from frozen stock that I brought from the UK. I have learnt methods for handling several species of *Leptospira* and *Salmonella*. I have used these skills to help establish experimental methods for investigating predation of different *Leptospira* species by *Bdellovibrio*. This includes doing experiments into the predation efficiency of pathogenic compared to non-pathogenic species. In addition I have set up a holographic microscope with equipment brought across from the UK. I have used this to generate 3D tracks of swimming *Bdellovibrio* and (for the first time ever) *Salmonella* cells. Although *Leptospira* cell shape makes holographic video analysis significantly more complex than tracking typical short rod cells, some preliminary experiments showed interesting results, e.g. obvious killing of leptospires by *Bdellovibrio*. Further work will be done to improve the analysis process of these videos. To continue our collaborative work after the current JSPS program, I have provided protocols for culturing *Bdellovibrio* and for holographic microscopy to the host researcher.

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

I have had a great time living and studying in Japan. I have made friends with students from all over the world through the JSPS programme and also from the international dormitory where I have been staying. I have enjoyed spending time with them, taking part in pot luck dinners where everyone cooked something from their home country and going on trips to explore Japan . I have visited many places in Japan during my weekend s including, Matushima, Shiogama, Hakone, Tokyo, Kyoto and Nara. The culture and scenery in Japan is beautiful and the people are kind, generous and helpful. One of my favourite things has been visiting shrines and temples and collecting Goshiun (traditional calligraphy and stamps). I would like to say a big thank you to JSPS and my supervisors for giving me this amazing opportunity!

9. Adviser's remarks (if any):

Ms. Brock got started on her experiments immediately after visiting our lab and has been working on research diligently. She obtained several intriguing results despite her short stay, which will be pursued in future work. Based on her results, I'm currently working to secure further funding with her supervisor.

JSPS Summer Program 2019
Research Report

1. Name: Ruth Veevers （ID No. SP19112 ）

2. Current affiliation: University of East Anglia

3. Research fields and specialties:

Mathematical and Physical Sciences

Biological Sciences

Interdisciplinary and Frontier Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Professor Akio KITAO

6. Description of your current research

Proteins are involved in all biological processes of the living cell, and in going about their specific functions they undergo shape-changing movements, such as when an antibody binds an antigen. Understanding the mechanism of proteins is key to understanding biology at the molecular level and is critical in the development of new drugs. My current research at the University of East Anglia focuses on computational analyses of these conformational changes, including visualization, analysis and prediction of the way that proteins move. During my first year at the UEA I focused on the problem of “protein morphing”. Through advanced experimental techniques we now know the atomic structures of many proteins and in some cases, we are also able to know what kind of movement they undergo during their function. However, we usually only have two structures, a start and end structure; we know nothing about the path taken between the two. Protein morphing techniques attempt to construct feasible intermediate steps between known structures. We developed a new method which we found to generally outperform other protein morphing techniques in passing closer to known intermediate structures. I furthered this research by producing a specially tailored, unique docking morphing technique. The method focuses on creating a visualisation of docking between two biomolecules, such as when a drug molecule binds with a target protein. My goal in Japan was to perform Molecular Dynamics simulations to obtain the gold standard for what such a visualization should look like and compare with my results, while also obtaining trajectories for an important interaction (that of a promising cancer drug, nivolumab, interacting with its target protein).

7. Research implementation and results under the program

Title of your research plan:

Investigation of a promising cancer drug using Molecular Dynamics

Description of the research activities:

- Learning how to prepare and run simulations in Molecular Dynamics software packages AMBER and GROMACS
- Preparation of the system for simulation, including removing unnecessary parts of the system to make the simulation faster, building the molecular topology and solvating the protein
- Performing Molecular Dynamics simulations, including Steered MD and Professor Kitao's method "parallel cascade selection MD" (PACS-MD). PACS-MD repeatedly performs cycles of MD, selecting snapshots from runs that pass closest to a target to start the next cycle of MD simulations. We used this technique to simulate the repeated association and dissociation of nivolumab and PD-1. While many of these associations resulted in structures that were not close to the native complex, we did obtain some complexes that approached the expected structure
- Writing and running scripts for preliminary analysis of the results, including quantifying the similarity between each snapshot and the target
- Taking part in lab meetings and seminars. Delivering a seminar on my research both at Tokyo Institute of Technology and at Nagoya University

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

I feel extremely fortunate to have been given this opportunity to visit Japan. As well as experiencing the welcoming and motivating research culture in my host laboratory, I was able to travel and experience city life in Tokyo, spiritual and historical landmarks in Kyoto and Nara, and beautiful countryside in Hakone and Matsushima.

9. Adviser's remarks (if any):

The research made significant progress as has been planned. The adviser believes that this program was very fruitful for both sides of the researchers and will further extend to future collaborations.

JSPS Summer Program 2019
Research Report

1. Name: John R. J. Maynard
(ID No. SP19113)

2. Current affiliation: University of Southampton

3. Research fields and specialties:
Chemistry

4. Host institution: Nagasaki University

5. Host researcher: Prof. Seiji Shirakawa

6. Description of your current research

My research in the Goldup group (Southampton) focuses on the synthesis and application of interlocked molecules as catalysts. A rotaxane is a class of interlocked molecule in which a macrocycle is trapped onto an axle by the presence of bulky stoppering units (Figure 1). Rotaxanes have been used as both organocatalysts and as ligands for metal catalysis, often exploiting the structure generated by the mechanical bond to generate unique reactivities.

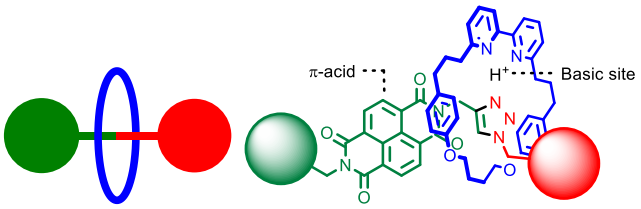


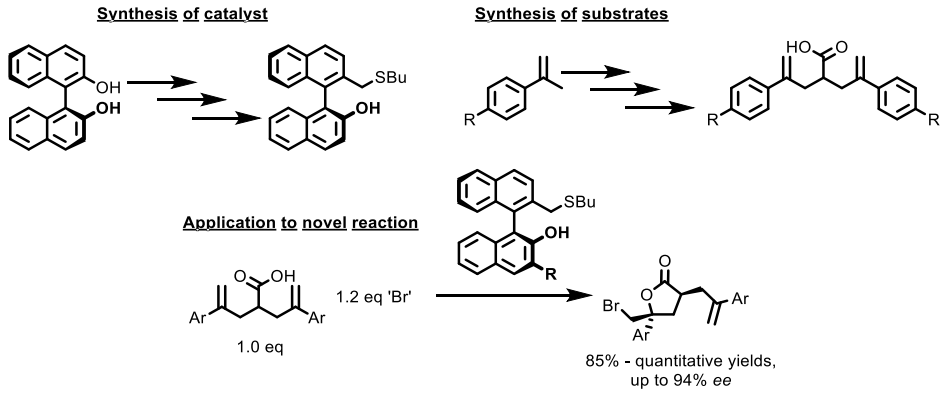
Figure 1 – Schematic representation of a [2]rotaxane, and π-acidic [2]rotaxane incorporating a naphthalenediimide.

The Matile group has recently introduced anion-π catalysis as a novel organocatalytic mode; using electron deficient aromatic compounds to stabilize anionic intermediates and transition states. Through the incorporation of an electron deficient naphthalene diimide into the axle component of both [2] and [3]rotaxanes, highly selective catalysts for the disfavoured Michael addition of malonic acid half thioesters were obtained. An exploration of the relationship between catalyst structure and activity showed a strong dependence of catalytic activity on the length of azide half-axle, and the interlocked structures were found to display far greater selectivities and rates of reaction than non-interlocked components in isolation and as an equimolar solution.

7. Research implementation and results under the program

Title of your research plan: Asymmetric Synthesis of Chiral Lactones by Molecular Recognition-Type Sulfide Catalysts

Description of the research activities: The research in the Shirakawa lab involved the synthesis of a BINOL derived catalyst, and a series of substrates with differing steric and electronic properties. A previously published result was reproduced to ensure that subsequent experiments were performed correctly. With both the catalyst synthesized and a modified catalyst, the effect of brominating agent ('Br') and substrate on yields and enantioselectivities obtained was examined. Quantitative yields of cyclised product were obtained in many cases, and high enantioselectivities were obtained (up to 94% *ee*).



With an understanding of the experimental procedure for enantioselective bromolactonisations using sulfide based catalysts and some experience with the synthesis of BINOL derived catalysts, we hope to develop a mechanically interlocked sulfide catalyst through collaborative work between Southampton and Nagasaki.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): My experience in the Shirakawa lab in Nagasaki has fantastically enriching experience, both scientifically and culturally! I've had the opportunity to gain some experience in a totally novel field of chemistry for me, and work with some incredibly talented and dedicated scientists. The kindness and warm hospitality of Prof. Shirakawa and all of the members of the lab has made my stay in a very alien country far less intimidating, and I hope that we can continue collaborative work between Southampton and Japan.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Sarah V GREENHAM （ID No. SP19114）

2. Current affiliation: University of Birmingham

3. Research fields and specialties: Engineering Sciences

4. Host institution: International Project Laboratory, Department of Civil Engineering, The University of Tokyo

5. Host researcher: Prof. Hironori KATO

6. Description of your current research

I am in the first year of my PhD, researching the ways that extreme weather leads to infrastructure failure and disruption for the infrastructure provider or operator. My primary focus is on how extreme heat affects the London Underground (LU) subway network, under changing climate conditions in the UK.

Rail infrastructure has a multi-decadal lifespan, and many infrastructure assets were built before our current understanding of anthropogenic climate change. Therefore, many networks may now be operating in a different climate than for which they were originally designed. This can increase the number or frequency of asset failures; increase delays for the customer; increase maintenance costs for the operator; and/or require the asset to be replaced earlier than anticipated. Understanding the interdependencies between and within infrastructure networks is also essential in order to achieve climate change resilience.

Extreme heat characteristics differ to other events such as heavy precipitation: there is no standardised measure or boundary to their impact; it is difficult to quantify damage; and it is not independent of other meteorological variables (*e.g.* wind, humidity, sunlight). Consequently, it is less studied compared to the other hazards such as flooding.

The LU network remains susceptible to heat-related asset failures. This is a historic issue, and infrastructure related failures vary by asset type, operating line, and local environment. My PhD research aims to identify causality through detailed spatial, temporal and interdependency analysis via multiple open and closed data sources. A product of this research is to develop a climate adaptation pathway for heat on the LU network; an emerging and dynamic strategy to improve climate resilience in accordance with a range of projections over time.

7. Research implementation and results under the program

Title of your research plan:

Climate change adaptation and resilience on metropolitan rail systems: A comparative study between Tokyo and London

Description of the research activities:

- I participated in weekly meetings where students present their research progress on a rotational basis. I presented twice, obtaining valuable feedback from the students and professors regarding my methodology and research direction.
- I visited 2 key rail museums: The National Railway Museum in Saitama and the Tokyo Metro Museum in Kasai, Tokyo. I collected information, validating that the rollout of subway cooling technologies was a historic response to the overheating build-up issue from the early 1970s. The Tokyo Metro cooling rate is now at 100%.
- Weekly meetings with Prof. Kato enabled us to discuss in more detail the key factors that regulate the below ground temperatures in Tokyo subways. He was able to direct me to Japanese literature that I otherwise would not have been able to access without translation regarding heating and cooling technologies and planning law on underground construction.
- Prof. Kato arranged for me to meet Tokyo Metro at their headquarters where we engaged in a very insightful discussion on their sustainability position. I was also presented with their disaster prevention strategy. Climate adaptation principles, though not obvious as an independent strategy, are underpinned in safety-led activity. Consequently, no heat-related damage has been recorded in the last 5 years. This is particularly owed to an extensive range of hard engineering measures.
- I also continued collecting and preparing UK data for my return as while in Japan, the UK experienced two particularly severe heatwaves; including one that broke the all-time UK high temperature record, which is critical to my forthcoming analysis.

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

This has been a truly incredible and rewarding experience both personally and professionally. Highlights include staying in a Ryokan at Matushima and Hakone; experiencing summer Tanabata Matsuri festivals in Tokyo and collecting Goshuin stamps at numerous Shrines and Temples around the country. Thank you to the IP Lab for being so accommodating and friendly – I had the best time working with you all!

9. Adviser's remarks (if any):

Ms Greenham has worked enthusiastically her research topic with Japanese case. She seems enjoying both lab life and daily life. I appreciate her positive manners, which has promoted international activities among our members.

JSPS Summer Program 2019
Research Report

1. Name: Belinda B. JOSEPH (ID No. SP19115)

2. Current affiliation: Queen's University Belfast

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Kyushu University

5. Host researcher: Assoc. Prof. Tetsuo YAMAGUCHI

6. Description of your current research

According to the World Health Organization (WHO), road traffic accidents leads to over 1.35 million deaths in the world. This shows that there is a definite need for improved vehicle crashworthiness; crashworthiness is defined as the ability of a vehicle to protect its occupant and minimise bodily injuries during a crash. This provides the motivation for my research, which is to use mechanical metamaterial for improved vehicle crashworthiness and to programme the metamaterial through topological and multi-objective optimisation.

A mechanical metamaterial is a material with advanced mechanical properties that are not commonly found in nature. These properties are achieved through the careful physical geometrical structural layup of the material, rather than from the mechanical properties of the material itself, e.g. Hoberman sphere, Kirigami, and memory foam mattresses. The ideal properties that automotive industries look for when manufacturing vehicles for improved crashworthiness are materials that exhibit high-energy absorption, lightweight, and high-strength to weight and high-stiffness to weight ratios. It is very hard to obtain material capable of all the above. However, by using mechanical metamaterials the above properties can be achieved.

Therefore, the aims of my project are to define and develop a computational framework for the crash simulation of cellular mechanical metamaterials at high-strain rate; and to programme the metamaterial by developing a numerical framework for the multi-objective, topological optimisation of its cellular structure. Currently, I have defined and developed an auto-generated algorithm to computationally model cellular mechanical metamaterials with different geometries, undertake crush simulation of the metamaterials, and output the crashworthiness parameters needed to improve vehicle crashworthiness. Furthermore, "programmed" cellular mechanical metamaterial have been achieved using multi-objective optimisation.

7. Research implementation and results under the program

Title of your research plan:

Validation of computational framework through experimentation

Description of the research activities:

- Ran optimisation simulation to obtain "programmable" cellular metamaterial models, and the corresponding crashworthiness parameters.
- 3D printed specimens using KEYENCE AGILISTA 3100 3D printer, and designed jig and fixtures for carrying out compression tests.
- Carried out compression tests, analysed experimental results and compared them to computational results.
- Results are inconclusive because of the limit of the load cell used to carry out the experiments. Further testing needs to be carried out using a bigger load cell. However, there were several difficulties with the experimental setup, such as, the gap between the specimen and the load cell, constraining of specimens, gap between specimen and secondary piece.

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

Research/University environment: Communication proved to be an issue since no one in my office really spoke English. Also, I found that the students in my office were shy and it was hard for them to approach me at first, but over time they started initiating conversation with me. I really enjoyed my office environment though; it's very different from my office back at my own university; I will definitely miss it!

Cultural: I had the opportunity to attend several festivals around Kyushu, including Omuta Daijayama, and Tobata Gion Oyamakasa. The experience was unreal – the festival feeling; crowds of people, food stalls, the actual event – it was amazing! Furthermore, my office had a BBQ to celebrate undergraduate finishing their last class. The students and lecturers all mingled together barbequing food, and drinking. It was a very nice experience.

This summer programme has been one of the best and unforgettable experiences in my life, and I am extremely grateful for being allowed to participant in programme. Thank you very much for the opportunity!

JSPS Summer Program 2019
Research Report

1. Name: Carlo Alexander Scott Page
(ID No. SP19116)

2. Current affiliation: Centre for Photonics and Photonic Materials, University of Bath

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Akira Furusawa

6. Description of your current research

Quantum computers harness quantum mechanical effects to perform tasks, which would be impossible with classical computation. Photonics is a highly promising platform for the implementation of quantum information processing. This is due to photons being ideal candidates for carriers of quantum information due to their high environmental isolation and large bandwidth capability. These beneficial properties of single photons, however, make essential photon-photon interactions inherently difficult. This introduces non-deterministic elements to optical quantum computing, which limits the scalability of producing the necessary elements for universal quantum computing.

A possible solution to overcome this problem involves the use of quantum memories (devices capable of storing quantum states of light). There are many proposal on which to build quantum memories, however to date none have fulfilled all of the requirements. These requirements include low noise, readout on-demand, high efficiency, broad signal acceptance bandwidth. Furthermore, for scalability, the quantum memory will also preferably operate at telecommunications wavelengths, at room temperature and in a platform that can be integrated.

At the University of Bath, I work on light-storage in atomic vapour. My research is aiming to implement an optically switchable Bragg mirror in warm Rubidium vapour. This is achieved by optically modulating the non-linear susceptibility across the vapour. An induced switchable mirror would have applications in low-loss fast switching in quantum optical networks as well as towards a scalable quantum memory where the induced mirror can act as an input-output coupler for a storage cavity.

7. Research implementation and results under the program

Title of your research plan:

All optical quantum memory and TES detectors.

Description of the research activities:

The research group of Prof. Furusawa pioneered the use of all-optical switchable cavity quantum memories. I worked as a part of the on-demand team aiming to interfere two phase sensitive single-rail superposition states, which can be released from two distinct quantum memories. Initially, I studied the complex optical set up (~350 optical components, ~15 laser beams) and was then able to help with the alignment of the optical system and measurement of stored quantum states. We produced single photons from both optical set ups which were stored for up to 400ns. We then introduced displacement beams to allow for creation and storage of the single rail superposition states.

I also worked on creating a fiber-optic delivery system to a transition edge sensor (TES). TES is a cryogenic sensor that has photon resolving capabilities. When the sensor absorbs an incident optical signal, the corresponding change in the resistance of the superconducting material is measured. To operate in the superconducting transition, the TES must be cooled to milli-Kelvin temperatures, and therefore housed in a cryostat. The fiber-optic delivery system will allow for high coupling efficiency from room-temperature free space optics, through the cryostat, to the TES.

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

I would like to thank all of Furusawa lab for being so very welcoming and for sharing their extensive knowledge on quantum optics. Outside of Tokyo, I enjoyed trips to Osaka, Yokohama and to the beaches in Kanagawa and Chiba prefectures. Climbing Mt Fuji overnight to watch the sunrise will be a memory I will remember for a very long time.

9. Adviser's remarks (if any):

I think Carlo did a good job on the research and also making friends not only in the lab but also in the group of JSPS Summer Program.

JSPS Summer Program 2019
Research Report

1. Name: Daniel Whitaker （ID No. SP19117）

2. Current affiliation: University of Cambridge

3. Research fields and specialties:

Chemistry

4. Host institution:

Osaka University

5. Host researcher:

Prof. Yoshinori Takashima

6. Description of your current research

My research in Cambridge involves the synthesis of a range of new quaternary N-heterocycle '*guest*' containing acrylamido monomers. The '*guest*' regions of these molecules can strongly bind in a 2:1 fashion with cucurbit[8]uril (CB[8]), a macrocyclic, barrel shaped, '*host*' molecule with a hydrophobic interior cavity. The binding results in the two guest moities being '*handcuffed*' together, i.e. two guests sitting head to tail within the cavity of the host.

When the monomers are polymerised, the resulting polymer has the guest moieties pendant to the main chain and so the addition of CB[8] causes spontaneous formation of '*handcuffs*', or dynamic crosslinks, between chains and gel formation occurs. The resultant supramolecular gels are endowed with unique properties owing to the dynamic nature of the crosslinks (when compared to a solely covalent system). For instance supramolecular gels thin to a liquid upon application of a shear force, meaning they can be sucked into a syringe and then when injected will re-form into a gel. The gels also have self-healing and thermoresponsive properties as well as ionic conductivity owing to the labile counter-ions of the quaternary ammonium.

7. Research implementation and results under the program

Title of your research plan:

Preparation of dynamic hydrogels cross-linked by pseudo-rotaxane structures with a combined a steric and electronic barrier.

Description of the research activities:

In a previous paper by the Takashima group a series hydrogels cross-linked by host-guest interactions between methyl viologen and beta-cyclodextrin (β-CD) were prepared. In these hydrogels β-CD resides on the long aliphatic region of a guest-monomer in a pseudo-rotaxane type structure and is kept in place by the 'electrostatic barrier' of the viologen's positive charge, which would be unfavourable for β-CD to pass over. My project proposed the synthesis of a series of aryl-viologen containing acrylate monomers. It was suggested the resulting polymers will introduce significant steric bulk to the methyl viologen 'stoppers' thus physically increasing the 'pull out' force required for β-CD to pass. During my time at Osaka University I was able to design a successful synthetic strategy to obtain of the first monomers in this series. I then verified by 2D ROESY NMR spectroscopy that the monomers bind with β-CD as expected. Finally I prepared some initial hydrogels which showed promising self-healing properties. Upon my return to Cambridge the collaboration will continue with me sending more monomers in the series to my colleagues in Osaka to be made into gels for tensile strength testing.

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

During my time in Japan I was able to make the most of weekends and public holidays to explore the Kansai region and (further afield) to a very thorough extent. Highlights of my time here include a visit to important cultural sights in Kyoto with Prof. Takashima and his family, seeing a Kabuki Theatre performance in Tokyo with my host family during orientation and climbing Mt. Fuji on a weekend trip.

9. Adviser's remarks (if any):

Daniel has begun preparation of 4-5 kinds of new functional guest monomers, which we could previously not prepare. He has successfully isolated two kinds of guest monomer, then investigated their gelation with cyclodextrin host monomers. One monomer successfully yielded gels which have been characterized by tensile testing, but unfortunately another guest monomer formed insoluble salts with the radical initiator. However, we have discussed future strategies to prepare gels.

Daniel has respectably carried out the research without summer holiday during this summer program. We have some issues for the research, but we will continue to study the research topic and publish an international co-authored paper between UK and JP.

JSPS Summer Program 2019
Research Report

1. Name: JOSH ARNOLD （ID No. SP19118）

2. Current affiliation: Loughborough University, UK

3. Research fields and specialties:
Biological Sciences

4. Host institution: University of Tsukuba

5. Host researcher: Dr. Naoto Fujii

6. Description of your current research

Our research seeks to investigate the impact of multifactorial extreme environments on the body's defense against the cold. For example, sojourn to high-altitude typically exposes the body to a range of stressors (i.e. temperature, low oxygen, solar radiation, fatigue), yet despite the prevalence of combined stressors in nature, multifactorial research has traditionally been superseded by investigation of stressors in isolation. The underpinning mechanisms which activate cold derived thermoeffectors and their relationship with secondary non-thermal factors remains unclear. While our research is broadly basic science, the study of human systems stretched to breaking point in extreme environments can increase understanding of critically ill hospitalised patients who experience such stressors through disease states.

Our previous research in this area has focused on the methodological quantification of the shivering response, with current investigations building on this by exploring the direct impact of hypoxia, nitrate supplementation and metaboreceptor activation on the threshold for shivering onset. The microvascular responses imposed by combined low oxygen availability and low ambient temperature, in particular their combined modification of nitric oxide (NO) production, provide an intriguing area for further investigation and a core theme for the work undertaken in Tsukuba, Japan. Indeed, links can be drawn between the physiological action of NO and thermoregulation in terms of cutaneous vascular control, while hypoxic and acidic conditions are known to suppress the endogenous NO synthase pathways of NO production. Alternatively, the reduction pathway of nitrate (NO_3^-) to nitrite (NO_2^-) and NO is augmented with hypoxia. To date, research has identified major determinants of cold-induced cutaneous vasoconstriction. Yet, the factors that regulate the vascular response to hypoxia are less clear, with an even greater dearth in understanding of the mechanisms regulating vascular control during combined hypoxia and cold stress.

7. Research implementation and results under the program

Title of your research plan:

Cutaneous vascular dynamics during independent and combined hypoxia and cold stress: Exploring mechanisms using microdialysis.

Description of the research activities:

During this collaborative research project, we aimed to assess the contribution of the two NO production pathways to skin blood flow in the presence of independent and combined hypoxia and cold. During experimental trials, we successfully implemented microdialysis techniques in order to perfuse a combination of selective NO production pathway blocking agents (L-NAME and allopurinol) into the skin at four sites. In addition to blow flow assessment at each, we were able to successfully collect dialysate samples from each site during respective cold, hypoxic and combined exposure. These samples will provide a proxy for local NO activity across conditions during independent pathway blockage. Finally, venous blood samples were also collected to assess whole body NO activity in response to hypoxia and cold exposure. In total we were able to collect a full profile of data from thirteen healthy volunteers, for later publication. This project also enabled transfer of knowledge, permitting microdialysis to be successfully conducted in Loughborough in the future, promising future collaboration between the UK and Japan.

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

Alongside research activity, the JSPS summer program afforded visits to other institutions across Japan, including Kobe University to meet Prof. Kondo and Niigata University to meet Dr. Amano. Such visits provided a chance to experience a variety of research culture and also a great chance to enjoy a wide range of Japanese scenery, food and surroundings.

9. Adviser's remarks (if any):

Despite limited time to stay at University of Tsukuba, Josh did an excellent job in executing the technically-challenging collaborative project, by working with professors at Loughborough University, students at University of Tsukuba, and me. Data collection was successful, and I believe data obtained are publishable in a high-impact journal. His work at my laboratory helps me to accelerate future collaborative projects with the UK.

JSPS Summer Program 2019
Research Report

1. Name: Christopher Hill （ID No. SP19119）

2. Current affiliation: University of Bristol

3. Research fields and specialties:

Chemistry

4. Host institution: Hirosaki University

5. Host researcher: Dr. Masanobu Sagisaka

6. Description of your current research

Fire-fighting foam formulations contain complex mixtures of both fluorocarbon and hydrocarbon surfactants. My research is based on developing new understanding on how these surfactant mixtures behave in terms of solution, surface and aggregation properties, with a view to developing new formulations containing lower concentrations/ compositions of the environmentally hazardous fluorocarbon surfactants.

7. Research implementation and results under the program

Title of your research plan:

Enhancing the viscosity of supercritical CO_2 with catanionic surfactants

Description of the research activities:

The aim of the work in Hirosaki University was to develop novel chemical additives for stabilisation of water in supercritical CO_2 ($scCO_2$) microemulsions. Development of these new additives will offer opportunities for control over the physicochemical properties of $scCO_2$.

The initial stages of my research in Hirosaki University consisted of learning how to synthesise and purify a novel tri-chain surfactant. The synthesis was carried out successfully, however low yields were produced. After the synthesis of the surfactant, the ability to stabilise water-in-$scCO_2$ microemulsions was determined using fourier-transform infrared spectroscopy (FTIR). Carrying out FTIR measurements required learning how to use high pressure apparatus with a water injection system, so that the volume of water within the pressure cell could be increased. The high pressure FTIR measurements were carried out with surfactants with a known water solubilsation ability before measuring the novel tri-chain surfactant. Results showed successful formation of water-in-CO_2 microemulsions up to a W ratio of 30. The same behaviour was observed in mixed system containing the tri-chain surfactant and a hydrocarbon.

Further to the work carried out in Hirosaki University, small-angle neutron scattering (SANS) experiments are scheduled for September 2019 at the ISIS facility, UK. These experiments will provide both addition evidence for the formation of water-in-$scCO_2$ and the shape of the formed structures.

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

I would like to thank Dr. Sagisaka, Prof. Yoshizawa and their respective research groups for being so welcoming and supportive during my stay. It was a pleasure to work with such talented scientists.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Harry JENKINS	（ID No. SP19120）
2. Current affiliation: Cardiff University	
3. Research fields and specialties:	
Chemistry	
4. Host institution: ICAT, Hokkaido University	
5. Host researcher: Prof. Hasegawa, Prof. Asakura	

6. Description of your current research

My PhD has been theoretical/computational, and focused on two main topics:

1. Investigate, to better understand, the mechanisms of surface photocatalysis, primarily on TiO_2.
2. Improve the accuracy, reliability, and underlying software of the computational techniques used, specifically the solid-state QM/MM embedded cluster methodology.

Photocatalysis

Of specific interest to our group is the photocatalysis of water-splitting on TiO_2 surfaces. TiO_2 is of particular interest due to its high chemical and thermal stability under reaction conditions, in addition to its abundance and relatively low cost. However, the mechanism by which photocatalysis occurs remains a topic of debate.

QM/MM

The current most popular computational method of modelling surface reactions is periodic planewave density functional theory (DFT). Periodic DFT is both expansive in its functionality, and easy to use. However, there are still some major limitations. For instance, it is computationally inefficient for the high-level hybrid-DFT (PBE0) approaches necessary for a reliable study of catalysis. In addition, it cannot be used to model charged defects in a material due to technical compatibilities when trying to include a compensating background charge.

As an alternative, hybrid quantum- and molecular-mechanical (QM/MM) modelling can be coupled with an embedded cluster approach, which combines the high accuracy of QM modelling, with the high efficiency of MM modelling, all in an aperiodic model that reproduces the bulk environment.

7. Research implementation and results under the program

Title of your research plan:

Computational Study of Excited State Structural Relaxations in WO_3 using Solid-State QM/MM Embedding.

Description of the research activities:

Prior to this collaboration, the Asakura group had undertaken X-ray studies of excited state monoclinic WO_3. Two of their observations were , firstly, that the energy of the 2s to 6p orbital transition is shifted by -1.0eV upon excitation, and secondly, that the shorter W-O bonds became shorter while the longer W-O bonds became longer.

In this collaboration, to validate these observations, two models of the system were set up – one periodic, and one using a QM/MM cluster.

The results were mixed. One one hand, the energy shift of -1.0eV agreed with the models. However, both models agreed that the bond lengths should do the opposite of what the experiment suggests; the shorter W-O bonds become longer, and the longer W-O bonds, shorter.

To establish why the models showed that this behaviour should occur, an electronic structure analysis was performed. The conclusion being that the LUMO of the monoclinic WO_3 was bonding with respect to the longer bonds, and anti-bonding with respect to the shorter bonds.

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

Summer festival activities: Hasegawa group bbq; Sapporo beer festival; riverside fireworks display (neglected to wear a yukata).

Elsewhere in Sapporo: View of the city from the top of Moiwa-yama; bars, karaoke, and nightclubs of the Susukino district.

Elsewhere in Hokkaido: Otaru and the seaside; mountain onsen; Hakodate for mountain monkeys and the sea.

Elsewhere in Japan: Nara; Kyoto; climbing Daimonji-yama.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Lok Ting Bonnie TSIM (ID No. SP19121)

2. Current affiliation: National Graphene Institute, University of Manchester

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Osaka University

5. Host researcher: Professor Mikito KOSHINO

6. Description of your current research

The start of my PhD project coincided with the discovery of unconventional superconductivity in magic-angle graphene superlattices. This groundbreaking realisation was published in March 2018 (*Nature* 556 (7699), p.43) and was a collaborative effort between researchers in the US and Japan. Since then, there has been a huge surge of interest in many research groups around the world, both experimentally and theoretically.

Twisted bilayer graphene consists of two layers of graphene overlaid on top of each other with a relative twist. As a result, a moiré pattern is formed due to the periodic pattern from the overlap of two graphene lattices. When the two graphene layers are twisted by 1.05°, the Dirac velocity near charge neutrality becomes zero leading to a flat band structure. This gives rise to a strongly correlated electronic system which has the potential to uncover more exotic phenomena in 2D correlated materials.

The overarching goal of my current research is to model the various electron transport properties in twisted bilayer graphene due to moiré superlattice effects. I am interested in electron transport of twisted bilayer graphene with varying twist angles as well as investigating the effects of magnetic and electric fields.

7. Research implementation and results under the program

Title of your research plan:

One-dimensional channels in small-angle twisted bilayer graphene

Description of the research activities:

Our research focuses on twisted bilayer graphene at small twist angles (~0.1°). By applying a perpendicular electric field, we find that the bandstructure exhibits one-dimensional channels within a specific range of energies. In twisted bilayer graphene, the local stacking arrangements vary within the moiré pattern. To our surprise, we find that the channels move in snake orbits avoiding AB/BA local stacking arrangements rather than directly along domain walls as previously thought. My results using the continuum model Hamiltonian match that of our collaborator Dr. Nguyen N. T. Nam (Tohoku University) who uses the tight-binding Hamiltonian. In the next few months, we hope to gain a better understanding of the formation of these one-dimensional channels and the parameters that determine where these channels form in the energy spectrum. At such small twist angles, this system is within the parameter limits of experimental capability which makes this research particularly interesting. These two months have begun what I think is the start of a successful collaboration and we hope to complete this project after the program.

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

Osaka has been a wonderful city to conduct research in and I will be sure to visit again in the future. The street food and shopping district Dotonbori was a highlight and I especially enjoyed the Tenjin Matsuri summer festival with the undeniable bustle and joy of the city. I highly recommend the JSPS summer program which includes a fantastic homestay experience. My homestay was in Tokyo and the teamLab Borderless museum in Odaiba has left a lasting impression on me. I sincerely hope that I will have the opportunity to collaborate in Japan in the future as it is a wonderful country with wonderful people with a rich history of culture and cuisine.

9. Adviser’s remarks (if any):

Bonnie did a great work on the cutting-edge research on the twisted bilayer graphene. In particular, she investigated the electronic properties under a large perpendicular electric field, and found out a special energy region dominated by the 1D chiral channel states. We are still investigating the origin of the special states, and we are going to continue our collaboration after the program. She also communicated with the group members very much and enjoyed life in Osaka.

JSPS Summer Program 2019
Research Report

1. Name: Jamie Francis Townsend
（ID No. SP19122）

2. Current affiliation: Cranfield University

3. Research fields and specialties:
Mathematical and Physical Sciences, Engineering Sciences

4. Host institution: Nagoya University

5. Host researcher: Prof. Shu-ichiro Inutsuka

6. Description of your current research

The current research seeks to develop numerical modelling tools for physicists and astrophysicists interested in high-energy fluid environments. In particular, for fluidic environments in which Einstein's theory of special relativistic is applicable. This is the field of **relativistic hydrodynamics**.

To successfully create numerical simulations of these fluid environments Computational Fluid Dynamics (CFD) is deployed in conjunction with special relativity. The current research has so far produced a high-resolution shock-capturing (HRSC) CFD software capable of achieving high-orders of accuracy for highly relativistic flows.

A variety of physical scenarios have been simulated in order to investigate how fluids behave under such extreme conditions, i.e. at velocities approaching the speed of light. Furthermore, new numerical formulations have been studied to overcome certain numerical issues that are well-documented in this research field. The current state-of-the-art technology from aerospace and automotive modelling strategies has been adopted and tested to understand the benefits and potential drawbacks of different modelling procedures for relativistic hydrodynamics.

7. Research implementation and results under the program

Title of your research plan:

Relativistic Dissipative Hydrodynamics for High-Energy Astrophysics

Description of the research activities:

The research undertaken comprised of successfully including non-ideal fluid effects such as heat conduction and viscosity into the previously developed high-order numerical modelling software. This objective was met.

By adopting the theory of Israel and Stewart, viscosity and heat conduction were included in the HRSC software following a strategy initially presented by Takamoto and Inutsuka. Competitive results were achieved with this initial strategy as high-order HRSC methods were used for the first time in this situation. Furthermore, a two-dimensional implementation of the non-ideal theory was incorporated such that investigates can now begin that concern the morphology and dynamics of turbulence under high-energy, relativistic conditions. Initial results have been gathered, data analysis is on-going and a working relationship between both UK and Japanese parties will continue on the subject.

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

This experience has provided me with a unique perspective of Japan that should not be taken for granted. Spending time travelling Japan on the weekends not only provided a break from research but also the chance to learn about a country and culture I previously knew very little about.

9. Adviser's remarks (if any):

As a supervisor I'm impressed by the hard work done by Jamie who almost looks like a Japanese postdoc researcher!　I also note that Jamie has nicely fit to my group together with postdocs and many students.　I strongly believe that he enjoyed his internship both in scientific research and cultural exchange. I hope he will come back to my group in near future as a JSPS postdoctoral fellow.

JSPS Summer Program 2019
Research Report

1. Name: Jordan Elouise Jones （ID No. SP19123）

2. Current affiliation:

University of Liverpool

3. Research fields and specialties:

Biological Sciences, Agricultural Sciences

4. Host institution: Western Region Agricultural Center, NARO, Fukuyama

5. Host researcher: Dr. Kazuki Miura

6. Description of your current research

My current research at the University of Liverpool focuses on a bacterium called *Spiroplasma*, which is found within many insect species. In the fruit fly, *Spiroplasma* confers protection against a parasitic wasp which lays its eggs into the developing fly larvae. *Spiroplasma* is not the only mode of defence against wasps in fruit flies. The fruit fly can also protect itself through endogenous defences which encapsulate the wasp egg and kills it. In addition, fruit flies can also use ethanol as a behavioural strategy to self-medicate against wasps. To date, these defence mechanisms have only been considering in isolation. However, it is important to understand how they interact for predicting their evolutionary and ecological dynamics in natural populations. My project aims to understand how *Spiroplasma*-mediated defence against parasitic wasps interacts with the other defence mechanisms in the fly.

7. Research implementation and results under the program

Title of your research plan:

Development of a symbiont enhanced biological control system.

Description of the research activities:

The main aim of my research in Japan was to artificially inject the institute's flightless ladybird strain with a bacterium called *Spiroplasma*, to improve its efficiency as a biological control agent. To begin my project I needed to collect ladybirds naturally infected with the bacteria. After visiting several parks in Fukuyama it was apparent that there was no ladybirds present at this time of year. Luckily, Dr Kazuki Miura had collected some a month prior for me and I was able to screen the ladybird's offspring for the bacteria using PCR methods. To our surprise 1 out of 4 ladybirds was infected with *Spiroplasma*, and so I went ahead and injected the bacteria from infected donor larvae into larvae of the flightless strain. Unfortunately this was unsuccessful and so I attempted injecting bacteria into the adults instead. I am still awaiting the results of this attempt. As my project required time for ladybird development, my supervisor arranged for me to visit other laboratories in Japan during those periods. This included a visit to Okayama University for 1 week to spend time in the lab of Dr. Taka Miyatake. During my time I was able to present my research and help collect data for an experiment examining death feigning behaviour in the flour beetle. I also went to NARO, Tsukuba to visit the lab of Dr. Daisuke Kageyama for 3 weeks. Here, I was able to present my research, speak to other researchers and help collect lacewings for an ongoing project. From here, I also visited the lab of Dr. Tetsuhiko Sasaki at Tamagawa University to give a seminar about my research in Liverpool.

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

During my weekends, I made the most of my time and travelled out of the city to visit other areas of Japan. I was lucky enough to visit several places including Hiroshima, Kyoto, Okayama, Osaka, Hakone and Tokyo. I also enjoyed many Japanese traditions such as a tea ceremony, a yukata festival, a visit to an onsen and karaoke!

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

JSPS Summer Program 2019
Research Report

1. Name: Fiona Torzewska （ID No. SP19124）

2. Current affiliation: University of Leeds

3. Research fields and specialties:
Mathematical Physics

4. Host institution: Ochanomizu University

5. Host researcher: Professor Tetsuo Deguchi

6. Description of your current research

I am interested in areas of Physics in which topology and algebra appear. In Leeds I have been studying various algebraic structures which are collectively known as cobordism categories. A cobordism is a manifold (in two dimensions, a surface) with boundary up to certain equivalences, and two of these manifolds can be composed by ‘gluing’ if they share a common boundary. Up to some technical details regarding the gluing of manifolds we can construct a category from these cobordisms. Although this notion seems very abstract, this kind of algebraic structure appears in Physics in many different ways.

In statistical mechanics, physicists are often interested in lattice models, where particles are organised in a grid and often each particle only interacts with its nearest neighbor. Most observable properties of these models can be found from the partition function, although this quickly becomes difficult to calculate exactly for large models. One solution is to consider the partition function for a small subset of the lattice, and then find how it changes as layers are added. This is described by transfer matrices and in certain models these transfer matrices are built from the Temperley Lieb algebra. The Temperley Lieb algebra can be seen as lying inside a certain cobordism category.

Another example is in quantum computation, we can encode computation by transporting these certain particles such that their time lines form a 'braid' in 2+1 dimensions. The outcome of computation is dependent only on the braid 'type' formed by these world lines. These braids are cobordisms and so we can construct an appropriate category and use tools from algebraic topology and representation theory to understand the computation.

7. Research implementation and results under the program

Title of your research plan:

Computing resistance distance via the Potts model.

Description of the research activities:

Given a graph representing a network of resistors, with a resistance assigned to each edge of the graph, the resistance distance between any two vertices is the effective resistance between those two points in the network. My host is interested in calculating resistance distances since they can then be used to find the elasticity of certain polymer networks based on his recent finding.

These electrical networks can be seen as part of a broad class of statistical mechanics models known as Potts models. Reformulation of the problem in this way allows us to construct a matrix which tells us how the partition function changes as we grow the electrical network. For certain cases we believe this method offers advantages over currently more common techniques for calculating resistance distance.

I have also been able to visit and discuss work with several other academics during my time in Japan, attend an international conference and give a talk at the Research Institute for Mathematical Sciences in Kyoto.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): The JSPS program has offered me and exceptional opportunity to experience life and work in Japan. The homestay was a real highlight for me, being a part of a Japanese family and seeing all the similarities and differences to life back home. I have also been made extremely welcome in the lab at Ochanomizu University, taking part in an office sightseeing trip, karaoke, a bbq and a fireworks night. I have also travelled both for work and with other JSPS students, I highly recommend watching the sunrise from Mt.Fuji.

9. Adviser's remarks (if any): It was scientifically quite timely for me to have Fiona in Ochanomizu university, since it has recently become important to find out connections of resistance distance to the Potts model in my theoretical study on topological polymers in the statistical polymer physics. She has found a nontrivial connection between them in her seminars with me. The result should be published somewhere near future.

JSPS Summer Program 2019
Research Report

1. Name: Esther CAZARES CORTES (ID No. SP19201)

2. Current affiliation: Laboratory of Molecular, Maromolecular Chemistry and Materials; at Ecole Superieure de Physique et de Chimie Industrielles de la Ville de Paris (ESPCI Paris)

3. Research fields and specialties:

Chemistry

4. Host institution: Departement of Chemistry, Kyoto University

5. Host researcher: Makoto Ouchi

6. Description of your current research

My current research at ESPCI in Paris, as a postdoctoral researcher, is part of collaboration between the Molecular, Macromolecular Chemistry and Materials Laboratory (Dr. François TOURNILHAC) and the Department of Polymer Chemistry? University of Kyoto (Pr. Makoto OUCHI). So far, we have been studying the physicochemical properties of sequence-controlled polymers in water and in organic solvents, such as dimethoxiethane. These sequence-controlled copolymers were prepared by original methods by the Japanese team, in Paris we identified a number of thermoresponsive and pH-responsive systems in solutions of these copolymers.

7. Research implementation and results under the program

Title of your research plan:

“Selective cyclopolymerization of newly designed divinyl monomer".

Description of the research activities:

We worked on the synthesis of a new divinyl monomer, in order to prepare alternating cyclopolymer whose cyclospacer is connected via a highly polar spacer for pyroelectric applications. During this summer internship, a 3 steps synthesis was made, the monomer was principally purified by column chromatography.

Various polymerization tests have been carried out (concentration, nature of initiator, etc.), but for all the tests we got crosslinked polymers while we wanted to get linear polymers.

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

Conducting research in the Ouchi’s laboratory and working on the synthesis of monomers (organic chemistry) was very interesting and broadened my knowledge in chemistry. Moreover, this stay allowed me to travel around Japan (Tokyo, Osaka, Hiroshima, Kobe and Nara), visit several castles and temples, tasting Japanese food, but above all, I met some great people.

9. Adviser’s remarks (if any):Dr. Esther Cazares studied the research "selective cyclopolymerization of newly designed divinyl monomer". She was not used to such synthetic experiments, but she made great efforts to synthesize the monomer. Finally she succeeded in the synthesis.
Unfortunately, she was not able to study the polymerization of the monomer very well, but her research was valuable. She was sociable and communicated with my students. I hope this experience will be useful for her next stage.

JSPS Summer Program 2019
Research Report

1. Name: Gilles-Olivier GRATIEN （ID No. SP19202）

2. Current affiliation: The University of Nantes, Chemistry Dept., PhD Candidate in Medicinal Chemistry

3. Research fields and specialties:

Chemistry

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

5. Host researcher: Prof. Yasuteru URANO, Prof. Toru KOMATSU

6. Description of your current research

Drug therapy is often limited by a wide dispersion of the bioactive substances in the patient's body. This makes treatments weakly specific to pathogens or sick cells. As a result, limited concentrations of drugs reach the treatment site and severe toxicity may occur on healthy cells. A "Drug Delivery System" seems to be one of the most promising answers to improve the effectiveness of many therapies. By releasing a highly potent drug specifically on the treatment site, this strategy could greatly reduce the side effects.

As a PhD candidate in medicinal chemistry at The University of Nantes, my research fit into this issue. My research is focused on the chemical synthesis and the biological evaluation of small antifungal and antiparasitic prodrugs which are programmed to be solely activated in the presence of a specific event (*e. g.* enzyme activity, pH variation, oxidative stress).

7. Research implementation and results under the program

Title of your research plan: Development of fluorogenic probes to allow the early diagnosis of viral infections

Description of the research activities:

Additional knowledge regarding cellular metabolism could help to improve the understanding of disease mechanisms and therefore identify new drug targets. For this purpose, Pr. Urano and coworkers have developed several fluorescent probes and successfully applied them to monitor intra- or extracellular markers in living cells as well as in whole organisms. Nevertheless, scientists still need new chemical tools to fill the significant lack of knowledge in the field of infectious diseases.

In Japan, my research was focused on the development of fluorogenic probes to track down the appearance of abnormal biological events and allow the diagnosis of viral infections. These programmed molecules should not exhibit any fluorescent signal in healthy biological samples (*e. g.* blood, saliva, organs) until they encounter their target for which they were designed (here a viral enzyme), and only at that time, display a strong fluorescent signal easily detectable. Combining organic chemistry, chemical biology and fluorescence imaging, I devoted my efforts over the last two months to achieve this promising goal.

After a tricky 8-step chemical synthesis, I was fortunate enough to succeed and obtain the desired compound. Right now, we just passed to the biological evaluation of this innovative chemical entity, so the results of this part are still pending.

Despite my short stay in Japan, this collaboration was so rewarding and should lead to one scientific paper soon published.

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

This fellowship provided such a good opportunity to truly experience work and lifestyle in Japan.

As a young scientist, be able to learn with talented researchers is greatly rewarding and highly valuable. Moreover, this experience allowed me to expand my professional network for future collaborations in my area of expertise.

Besides, work is not everything and I also appreciated my stay on a cultural level! About that, as examples, during the past months in Japan,

- I really enjoyed my homestay at the beginning of the program (and I have kept in contact with my host family).
- I made new Japanese friends with which I did so many parties, karaoke and went to delicious Japanese restaurants.
- I visited a lot of shrines, castles, onsens and other cities like Kyoto and Hakone.
- I experienced the lot of summer festivals (matsuri) and fireworks (hanabi) that were held in the vicinity of Tokyo.

After this amazing stay in Japan, I kept so many good memories and I will be back in the future for true vacation or another business trip.

9. Adviser's remarks (if any):

Gilles-Olivier GRATIEN worked in our laboratory for two months, engaging in the project of preparing novel fluorescent sensors for the detection of viral enzymes with high sensitivity. With his extraordinary talent for organic synthesis, he completed the preparation of the designed sensor, and proceeded to the biological evaluation. He usually came to the laboratory early in the morning, and worked late, spending much time devoting to his project. Besides working hard on the project, he enthusiastically had discussions with other lab members, and even did valuable suggestions regarding the research from his expertise. Having him working in our laboratory was so fruitful for us, and I am also glad to learn that he was able to learn a lot during his stay. I do hope that we will have a chance to work together in the near future.

JSPS Summer Program 2019
Research Report

1. Name: Delphine KERVELLA （ID No. SP19 203 ）

2. Current affiliation: Université de Nantes

3. Research fields and specialties:

Biological Sciences

4. Host institution: Aichi Medical University

5. Host researcher: Pr KOBAYASHI Takaaki

6. Description of your current research

Renal transplantation is the best therapeutic option for patients suffering from end-stage renal disease. Compared to dialysis, renal transplantation offers better patient survival, better quality of life and lower economic cost. Human leukocyte antigens (HLA) are critical for determining compatibility between donor and recipient and leading to rejection of the transplanted organ. Despite immunosuppressive treatments, acute or chronic antibody-mediated rejection (AMR) is a major cause of renal graft loss. Anti-HLA antibodies, especially directed against donor HLA (donor-specific antibodies, DSA) play a central role in AMR. The main target of these DSA are the endothelial cells lining the blood vessels of the transplant. Deciphering mechanisms of DSA production by host immune system and protecting the graft endothelium against DSA-induced aggression are major challenges in kidney and other solid organ transplantations.

The aim of my thesis project is to induce endothelial protection against DSA in a preclinical large animal transplantation model. We have developed pig and non-human primate models of allo-immunization and acute kidney transplant antibody-mediated rejection. Furthermore, we have developed a model of *ex vivo* kidney perfusion that will allow us to treat the organ (graft) before transplantation. Such a preconditioning approach, either *ex vivo* or *in vivo,* is the next step of our project.

7. Research implementation and results under the program

Title of your research plan:

Donor specific antibodies in transplantation: mechanisms of production and toxicity

Description of the research activities:

I participated in two research projects currently ongoing in Pr Kobayashi's laboratory under the direction of Dr. Iwasaki and linked to my research topic. The first project addresses the question of HLA combinations between donor and recipients (i.e. compatibility) that will lead or not to the production of anti-HLA antibodies by the recipient. Some of these combinations appear to be protective in a clinical setting. We attempted to clarify the mechanisms explaining this protection using in vitro assays. We were able to show that some combination of allogeneic peptide and recipient HLA class II led to the production of anti-inflammatory and tolerogenic cytokines by recipient immune cells. Secondly, although anti-HLA class II antibodies are the most pathogenic in vivo, there was a problem that in vitro cultured endothelial cells would not express HLA class II. Therefore, we needed to establish HLA class II-expressing endothelial cells by transfection of the class II transactivator via plasmid electroporation. This will allow the development of in vitro model for anti-HLA class II antibodies interaction with endothelial cells. I also participated in lab meetings and journal club sessions. Furthermore, I had the opportunity to visit the clinical department and to attend a living-donor kidney transplantation. As a medical doctor, it was very interesting to both work in the lab and learn about the Japanese medical system and current issues in the transplant field in Japan.

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

I would like to thank JSPS for excellent program organization. I warmly thank the research team who hosted me, I could share a lot with them, about work but also about life in Japan and in France. I really felt included and the lab and was happy to share with them also some nice afterwork times. I had the chance to visit some places around Nagoya with team members. Going to the sumo tournament with one of my colleagues from the lab was an unforgettable experience!

9. Adviser's remarks (if any):

It is my great pleasure to make a comment on Dr. Delphine Kervella who has completed the JSPS summer program in our department between June 18 and August 19, 2019. She is a diligent and enthusiastic doctor who has shown considerable interest in any field as well as her specialty, renal transplantation. She was actively involved in our research projects, lab meeting (research conference), Journal club, clinical living donor renal transplantation and many Japanese cultural activities. I have found that she could quickly and effectively obtain necessary information and broaden her knowledge base through Japanese she has just learned. Because of her pleasant personality, all of our department fully enjoyed her stay in my department. I believe that she will certainly develop her career and internationally play an active role in any field of medicine or science. (Takaaki Kobayashi)

JSPS Summer Program 2019
Research Report

1. Name: Angelique V. LESPORT （ID No. SP19204 ）

2. Current affiliation: Universite de la Réunion

3. Research fields and specialties:

Engineering Sciences

4. Host institution: University of Health and Welfare - Takasaki

5. Host researcher: Yosuke TOMITA

6. Description of your current research

The main aim of the current research is to explore the motor control during dual task to assess risk of falling in elderly people. Altered performance in coordination during dual task has been relevant in the risk of falling in elderly people. By coordination in dual task, we mean to simultaneous control two components, that are:

- focal component (the variable related to the movement, eg the index finger position in a pointing task)
- postural component (the variable related to the stability that is disrupted by the movement, eg the whole-body center of mass position)

This simultaneous control is ensured by the central nervous system (CNS) and it use of the motor redundancy (joints, limbs and muscles coordination). The spatio-temporal coordination links between these two different task-specific performance variables remained unclear. We will used the UnControlled Manifold (UCM) computational method to quantify the control ability during the movement by index synergic. Higher index synergic for one task component-specific variable given show how much this parameter is controlled by the CNS.

We suppose that there are different strategies for coordination throughout the ages. These differences due to age can be explain by aging sensitive, motor and especially cognitive systems and further affect dual task. In fact, dual tasking implies particular attentional cost and cognitive process that can deteriorate the motor performance if it exceeds the attentional capacity.

7. Research implementation and results under the program

Title of your research plan:

"Motor control quantification IMU sensors-based." Validation of IMU sensors-based measurement to a 3D kinetic model based on motion capture.

Description of the research activities:

During my stay in the lab of Takasaki University, I had the opportunity to accompany Professor Tomita during his rehabilitations tests with different patients. This allowed me to familiarize myself with new assessments tools. We also have made some data collection session with my protocol using IMU sensors and motion capture system with students in University of Takasaki. I designed the program for data analysis with help of my thesis advisor in my origin university. Unfortunately, the 3D motion capture system that they had in Takasaki University did not permit us to collect lot of data because of the old version used, the poor quality of markers. Then Mr. Yosuke Tomita bought news markers that help us a lot.

Moreover, Mr. Yosuke Tomita offered me to take part in the data collection and analysis of phase detection during the gait using IMU compared to two gold standards methods that are 3D motion capture and faceplate data.

During my stay, I was also able to use and share my skills with the lab's members. My experience on the 3D motion capture was appreciate and I passed on my knowledge to the colleges of the University of Takasaki. Indeed, I helped Mrs. Yuko Takahashi to design a template within the 3D motion capture software.

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

I have really appreciate the first week organized by JSPS and Sokendai. In reassuring atmosphere it permit us to meet the others fellows of the program, create groups, friendships and plan some activities together. Then this program offer us the opportunity to develop a scientific network.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: David Leturcq

(ID No. SP19205)

2. Current affiliation: Université Grenoble-Alpes, Institut Fourier

3. Research fields and specialties: Mathematical and Physical Sciences

4. Host institution: Shimane University

5. Host researcher: Prof. Tadayuki Watanabe

6. Description of your current research

Long knots are embeddings of R^n into R^(n+2) with a specific behaviour near the infinity.
Bott, Cattaneo and Rossi defined graded invariants of these knots, for odd n, as combinations of configuration space integrals, with respect to graph configurations associated with the knots.
These BCR invariants are high dimensional generalizations of knot invariants introduced by Witten, Bar-Natan, Guadagnini, Martellini, Mintchev, Kontsevich, Bott, Taubes, among others…
During my second year of Master, I gave a discrete definition of the BCR invariants, which presents them as differential degrees of maps to products of spheres. My definition shows that these invariants are rational.
In my Ph. D work, I have introduced more flexible versions of both definitions: the original BCR continuous definition by means of configuration space integrals, and my discrete definition, which counts graphs. I have also generalized my new flexible definitions to long codimension 2 knots in parallelized odd-dimensional manifolds that behave like R^{n+2} near infinity and that have no homology in positive degree. I proved that the obtained generalized invariants are rational and independent of the parallelisation. Eventually, I expressed the degree 2 part of the generalized invariant in terms of the Alexander polynomials of the knot, for a certain class of knots and manifolds. This class contains all the long n-knots of a (n+2)-homology sphere for n congruent to 5 modulo 8.
This result extends a theorem of Tadayuki Watanabe, which holds for the class of ribbon knots in any odd dimension.
My proof is completely different. It heavily relies on the flexible definitions, which I introduced, whereas Watanabe's proof relies on finite type invariant theories.
What I am currently working on is how to extend these results to higher degrees, if possible.

7. Research implementation and results under the program

Title of your research plan: Extended Bott-Cattaneo-Rossi invariants of long knots in asymptotic homology R^{n+2} and their relation to Alexander polynomials

Description of the research activities:

During my stay in Japan, I had the opportunity to discuss widely with T. Watanabe on his previous work on the invariants I am working on and on my current work on this topic. This was very helpful and give me some time and ideas on how to pursue this study, and extend his results, which are for any degree, whereas mine are only for degree 2, yet. Thanks to this, I have finished (on draft) the proof of such an extension, even if some indeterminacies may again be studied. Our discussions also help me in extending these invariants to the even dimensional case, in a way that may simplify the only already known case (which was the degree 3 invariant for embeddings $R^2 \to R^4$).

My stay was also the opportunity to attend some conferences on subjects close to mine in Japan (in Tsukuba), and to give some talks about my work in Matsue and in Kyoto, where I had the chance to talk with some researchers working on very similar topics, and this gives me some good ideas I will continue to investigate in the following months.

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

I also took the opportunity, during the week-ends and holidays to do some visits in Japan and was very happy to have the chance to see Nara, Izumo, Kyoto, and Ise. I also took some time to learn a little bit on Japanese letters, and it was very fulfilling for me to study it.

9. Adviser's remarks (if any):

JSPS19205

JSPS Summer Program 2019
Research Report

1. Name: Jesua Israel Epequin Chavez (ID No. SP19206)
2. Current affiliation: Academy of Mathematics and System Science – Chinese Academy of Science
3. Research fields and specialties: Mathematical and Physical Sciences
4. Host institution: Department of Mathematics – Kyoto University
5. Host researcher: Ichino Atsushi
6. Description of your current research I am currently trying to prove a conjecture by R. Howe and S. Gurevich (cf. Small representations of finite classical groups) concerning the so-called Theta correspondence. I aim at treating a particular case first (unipotent representations) In order to do so it is important to get familiar with the foundational work of Lusztig, mainly its classification of unipotent representations by combinatorial objects called symbols. After finishing with the unipontent case, a proof of the general case can be attempted by using the Lusztig bijection. For this an understanding of its relation to the Theta correspondence, this problem has been addressed by S.-Y. Pan on a series of three papers released between 2016 and 2019. A parallel problem concerning the paper cited above is comparing the so-called eta correspondence found by Howe and Gurevich with a similar correspondence found by me during my PhD. This could provide further properties of the eta correspondence.

7. Research implementation and results under the program

Title of your research plan: Eta correspondence in Deligne-Lusztig paremeters

Description of the research activities: I used these two months to get used with the techniques necessary for the undertaking of the problem explained above. For this I chose to read the following papers by S.-Y. Pan: “Supercuspidal representations and preservation principle of the theta correspondence”, ”Howe correspondence of unipotent characters for a finite simplectic/orthogonal dual pair”, “Lusztig correspondence and Howe correspondence for finite reductive dual pairs”

In order to learn how to use the techniques introduced on those papers I first attacked the problem of showing that the Theta correspondence (for simplectic/orthogonal pairs) is compatible with the projection on the space of uniform functions. I got results for some particular cases (I am following the presentation of paper 2 above). And although the identity I found is not what I expected, it still allows to prove that the Theta correspondence preserves the space of uniform representations. After finishing with this problem, I will be comfortable enough to attempt to solve the conjecture of Howe and Gurevich.

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

Japan is a beautiful country, full of nature (and deer if you go to Nara). I climbed mount Mitsutoge. I also went to Hiroshima and, for the first time in my live, got to think what the dropping of the bombs really meant. Visiting the memorial and the museum there was a deeply moving experience. I am amazed at how Japanese people see this matter, that they didn’t seek for revenge, but on the contrary, they wished for it to never happen again, nowhere.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Lemarié Julien （ID No. SP19207 ）

2. Current affiliation: Université de Caen – PhD Student

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: University of Rikkyo – Tokyo

5. Host researcher: IEKI Kazuo

6. Description of your current research

After the discovery of the atomic nucleus by Rutherford, physicist made a lot of research to understand its properties. However, the size of the nucleus make it really hard to study and huge facility are needed. These facility are called particle acceletor and can accelerate nuclei and in our case, we accelerate them from 0 to 60% the speed of light and we make them collide with others nuclei.

And so, to study the structure of the atomic nucleus, we perform experimentation in Nishina center, RIKEN, a particle accelerator situed in Wako, near Tokyo.

We are studying exotic nuclei that has a lot of neutrons and that does not exist naturally in order to probe the extreme properties of the atomic nucleus.

7. Research implementation and results under the program

Title of your research plan:

Structure of exotic nuclei : Study with gamma-ray

Description of the research activities:

The detector CATANA is used for the detection of gamma-ray. A researcher has reported in a presentation that this detector has data loss, and he thought that it was coming from the amplifier, a very important electronic module. And so, during my internship, I investigated and tried to reproduce this data loss by changing the parameter of the amplifier. However, after my analysis, and after changing the amplifier, I did not succeed reproducing the data loss. And so I concluded that it was not coming from the amplifier but I had no time to do further investigation.

While it was not possible to go at the facility where the detector is, I was analysing the data of an experiment of Calcium as projectile and Carbon as target done two years ago. I was trying to do the “AddBack”.

Sometimes, gamma ray does not deposit all of their energy in one detector. And so, we lose important information. The purpose of the AddBack is to look if the rest of the energy were deposited in other detectors.

Finally, when the AddBack is done we recovered information and we can probe and determine the nuclear structure with a better accuracy.

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

I mainly stayed in Tokyo, yet in two months I did not have time to visit evrything. I could visit traditional place like asakusa, and also went to the beautiful Yoyogi Park.

Also, since it was in early August, I had the occasion to go to Comiket. There, I could see organisation skills of japanese to make everything work very smoothly with 200,000 persons going to this event in 4 days.

And the funniest experience was at a convenience store, where an old woman was very impressed by my height (~2m). My japanese is not very good but I discussed with her few minutes. She was very kind and I will keep this memory for a very long time.

9. Adviser’s remarks (if any):

Form 5-1／様式 5-1
【SP19　　】

JSPS Summer Program 2019
Research Report

1. Name: Vincent BOUAD　（ID No. SP19208）

2. Current affiliation: ENSCM

3. Research fields and specialties:

Chemistry

4. Host institution: Kyoto University, Uji Campus, Tsujii Laboratory

5. Host researcher: Pr. Kohji Ohno

6. Description of your current research

I am currently undertaking research as a PhD student in the field of fluoropolymers such as copolymers of vinylidene fluoride (VDF) and trifluoroethylene (TrFE). These polymers possess remarkable ferroelectric and piezoelectric properties. Ceramics such as PZT (lead zirconate titanate) or BNT (sodium bismuth titanate) also display such strong electroactive properties. My PhD thesis entitled “Study of the multi-scale piezoelectric behavior of innovative micro and nano-structured composites” aims to combine piezoelectric fluoropolymers and piezoelectric ceramics to prepare microstructured and nanostructured electroactive hybrid materials. Such materials may possess original properties generated by the coupling of the piezoelectric character of the parent materials. A key feature for the coupling of these electroactive properties is the stability of the polymer/ceramic interface when it is placed into an alternative electric field of various frequencies. A crucial objective of my work is thus to prepare functional fluoropolymers with superior adhesion properties able to generate a sufficiently stable polymer/ceramic interface. To do so, we chose to prepare such functional P(VDF-co-TrFE) copolymers using RAFT polymerization (Reversible Addition Fragmentation Transfer). The RAFT technique not only allows us to control the size of the polymer chains but also gives functionalizable chain ends on which it will be possible to graft adhesive groups such as catechol functions to create polymer acting as adhesion primer.

Covalently binding the polymer onto the ceramic surface may be the only viable solution. To do so, surface-initiated radical polymerization is a very powerful technique. Learning this method in Kyoto University would be very beneficial to my PhD studies.

7. Research implementation and results under the program

Title of your research plan:

Synthesis of innovative polymer grafted Silica Nanoparticle by Surface Initiated RAFT polymerization (SI-RAFT)

Description of the research activities:

The research started with a bibliographic review of the different RAFT syntheses previously made with NVC (N-Vinyl Carbazole) that paves the way to a better understanding of the way this monomer polymerizes. NVC is described as a LAM (Less Activated Monomer) and its polymerization is well controlled by xanthate chain transfer agent (XA CTA). The reaction conditions (Monomer/CTA/AIBN ratio, solvent and initiator used, time et temperature of the reaction…) were chosen according to what has been found in the literature and tested on NVC RAFT polymerization. Various conditions have been tested for this polymerization and surprisingly, a high Initiator to CTA ratio gives a better control (not a common result in RAFT polymerization. The different tested conditions are summarized in the following table :

	RATIO [M]:[CTA]:[I]	TIME H	TEMP °C	CONVERSION %	$M_{N,GPC}$ G/MOL	Đ
PNVC 0.1	200:1:0.1	20	70	12	3000	1.69
PNVC 0.5	200:1:0.5	20	70	90	16400	1.37
PNVC	1000:1:0.5	3	90	89	56000	1.53
PNVC	1000:1:0.5	24	70	92	64600	1.57

In parallel, Xanthate decorated Silica Nano Particles (SiP-XA) were prepared via a two-step synthesis. The first step consists in grafting BPHE moieties which also are ATRP (Atom Transfer Radical Polymerization) agent by a sol-gel reaction. The functionalization was confirmed by leading surface-initiated ATRP with methyl methacrylate (DP_{target} = 1200). The polymer obtained show high molecular weight (190kg/mol) and low dispersity (Đ = 1.39) and has been successfully grafted on the SiP (grafting characterized by Thermogravimetric Analyses) emphasizing the good grafting of the BPHE moieties on the SiP. The second step (grafting of the XA moieties) has been achieved by substitution reaction and the SiP-XA tested with NVC and VAc RAFT polymerization. No PNVC nor PVAc was grafted on the particles. This bad result should come from a problem in the second step of the functionalization of the SiP-XA so the synthesis of another batch of decorated particles has been started.

No polymer was grafted on the SiP during this mission but affordable conditions for the RAFT synthesis of NVC have been chosen.

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

9. Advisor’s remarks (if any):

I hope all of Vincent's experience in Japan will be of great help to his future life. I would like him to continue our collaboration and achieve fruitful results.

JSPS Summer Program 2019
Research Report

1. Name: Nicolas Debons （ID No. SP19210）

2. Current affiliation: Sorbonne University

3. Research fields and specialties:
Chemistry

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Prof. Toshiyuki IKOMA

6. Description of your current research

Tissues can be damaged by diseases, injuries or traumas and necessitate treatments to help their repair, replacement or regeneration. Some strategies exist, as the autograft and the allograft, but they are strongly invasive and their final result is full of uncertainties. The field of tissue engineering is an interesting alternative as it relies on the intrinsic self-healing abilities of the body: the new gold standard is to develop low-invasive biomaterials to restore or improve tissue integrity.

Let’s focus on the main actors of tissue engineering. Cells evolve in a dynamic microenvironment, where biochemical and biophysical signals are necessary. To translate this in regenerative medicine, strategies have to be found to combine scaffolding (*ie* providing the best structure around the cells) and signaling (*ie* controlling the specific interaction with the targeted cells to trigger a given cell behavior).

I am developing composite biomaterials based on type I collagen (the most abundant protein in the matrix around the cells) and silica nanoparticles (SiNPs). SiNPs surface chemistry can be tuned in order to interact with collagen and/or cells. My work aims at building interfaces between functional SiNPs with (1) cells and (2) collagen, to control good cells adhesion, differentiation and proliferation, and the matrix structure and properties respectively.

There are four main objectives in this work: the synthesis of SiNPs with a controlled surface chemistry; the processing of hybrid silica-collagen materials; the characterization of the matrix structure; and its biocompatibility and biological effect on targeted cells. I considered different types of materials to mimic cells environment, from nervous regeneration on 3D collagen threads, to skin cells adhesion onto 2D collagen membranes.

7. Research implementation and results under the program

Title of your research plan:

Synthesis of composite silica nanoparticles (SiNPs) – collagen membranes with 1D aligned collagen fibers under a high magnetic field.
Assessment of cancer cells attachment depending on the SiNPs surface chemistry.

Description of the research activities:

We first focused on the best conditions to get 40 µm thick collagen membranes with well-defined collagen fibers, with the collagen used here and the one I use in France.

We went then to NIMS at Tsukuba to take advantage of a special set-up with a 13T magnet (1 million times Earth's magnetic field). I mixed collagen and surface engineered SiNPs, and let them interact during the magnetic alignment of the fibers.

I then characterized the composite collagen membranes thanks to FT-IR spectroscopy, optical and scanning electronic microscopies. No global alignment of the collagen fibers was observed in the ranges of SiNPs size and concentration.

I still cultured cancer cells on the composite membranes in order to assess cells attachment depending on the SiNPs surface chemistry. I have observed cancer cells attachment under a fluorescent microscope and I have now to process the data.

We finally came back to Tsukuba to produce a last set of membranes with another set of SiNPs in order to use these membranes in France with neural-type cells.

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

I had a really good time in Pr. Ikoma's laboratory. The other students helped me adapt to the numerous facilities. It was a real pleasure to discuss science and cultural shifts with Pr. Ikoma. Going to Tsukuba was also of great interest since the facilities over there are of excellent quality. I am heading back to France full of memories (Tokyo, Kyoto, Nagoya, Hakone, Kamikochi, Nikko visited with JSPS fellows) and of collagen membranes to test!

9. Adviser's remarks (if any):

Nicolas is so smart student, works really hard, and makes good relationship with my students. We also spend wonderful time with Nicolas.

JSPS Summer Program 2019
Research Report

1. Name: Emmanuel Senft	（ID No. SP19211）
2. Current affiliation: University of Plymouth	
3. Research fields and specialties:	
Engineering Sciences	
4. Host institution: Intelligent Robotics and Communication Laboratories, ATR (Advanced Telecommunications Research Institute International)	
5. Host researcher: Prof. Takayuki Kanda	

6. Description of your current research

I research and develop Interactive Machine Learning systems for robots interacting socially with humans. My previous research was centred around SPARC (Supervised Progressively Autonomous Robot Competencies), a framework of interaction allowing humans to teach robots to interact with humans in the real world.

I will soon start a position researching how robots can learn to collaborate with humans and assist them in industrial tasks. In this project, we will bring collaborative robots to factories building aircraft, and use them to decrease the workload for workers in these facilities.

My research lies at the intersection between Human-Robot Interaction, Interactive Machine Learning and Learning from Demonstrations. I want to make robots useful in the real world and able to learn from humans how to support them in a wide range of tasks.

7. Research implementation and results under the program

Title of your research plan: Robots communicating yielding intention through body rotation

Description of the research activities:

During this research stay, I experimented with navigation for robots, and especially social navigation in narrow environments. I improved my familiarity with classical tools used in robotic research (ROS), and used them to develop an autonomous behaviour allowing a robot to produce four different yielding strategies for crossing humans in narrow corridors. These behaviours are inspired from human observations (both published works and observations from in-house pilots). When crossing is narrow spaces, humans tend to step on the side and slide forward, rotating their bodies just before crossing the other party. We deconstructed this motion into three parts: a first side-step, a sliding motion and a body rotation. We implemented these behaviours on a robot, and allowed two variations. First the robot can slide forward or not, simply waiting for the human to cross it. And second, the robot can rotate its body or not. With this project, we want to observe if the robot can adapt its behaviour to make its intention to yield the way clearer for humans.

This behaviour was tested in pilot studies with over 20 subjects from the research institution. From these pilot studies, we refined the behaviour and the study design. The final study will be run in the weeks following my departure by people I have worked with during the stay. Results from this final study will be submitted at HRI 2020, the main conference for research in Human-Robot Interaction.

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

This project was a great opportunity for me to collaborate with world-renowned roboticists, explore a new side of Human-Robot Interaction I did not know and experience the life in Japan as someone working there. I had been in Japan as a tourist, but actually living in a place and working there is a different experience.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Aurélien VELLERET	（ID No. SP19213 ）
2. Current affiliation: Institut de Mathématique de Marseille, Aix Marseille Université	
3. Research fields and specialties:	
Mathematical and Physical Sciences	
4. Host institution: Kumamoto University	
5. Host researcher: Daehong KIM	

6. Description of your current research

In my previous works, I have presented general conditions ensuring existence and uniqueness of quasi-stationary distributions in the general context of --possibly non-reversible-- continuous-time and continuous-space Markov processes.

My approach was of course inspired by the model of genetics I had first considered, which may partly explain its specificity. The implications of these assumptions extend well beyond the mere existence and uniqueness of this distribution into what I described as the quasi-ergodicity of the process. To put it simply, it means that the dependency on the initial condition of the process vanishes in the long run, both when we look at the law of surviving realization (at time t) and their averaged history backward in time. It means also that the long-term effect of this dependency on the initial condition can be summarized into the evaluation of a single function.

Under my assumptions, I deduce that the convergence to the quasi-stationary distribution is exponential, with a multiplicative constant being possibly non-uniform over the initial conditions. This dependency, and especially its non-linearity, is another specificity of my paper. It is naturally related to the time needed for the process to reach areas where it can survive well. I've considered several models of adaptation as application of these results.

7. Research implementation and results under the program

	Title of your research plan: Generalization of Harris recurrence to Feynman-Kac models, with applications to Large Deviation principles

Description of the research activities:

This research internship yields very promising results, that shall certainly conclude in at least two publications in the near future. In the first article, I plan to present the interpretation of the Large Deviation principle for general additive functionals in term of the quasi-ergodicity of related stochastic processes with some additional Feynman-Kac penalization. Although this condition is not a necessary one, the range of applications of this method is certainly large. We shall focus in this article on original yet easy to justify examples. Some extensions to more general features is intended for the second paper. At least, numerical simulations already provide very promising results (although not yet thoroughly justified) for this model of a population facing a gradual environmental change. Now that I have completed the code, it is mostly a matter of time to exploit the data before a precise interpretation can be given.

The seminar that I presented in Kansai University and the conference I attended in Fukuoka gave me wonderful opportunities to discuss with specialists of probability, and specifically of Large Deviations and long time estimates of processes with Feynman Kac penalization. By joining this research program, I could confirm that my project is notably inovative. The new techniques that I learned during my PhD to prove the quasi-ergodicity of submarkovian processes may be a significant breakthrough, which I hope may highlight this link between Feynman-Kac quasi-ergodicity and Large Deviation estimates.

The aim of Large Deviation techniques is to justify the existence of an exponential decay in time for the probability of observing a given difference (constant in time) between the average (over the time-interval) of some additive functional and the value to which this average shall converge. At the core of the proof lies classically an optimization procedure that I highlight in my proofs. In the same way as in statistical physics, it is much more convenient to compute in the canonical perspective than in the micro-canonical one, considering these related Feynman-Kac biased models is much more convenient than estimating directly large decaying rates in probability. In view of estimating by numerical methods the constraints on the value of the averaged additive functional, one can rely on the characteristic features of the quasi-ergodicity for the Feynman-Kac biased processes. In other words, one can translate the problem of evaluating exceptional behavior into the study of how some related modifications of the process alter its typical behavior. Rather than exploiting some thresholds on this error term (for the average), this reparametrization by the strength of the bias is much easier to deal with. It gives us moreover more insight upon what happens for the process conditioned on having such large deviation.

8. Comments, including any cultural experience during your stay in Japan:

I participated in the regular sessions of discussion in japanese intended for international students at Kumamoto university. This has been for me a perfect way to get used to talk informally even with japanese students. Of course, I also took much time to visit the marvelous temples and landscapes of Japan. The festival at Fukuoka has also been very impressive. The craftmanship in Japan is of an astonishing quality that there are too many things I would love to take back home ! Although the activities have ended quite early, I could join with great pleasure the training of Shorinji Kempo and meet with japanese students there.

JSPS Summer Program 2019
Research Report

1. Name: Lise DESCHUTTER （ID No. SP19214　）

2. Current affiliation: University of Lille

3. Research fields and specialties:

Physical Sciences

4. Host institution:

Atmospheric Chemistry, Kyoto University

5. Host researcher:

Pr. Yoshizumi Kajii

6. Description of your current research

Currently, in the atmosphere many instruments recording its chemical composition allow us to get more information about its components. It is possible to detect aerosols using a Fourier Transform Infrared (FTIR) spectrometer in order to quantify the nature, the size and the concentration of atmospheric particles. These properties are strongly linked to the optical properties of the aerosols, which can be described by the complex refractive index (CRI). The physical, chemical and optical characteristics of aerosol can influence directly and indirectly the radiative transfer of the atmosphere. It remains a large uncertainty of their quantitative effect.

An innovative numerical methodology for restoring the CRI has been developed at Lille University based on laboratory measurements of suspended particle extinction spectra and on a new algorithm which associates the Mie theory, the single subtractive Kramers-Kronig relations and the optimal estimation method. Our main goal is to highlight the link between the optical properties (CRI) and the chemical composition. This method has been applied to silica test particles and natural samples as volcanic ashes and dust particles.

7. Research implementation and results under the program

Title of your research plan:

Physico-chemistry of aerosol, possible link between the aging and the optical properties.

Description of the research activities:

Aerosols and radical species interact with each other through a chemical process, hence the character and chemical composition of aerosols might be changed, this process is called ageing or growing. At Kyoto University a laser flash pump and probe technique has been developed to measure OH and HO_2 radical reactivities and it has been applied to measure their radical uptake on the surface of aerosols for the first time. During this program we combined our techniques in order to measure uptake coefficient of radicals on natural aerosols (brought from Lille University) using the suspended aerosol generation system developed in Lille. Some conclusions were obtained, showing that particles interact with radicals in the atmosphere. The next step is to use these aged particles to evaluate the possible modification of their optical properties. I had also the opportunity to participate to a summer campaign in a polluted area (Yokohama bay) and to collect filters of natural aerosols that can be tested though our system in Lille.

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

In addition to be an efficient starting collaboration between two laboratories, being in Japan thanks to this program was a full cultural experience regarding the work life, the Japanese tradition and way of living and all the new network build.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Romain Rocco BOTELLA （ID No. SP19215）

2. Current affiliation: Institut de Recherche de Chimie Paris (IRCP), France

3. Research fields and specialties:

Chemistry

4. Host institution: Osaka University

5. Host researcher: Prof. Satoru NAKASHIMA

6. Description of your current research

The goal of my PhD thesis work is to bridge a very important gap related to molecular adsorption processes on solid surfaces. Although both solid/vapor interfaces (dry systems) and solid/solution interfaces (wet systems) have been extensively studied, transitions between these two stages remain poorly understood. Drying process is starting from the fully wet surface (infinitely thick water film thickness), passing through unsaturated stages (finite thicknesses of water film) and arriving to the dried system (thin and discontinuous water films). The wetting process can be considered as the reverse transition, and hysteresis may occur. The main question of my research to answer is **what is the influence of hydration/dehydration on the surface speciation of adsorbates on solid substrates?** As water is the main solvent both in industrial and environmental chemistry, a major part of the current work is focused on adsorption from aqueous solutions. These drying/wetting processes might occur in soils and material processing during weather changes or surface treatments of materials to acquire new properties.

As representative systems, drying of small inorganic ions (molybdates, sulfates) on solid substrates, namely Goethite (α-FeO(OH)) and Lepidocrocite (γ-FeO(OH)), has been studied by means of Infrared spectroscopy (Attenuated Total Reflectance). So far the results are showing increase in the coordination number of the adsorbate, and the impact of the wetting/drying cycle will be studied.

7. Research implementation and results under the program

Title of your research plan:

INFLUENCE OF HYDRATION/DEHYDRATION ON ADSORBED MOLECULES: CASE OF PHTHALIC ACID ON GOETHITE

Description of the research activities:

The behavior of organic molecules on solid substrate during wetting/drying cycle was studied at Prof. Nakashima's laboratory in Osaka University during my 2 months stay. To this end, Phthalic acid was chosen as a model system for the interaction between Natural Organic Matter (NOM) and soils (represented by Goethite).

Batch adsorption of Phthalic acid to Goethite were performed and a drop of their mixture suspension were dried to obtain a Goethite/Phthalate deposit. The deposit was then studied by Infrared (IR) transflection spectroscopy during a wetting/drying cycle.

The results showed that the drying of the Goethite/Phthalate interface resulted in important changes, both in initial IR bands of the dried deposit and their wetting/drying behavior. IR bands of Goethite (Fe-O-H) decreased greatly in the presence of Phthalate and IR bands of Phthalate such as COOH showed changes with humidity changes. **The adsorbate (phthalate on goethite surface) appears to show significant effects on the wetting/drying cycle and their physicochemical forms can be greatly modified.**

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

9. Adviser's remarks (if any):

Mr. Romain BOTELLA could obtain significant results on the impacts of wetting/drying cycles (humidity changes) on adsorbed organic molecules on minerals in such a short stay of 2 months by taking advantages of experimental setups developed in my laboratory. He also gave a very nice presentation of his results in our seminar.

JSPS Summer Program 2019
Research Report

1. Name: Harald BAYERLEIN （ID No. SP19301）

2. Current affiliation: EURECOM and Sorbonne University

3. Research fields and specialties:

Engineering Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Prof. Akira HIROSE

6. Description of your current research

Machine learning (ML), the study of algorithms and models that allow computers to execute tasks without being given explicit instructions, has become an indispensable tool to make certain optimization problems tractable, e.g. in data analysis, classification and decision-making. My work focuses on the development and the application of machine learning methods to challenges in wireless communications engineering. This includes all systems that are tasked with the transmission of information, as well as the processing and decision-making based on this information.

Recent applications I have worked on include trajectory planning for unmanned aerial vehicles (UAV) that carry a mobile base station to serve a group of users for events where stationary communications infrastructure has broken down or is overwhelmed (e.g. natural disasters)[1], as well as the optimization of channel feedback in multiple-input/multiple-output (MIMO) wireless communication under challenging conditions. These are examples of application scenarios where no closed-form optimal solutions are known (UAV base station trajectory planning) or where the optimal solution is not practically feasible (MIMO channel feedback). In these contexts, the methods I have worked on included e.g. deep Q-learning, a reinforcement learning technique for training neural networks.

[1] H. Bayerlein, R. Gangula and D. Gesbert, "Learning to Rest: A Q-Learning Approach to Flying Base Station Trajectory Design with Landing Spots," *52nd Asilomar Conference on Signals, Systems, and Computers*, Pacific Grove, CA, USA, 2018.

7. Research implementation and results under the program

Title of your research plan:

Machine Learning for Transmission and Classification of Radar Satellite Data

Description of the research activities:

Data collected by radar satellites observing earth is an indispensable source of environmental information forming the basis for scientific disciplines like meteorology, oceanography or climate research. In comparison to other sensor technologies like optical imaging, radar has the capability to collect data under all environmental conditions, e.g. at night or under cloud cover.

A particular type of radar frequently used is **polarimetric synthetic aperture radar (PolSAR)** which collects data in a manner that is sensitive to the polarization of the transmitted and received electromagnetic waves. One data point generated in this way can be represented by a 4-element vector of real numbers. To further process and analyse the data, it is often useful to find and select only the most distinctive features in the data, or in other words to compress the PolSAR data. Previous work in my hosting lab has extended the theory of neural network-based autoencoders (AE), which are very useful to find these distinctive features, to the **quaternion** number system. The quaternions are an extension to the complex number system that allows for the native representation of 4-dimensional data such as PolSAR data.

During the course of my stay, I extended this framework to allow for autoencoder-based processing of **interferometric PolSAR (PolInSAR)** data. Interferometry is a technique to increase the information content of PolSAR observations further by combining two observations of the same target area. This adds a phase difference to the data that is proportional to the elevation of the observed target area, thereby capturing an essential feature of the observed target area. I implemented an autoencoder that is capable of processing this data natively, the **Phasor Quaternion Autoencoder (PQAE)**.

During my stay, I was also given the opportunity to attend the 2019 IEEE International Geoscience and Remote Sensing Symposium (IGARSS) in Yokohama, one of the biggest conferences concerning the collection and analysis of earth-observational satellite data.

JSPS Summer Program 2019
Research Report

1. Name: Andreas Besginow （ID No. SP19302）

2. Current affiliation: Technische Hochschule Ostwestfalen-Lippe / Institute industrial IT

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Toyota Technological Institute (TTI)

5. Host researcher: Prof. Norimichi UKITA

6. Description of your current research

Development and implementation of a projection-based assistance system to support workers in manual assembly tasks.

Part of the development is the implementation of more flexibility in regard to the task execution and information display, since many assistance systems have very rigid ways of interaction. Machine learning is the tool of choice for these kinds of implementations.

For example, object recognition, using a convolutional neural network, has been implemented to allow the user to easily access information about all of the objects that he is interacting with. The information display is triggered by directly interacting with the object itself, this way to control the system/ user interface is often referred to as tangible interaction.

The current goal is to provide better and more precise feedback to the user while keeping the system easy to maintain and able to work in different scenarios.

To do this, a method to recognize the users' action and determine which step of the assembly is executed needs to be developed. This is the focus of the work during the summer program.

7. Research implementation and results under the program

Title of your research plan:

Development of a Deep Learning-based approach for complex hand action recognition.

Description of the research activities:

First, a literature-based analysis of possible Machine Learning architectures for gesture and action recognition has been carried out and a design to implement has been selected. After the implementation of the software, a dataset has been created. This dataset consists of 6 different actions, based on an industrial assembly process. The dataset consists of 309 videos with a total of approx. 333000 frames, of which 141000 are gesture frames. Using this dataset, a neural network has been trained to recognize the gestures. To perform a qualitative evaluation, a live detection has been implemented to observe the performance of the network. The evaluation shows that all 6 actions can be classified with good precision. Showing that the algorithm has the potential to be used in future industrial applications. Another conclusion from the evaluation was that the dataset is yet too small for high precision detection, but provides valuable insight for qualitative measures of the algorithm.

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

Thanks to the incredible people in my lab, I was able to visit Kyoto and Nara accompanied by them and learning about the culture and life in Japan.
I also greatly enjoyed the Hanabi in Gifu city, which was beautiful and exciting to watch.

9. Adviser's remarks (if any):

The effort of Andreas was great in this stay. His advice and results help students in my lab. Since his research group has been collaborating with our lab for the theme in which he is involved, we continue working together.

JSPS Summer Program 2019
Research Report

1. Name: Jana Boerger （ID No. SP19303）

2. Current affiliation: Georgia Institute of Technology

3. Research fields and specialties:
Engineering Sciences

4. Host institution: RIKEN AIP

5. Host researcher: Kazuki Yoshizoe

6. Description of your current research

My research is concerned with the application of machine learning in the physical world which includes logistics but also other fields of application. Currently I'm working on applying reinforcement learning algorithms in inventory control problems. Inventory control problems require an agent to make decisions on the order quantity of a product from a supplier to meet future costumer demand. The trade-off between holdings costs and backlog costs or lost sales must be considered when deciding on an order. Furthermore, non-linear order cost might also play a role; increasing the difficulty of the decision. Traditionally, these problems have been solved optimally by solving the Bellman equations for the related markov decision process to derive a static (s,S)-policy with which up to S units are ordered once the inventory level falls under s units. Reinforcement learning (RL) approaches have been applied in the past but the state space has been too high to prove to be viable. Today, we can show that using new approaches from reinforcement learning that involve neural networks the optimal (s,S)-policy can be learned and furthermore, we can outperform the traditional approach in more complicated settings that involve seasonality in demand. A challenge in these solutions is the instability of the used algorithms.

7. Research implementation and results under the program

Title of your research plan:

Machine Learning and Search

Description of the research activities:

During my stay at RIKEN AIP, I was working on search algorithms in contrast to learning algorithms that I had previously worked on. The main focus was on the algorithm Monte Carlo Tree Search which is at the core of Expert Iteration and similar algorithms. I implemented the algorithm and the idea is to use machine learning to further improve its performance. This research is ongoing and thus no results are present at this time. We hope to further collaborate.

Dr. Yoshizoe's group is very diverse so that I had the opportunity to learn about heuristic search, graph search, applications in medicine as well as chemistry and topics in learning from imperfect information through weekly group meeting as well as individual discussions with group members.

During my stay, part of my activities included the participation in the 2nd workshop on Machine Learning and Discrete Optimization workshop in July at RIKEN AIP and which I had presented the year before.

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

The JSPS summer program provided me unique insights into Japanese culture. Besides research, I explored Kyoto and Hiroshima with fellow JSPS Fellows. An hiking trip in Hokkaido including the sighting of a bear not far off our trail and exploring Ramen all around Tokyo are experiences that I hold dear. Through language lesson and exchanges in my spare time I tried to learn a little Japanese which I applied when visiting my host family again after having settled in. Finally, I would like to express my thanks to my host supervisor Dr. Kazuki Yoshizoe and RIKEN AIP for hosting me this summer.

9. Adviser's remarks (if any):

JSPS Summer Program 2

1. Name: Nils M. Chudalla （ID No. SP19304 ）

2. Current affiliation: B.Sc. Student - RWTH Aachen University

3. Research fields and specialties: Structural Geology and Numerical Simulations

Humanities Social Sciences Mathematical and Physical Sciences

Chemistry Engineering Sciences Biological Sciences

Agricultural Sciences Medical, Dental and Pharmaceutical Sciences

(Interdisciplinary and Frontier Sciences)

4. Host institution: JAMSTEC

5. Host researcher: Arthur Bauville

6. Description of your current research:

At active plate margins, sediments covering the subducting oceanic get scraped off to form accretionary prism. The continuous accretion of sediments at the margin eventually creates emerged lands. Examples are the Boso and Izu peninsula and a large portion of the Japanese Islands. Furthermore, the creation of faults (i.e. fractures) or the sudden movement of rock masses along these surfaces in accretionary prism can trigger earthquakes and tsunamis. Thus, understanding the formation and mechanical behavior of accretionary is of primary importance for civil engineering, geo-hazard prevention and natural resources usage in Japan.

In most accretionary prisms, e.g. in the Nankai Trough or Japan Trench, faults planes are inclined towards the land (i.e. “forethrust”). However, in some rare places, faults are dominantly inclined in the opposite direction and are called “backthrusts” (e.g. Cascadia, Sumatra). The regions where backthrusts dominate tend to be particularly threatened by tsunami hazard. The goal of my research is to better understand the mechanics of accretionary prisms, and to identify the particular physical conditions and parameters that control the orientation of faults. In this way we hope to better assess the mechanical properties of natural accretionary prisms.

Prior studies have brought some elements of answer. McKay (1995) proposed that an accretionary with a high basal angle a low basal resistance would favor the formation of backthrusts. Cubas et al. (2016) performed numerical simulations that confirmed and quantified McKay’s proposal. On the other hand, Gutscher (2001) produced a backthrust-dominated accretionary prism analog with a horizontal base using sand, thus contradicted the results of previously mentioned studies.

7. Research implementation and results under the program

Title of your research plan:

Control of geometry and mechanical properties on the orientation of faults in accretionary prisms

Description of the research activities:

Our goal is to determine the mechanical conditions that control fault orientation. We use a numerical method to simulate the flow of rocks of geological time scales with boundary conditions which reproduce the conditions at an active plate margin.

The model successfully produced accretionary prisms dominated either by forethrusts, backthrusts or pop-up structures and we were able to determine quantitatively the mechanical parameters that control fault orientation. In the model, backthrusts formed systematically for low basal angle and low basal stress but not for high basal angles. This is in agreement with previous analog experiments but in contrast with simulation studies. We attribute the difference to initial assumptions in the mathematical models used in the various studies.

After concluding my summer project in Japan, I will continue this work as part of my master thesis back in Germany. The final step is to apply of the simulation results to natural examples from Cascadia and the salt-related Carpathian foreland in Romania which formed in a geological context similar to accretionary prisms.

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

The JSPS Summer Program allowed me to immerse into Japan's culture very smoothly after the introduction week. I am leaving Japan with wonderful memories and great new friends. Even though I spent a lot of time in JAMSTEC, I could spend my weekends to visit people from the Summer Program and explore the country together with them. The research at JAMSTEC was very productive and was conducted in an open and friendly environment.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Philipp Flotho
（ID No. SP19305）

2. Current affiliation: Saarland University

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

4. Host institution: Okinawa Institute of Science and Technology Graduate University

5. Host researcher: Dr. Bernd Kuhn

6. Description of your current research

My current research focus are quantitative and qualitative motion analysis techniques in the context of biomedical imaging and psycho-physiological experiments.

On the one hand, even the smallest motions in videos can carry information such as micro expressions in the face or other small and or slow movements. On the other hand, due to small signal-to-noise ratio and the propotional relation of spatial image gradients and motion magnitude on motion induced artefacts, unwanted motion can be a large noise source in the context of many biomedical imaging methods.

Denoising with image registration, motion quantization with tracking and motion visualization with motion magnification approaches are related groups of different motion analysis techniques and I try to combine those in a non-parametric Lagrangian framework. I am making use of recent advancements in related computer vision areas and adapt them to the unique challenges of different biomedical imaging modalities and settings.

7. Research implementation and results under the program

Title of your research plan:

Modification and Application of an Optical Flow Based Non-Parametric Image Registration Approach for Two-Photon Brain Imaging

Description of the research activities:

In the context of two-photon imaging, optical flow based image registration methods are generally considered to be too prone to noise to remove motion reliably. In the first part of the project, we benchmarked a new, robust, optical flow based motion reduction approach on different two-photon brain recordings with non-rigid and non-elastic motion contamination. The method and parameters have been modified to fit the challenges of the data and extended to exploit redundancies in the data.

The preliminary results suggest, that our approach results in much better signa-to-noise ratio than motion correction with rigid registration. Qualitative comparisons show a better registration performance on challenging datasets than state of the art toolboxes for non-rigid registration such as NoRMCorre. In the second part of the project and as ongoing work, we have started planning and implementing an ImageJ / Fiji Plugin with the goal to extend the toolbox with a user interface for interactive parameter selection and image registration as well as parameter selection heuristics.

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

The JSPS summer program has been culturally and scientifically a very enriching experience that I can recommend to any PhD / Master's student with an interest in Japan. I received valuable guidance and lots of scientific input regarding my research and had many interesting discussions with people from all different faculties. The research results of the summer program contribute well to my phd work and we will continue the collaboration in the future.

9. Adviser's remarks (if any):

Movement artifacts are hampering two-photon imaging projects with low signal-to-noise ratio. Due to this interdisciplinary JSPS Summer Research project we were able to reduce this problem significantly. We collected experience and will develop a simple-to-use plugin for ImageJ - online available and a useful tool for many researchers worldwide.

JSPS Summer Program 2019
Research Report

1. Name: Tom Goertzen	（ID No. SP19306 ）
2. Current affiliation: RWTH Aachen University	
3. Research fields and specialties:	
Mathematical and Physical Sciences	
4. Host institution: University of Tsukuba	
5. Host researcher: Prof. Daisuke SAGAKI	

6. Description of your current research

In the context of my Master's thesis I got interested in the field of Lie algebras. My supervisor in Germany, Professor Fourier, gave me a Paper written by Vyjayanthi Chari, Daisuke Sagaki and himself called "Posets, Tensor Product and Schur Positivity" published in the Journal "Algebra Number Theory 8 (2014) 933-961.

The authors define for every Lie algebra a family of preorders on a set of tuples of dominant weights. For a specific subfamily of these preorders, the classes of the equivalence relation induced by the preorder coincide with the sets of tuples with the same content. Furthermore, the authors establish the following: Each tuple defines a tensor product of simple finite-dimensional modules and the dimension of this tensor product increases along the defined preorder, which means the dimension pre-order on the tensor products is always preserved by the preorder on the tuples. In certain cases, even the inclusion preorder on tensor products is capable with the module structure. The authors make the conjecture that this is true in wider generality. This would imply Schur positivity in the case of the special linear algebra. Independent of them Thomas Lam, Alexander Postnikov and Pavlo Pylyavskyy gave some evidence for this conjecture in their paper "Schur positivity and Schur log-concavity" (Amer. J. Math 129(6):1611–1622, 2007). As did Galyna Dobrovolska and Pavlo Pylyavskyy in a paper published in 2007 in J. Algebra , 316(2):706–714.

My first goal was to understand the paper and together with my host professor Daisuke Sagaki our next goal was to extend the results of the above mentioned paper.

7. Research implementation and results under the program:	
	Title of your research plan: Improvements on Schur Positivity Conjecture
	Description of the research activities: After my arrival in Tsukuba I discussed my work plan with Professor Sagaki. He introduced me to his PhD and Master Students and we all gave presentations about our research interests to give a basis for further discussions. I implemented a computer program using the computer algebra system Sage to test the conjecture in low dimensional cases. and reformulated the conjecture to simplify the theory in special cases. Professor Sagaki and I had weekly discussions about my work. He gave me fruitful advice and introduced combinatorial methods to me that have been of great help. I discussed a lot with his PhD students inside the group and showed them how computational methods can be used to test new methods and to generate inspiring examples. For one week I participated in the second international undergraduate mathematics summer school at the University of Tokyo. Together with my host supervisor we made the first steps to generalize the conjecture and I am looking forward to carry on the research with this ideas in Germany.
8. Please add your comments, including any cultural experience during your stay in Japan (if any): I enjoyed the stay the Japan. Especially staying a weekend with a host family was a unique cultural experience for me. We had a lot of fun together including cooking together and visiting different places like the Ramen museum in Yokohama and the island Enoshima. Experiencing the working environment in Tsukuba including the many discussions there was another positive thing I will not forget. I explored Tsukuba by bike, went to Mount Tsukuba, discovered fascinating sides of Tokyo and had the chance to ascend Mount Fuji.	
9. Adviser's remarks (if any): "During this summer program, we discussed our problem many, many times. They were very fruitful for both us. It is remarkable that the researcher tried to find a graph structure in the set of Littlewood-Rechardson tableaux, which will provide a new interesting topic in the representation theory in the near future."	

JSPS Summer Program 2019
Research Report

1. Name: Jan HAGENLOCHER （ID No. SP19307）

2. Current affiliation: Eberhard Karls Universitaet Tuebingen

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Institute for Molecular Science, Okazaki

5. Host researcher: Prof. Satoshi Kera

6. Description of your current research

In my current research I'm interested in the impact of structural and morphological imperfections on the energy level alignment in organic semiconductor heterostructures. Organic semiconductors are small molecules consisting mainly of carbon and hydrogen which, due to their electronic configuration, show semiconducting behaviour and can be used in (opto-)electronic devices such as organic light emitting diodes (OLEDs) or organic photovoltaics. The most successful devices consist thereby of two (or more) layers of different organic thin layers forming a so-called heterostructure. A critical parameter for the device fundamental functionality and efficiency are the energy barriers arising between the frontier molecular orbitals (highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO)) of the respective layers. By knowing the energy values of every molecular orbital, in principle, it should be possible to manufacture the most efficient devices. However, due to a phenomenon called energy level alignment, the prediction of energy barriers proves to be difficult. The model we use to explain energy level alignment is the so-called "gap-state model", where electronic states arise in the formerly forbidden energy gap as a result of structural defects. As a result of those gap-states electrons can transfer from the substrate or a different layer and lead to an up- or downward shift of energy levels and, with that, to different energy barriers. My main goal is it to study the impact of different kinds of structural defects on the density of gap states and their impact of gap-states on the energy level alignment in different heterostructures. By changing the substrate temperature during the growth of organic thin films it is possible to change the density of structural defects which can be studied using different x-ray scattering techniques or atomic force microscopy.

7. Research implementation and results under the program

Title of your research plan:

Impact of structural defects on the gap state density and the energy level alignment in organic heterostructures.

Description of the research activities:

Using the ultra-low background ultraviolet photoelectron spectroscopy (UPS) setup at the IMS in Okazaki, I was able to quantify the number of gap states in different organic heterostructures and study their impact on the energy level alignment. Getting UPS data in high enough quality to directly observe gap states is something very special and Prof. Kera's setup is one of only ones in the world where this is possible. By altering the substrate temperature (250 K, 300 K and 350 K) the density of structural defects can be controlled. As expected, using a lower temperature led to a higher density of gap states and a higher interface dipole (a measure for transferred electrons). Additionally, I was able to measure the density and impact of gap states thickness-dependent in 2 nm increments for thicknesses up to 40 nm. Combing this with already existing real-time structural data will allow for a comprehensive description of the relationship between structure and electronic properties in organic heterostructures.

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

My time in Japan was full of cultural experiences. First of all, Prof. Kera's group welcomed me very sincere and I spent a lot of time with Japanese colleagues, getting to know Japanese life. The weekends I used for travelling to different cities in japan, e.g. Kyoto, Hiroshima or Nagoya, where I visited temples, shrines, museums, etc. It was very interesting to learn about the Japanese history and the development in recent years. The people everywhere, were really nice, helpful and open.

9. Adviser's remarks (if any):

File name：SP19308_Research Report

JSPS Summer Program 2019
Research Report

1. Name: Jennifer KAPPE （ID No. SP19308）
2. Current affiliation: Justus-Liebig-University Giessen (JLU), International Graduate Centre for the Study of Culture (GCSC)
3. Research fields and specialties: Humanities (Literary and Cultural Studies)
4. Host institution: Keio University, Tokyo
5. Host researcher: Prof. Kentaro KAWASHIMA
6. Description of your current research In my current research, I seek to examine unipolar and bipolar depression in contemporary literary texts. According to the World Health Organization, depressive disorders affect approximately 300 million people on the planet and pose crucial challenges to our societal, cultural, and economic systems. With depression being one of the leading causes of incapacity to work, disability, and suicide worldwide, it is thus legitimate to speak of a global yet mostly invisible mental health crisis. It eludes public perception and is rather characterized by its absence on the scientific, social, and political agendas. Medicine reaches its limits, politics refuse responsibility, and media coverage is shifting between misinterpretation and sensationalism. The perception of depression still oscillates between medical diagnosis, social pathology, and individual deficiency. Hence, the life-threatening disease is still rather experiencing intolerance, discrimination, and (self-)stigmatisation. (Auto-)fictional literature, however, has always made such threats to the *conditio humana* one of the main points on its agenda. Literature (self-)reflexively comments on critical societal conditions and cultural concerns like mental ill-health. In my research, I focus on the genre of German and Anglophone autofictional memoirs and the way they employ narrative, rhetoric, and stylistic strategies. By anchoring the abstract pathology of depression in an individual biography, literary narratives not only convey but also develop knowledge where other discourses struggle. These narratives also provide a vocabulary for speaking about the unspeakable. They enable thought-experiments for the unthinkable. Moreover, by giving a voice to individuals otherwise often suffering in silence, literature helps to establish a public discourse to raise knowledge, reduce stigmatisation, and fight ignorance of mental ill-health issues in general. Analysing literary texts that depict depressive disorders helps to better understand both the pathologies and the sociocultural mechanisms that shape the illnesses.

7. Research implementation and results under the program

Title of your research plan:
Autofictional Japanese and German writing on depressive disorders

Description of the research activities:
My research activities in Japan include a project presentation, one draft analysis of a primary text, two interviews with an author and a translator, reading of relevant primary and secondary literature, and writing a theory subchapter of my dissertation.
I presented an overview of my project and a first analysis of a text that I had worked on during the first weeks of my research stay in the research colloquium of German Studies at Keio University, hosted by my host Prof. Kentaro KAWASHIMA. The questions and the feedback I received were very useful. I will continue to work on especially two larger aspects that were proposed to me by Prof. Kawashima.
Regarding one primary text, I had a meeting with Dr. Jisung KIM, who translated the German original text on depression and mania into Japanese. We discussed the challenges and possibilities of translating the text with regard to language, culture, and genre. The interview gave me invaluable new insights not only into the text but also into Japanese social, cultural, and literary landscape.
Further, my Japanese advisor put forward the idea to interview in Fukushima Mr. Sokyu GENYU, the zenmonk-author of a Japanese text on depression, mania, and schizophrenia that I read in the German translation. I conducted an interview with him on the cultural construction of normalcy and mental ill-health, causes of depression as well as spiritual ways of dealing with it, and symbolism in his text. This was possible due to the financial support by the JSPS research allowance, as I could hire a translator for the interview, pay a remuneration to the author, and cover travel expenses.
I managed to read the relevant secondary sources for my theory chapter and wrote a first subchapter. In addition, I worked on some primary texts of my dissertation corpus.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):
I am very grateful for having had the opportunity to immerse so deeply into the Japanese (research) culture! Apart from the interesting discussions with my Japanese advisor as well as the students at Keio University, I got to know many other lovely Japanese people, tried many delicious Japanese dishes and learnt about Japanese cuisine, travelled and explored many beautiful places during my stay in Japan. These travels include hiking Mt. Fuji and Tateyama, walking through beautiful shrines in Kyoto, Nara, and Nikko, and visiting Hiroshima, Magome, Tsumago, and Kanazawa. In addition, I visited various museums in Tokyo, some of which had very interesting and unique narratives also relevant for my research, for instance the exhibition *The Soul Trembles* from Mrs. Shiota CHIHARU at Mori Art Museum. Thank you for making all these wonderful encounters and experiences possible!

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Male KOESTER
（ID No. SP19310）

2. Current affiliation: Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research

3. Research fields and specialties: Geosciences, Marine Geochemistry

4. Host institution: Center for Advanced Marine Core Research, Kochi University

5. Host researcher: Dr. Myriam KARS (Assistant Professor)

6. Description of your current research

The deep subseafloor biosphere, which describes any habitats extending deep into ocean sediments and rocks, represents one of the Earth's largest ecosystems. It is, however, also the most poorly understood ecosystem. The International Ocean Discovery Program (IODP) is an international marine research collaboration that explores the Earth's history and dynamics. Different platforms and drilling vessels are deployed to recover sediment samples from the deep biosphere.

My PhD project is related to IODP Expedition 370, which aims at exploring the potential temperature limit of microbial life in sediments in the Nankai Trough off Shikoku Island, Japan. Besides characterizing microbial communities and their activities, another aim is to investigate the availability of nutrient and energy substrates that potentially sustain life in the deep biosphere. The overarching goal of my PhD project is to decipher the role of iron mineral phases in maintaining life in deep subsurface sediments in the Nankai Trough by applying sequential extraction of different iron mineral phases and iron isotope analyses. Stable iron isotopes are a useful tool for tracing iron sources and reaction pathways and discriminating biotic and abiotic processes that altered the primary sedimentary record.

Iron (oxyhydr)oxides are important carriers of sedimentary magnetic signals. Diagenetic cycling, in particular the reductive dissolution of iron (oxyhydr)oxides driven by microbial degradation of organic matter and/or by reactions with hydrogen sulfide, may lead to transformations of primary ferrimagnetic iron (oxyhydr)oxides to secondary iron sulfides and thus, to modification of rock magnetic properties. Since the sequential extractions of iron oxides is not entirely mineral-specific, the rock magnetic properties of sedimentary sequences can reveal further information about the composition and grain size of magnetic mineral assemblages.

7. Research implementation and results under the program

Title of your research plan:

Effect of diagenetic iron cycling on rock magnetic properties in sediments from the Nankai Trough, Japan – IODP Expedition 370

Description of the research activities:

The aim of my research stay at the Center for Advanced Marine Core Research (CMCR) at Kochi University was to combine my geochemical data with the rock magnetic results already conducted by Dr. Myriam Kars as well as to perform additional rock magnetic analyses in order to assess the diagenetic overprint of sediments from the Nankai Trough. These analyses include (1) magnetic hysteresis and isothermal remanent magnetization (IRM) measurements, (2) extraction of magnetic minerals and the subsequent (3) mineralogical analyses by scanning electron microscopy with energy dispersive spectroscopy (SEM-EDS).

(1) Magnetic hysteresis measurements were performed using a vibrating sample magnetometer (VSM) to characterize magnetic mineral assemblages in deep sediments of the Nankai Trough. The magnetic parameter IRM is the magnetization acquired by a sample after being exposed to a large magnetic field for a short time. Magnetic mineral assemblages in marine sediments are often a mixture of different iron minerals. In order to "unmix" the magnetic mineral components, I decomposed the measured IRM acquisition curves into four different end-members by using the MAX UnMix web application (Maxbauer et al., 2016).

(2) The magnetic extraction is a useful technique to separate strongly magnetic minerals from the non-magnetic matrix. For this extraction, deionized water was added to approximately 1g of sediment. The magnetic particles were extracted from this sediment slurry by dripping it through a burette, which was attached to a strong permanent neodymium magnet. The non-magnetic slurry was then collected and filtered. After removing the magnet, the burette was rinsed with deionized water and the magnetic particles were also collected and filtered.

(3) After extracting the magnetic particles, the iron mineralogy of both, the magnetic and the residue separates, were analyzed by SEM-EDS. The SEM was used to capture images of different iron minerals and their elemental compositions were obtained by EDS.

The results of both, the end-member unmixing and the mineralogical analyses complement my geochemical data and improve our understanding of the iron and sulfur cycling in deep sediments of the Nankai Trough. The data obtained during my research stay at the CMCR will be incorporated into my PhD project and we are currently working on a joint publication.

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

My stay in Kochi has provided great insight into life and academia in Japan. The way of life in Kochi is still traditional and I enjoyed the cultural experience and the Japanese cuisine very much. I visited the Ino-cho Paper Museum and participated in a *nagashizuki* papermaking workshop. Kochi Castle is worth visiting since it is one of just twelve Japanese castles, which have survived the post feudal age. One of the highlights was the *Yosakoi Matsuri*, which is a traditional dance festival, taking place every August in Kochi. The nature on Shikoku Island is unique and I got the chance to visit many beautiful places including the Shikoku Karst Natural Park, the Capes of Muroto and Ashizuri as well as the deep blue waterfalls Nikobuchi and Uryu. Furthermore, I went to Kyoto and Hiroshima for weekend trips, where I could visit different culturally important places. Overall, I thoroughly enjoyed my time in Japan, not only from a cultural, but also from a scientific point of view. I am very grateful to JSPS for offering me the opportunity to participate in the Summer Program. I am also very thankful to my supervisor Myriam Kars for all her support during my stay in Kochi. I am looking forward to our future collaboration.

9. Adviser's remarks (if any):

Male has done an excellent job at the CMCR, by conducting a lot of measurements and observations. Upon her arrival, she has given a seminar in my institute to present her research project. She has spent most of her time in the laboratory acquiring new data which were helpful for her project. We had very interesting discussions about the results and future joint publications. It was a great pleasure to host Male, her enthusiasm and easy-going character were appreciated by everyone. She will always be welcome in Kochi. This collaboration is certainly just the beginning of many others. I wish her success in her PhD, she's undoubtedly a promising future researcher. I'm very grateful to Male for the very good time together at and outside work. I would like to thank JSPS for support and providing this amazing opportunity for young overseas students/postdocs to conduct a part of their research in Japan.

JSPS Summer Program 2019
Research Report

1. Name: Manuel Lechner （ID No. SP19311）

2. Current affiliation: Ulm University

3. Research fields and specialties: Chemistry

4. Host institution: Kanazawa University

5. Host researcher: Prof. Yuji Kikukawa and Prof. Yoshihito Hayashi

6. Description of your current research

We developed vanadium-based POMs. Recently, we successfully synthesized the discrete tube-type structure $[Ba_4(dmso)_{14}V_{14}O_{38}(NO_3)]$ (**{$Ba_4V_{14}(NO_3)$}**, dmso = dimethyl sulfoxide). The structure of **{$Ba_4V_{14}(NO_3)$}** is determined by single crystal X-ray analysis. The cluster is composed of 14 square pyramidal $[VO_5]$ units arranged around a central nitrate template, which results in a tube-shaped vanadium oxide arrangement incorporating two binding sites on top and bottom of the cluster shell. The tube is capped by four Ba^{2+} ions. During our investigation, we found **{$Ba_4V_{14}(NO_3)$}** is quite stable to investigate catalytic performance, although most vanadium-based POMs are easily isomerized. We found **{$Ba_4V_{14}(NO_3)$}** acted as an efficient catalyst for the oxidation of 9,10-dihydroanthracene to anthraquinone under 8 bar oxygen conditions. In this reaction, the re-oxidation of the catalyst became the rate-limiting step. To overcome the limitation, the developments of the reaction system and/or of the modification of **{$Ba_4V_{14}(NO_3)$}** is required. Current limitations to catalytic activity are identified and future directions based on combined chemistry and chemical engineering approaches are discussed to show that this approach could lead to sustainable production methods in industrial chemistry based on alternative energy sources and chemical feedstocks. As preliminary experiment, we started to use a self-developed flow-reactor system (the so-called slug-flow process). With this system, the reaction rate was significantly increased. On the other hand, we faced the difficulty to modify the $\{V_{14}\}$ cluster.

7. Research implementation and results under the program

Title of your research plan:

Synthesis and modification of tube-type $\{V_{14}\}$ vanadium-oxide cluster structures incorporating redox-active metal centers

Description of the research activities:

In the last weeks I was able to learn about new synthetic strategies and new synthetic routes to synthesize several vanadium oxide clusters with different template ions. First of all, I had to synthesize the precursor for further modification. As a precursor I used the $\{V_{10}\}$ cluster structure, which was made in a one-pot synthesis. Next step was the cluster enlargement of $\{V_{10}\}$ structure to obtain the $\{V_{12}\}$ structure. This step was done by addition of peroxide to the reaction mixture of the cluster in nitromethane as solvent. With this synthetic procedure I was able to expand the cluster shell from a $\{V_{10}\}$ structure to an enlarged $\{V_{12}\}$ structure. This $\{V_{12}\}$ cluster has the shape of a bowl and can serve as a host for an additional organic guest molecule. In the synthesis the nitromethane serves not only as solvent, it is also able to be this guest to lead to the final cluster structure $\{V_{12}(CH_3NO_2)\}$. Concluding the last step, I was able to expand this cluster shell even further to create a $\{V_{14}(Y)\}$ ($Y=NO_3^-$, N_3^-, OCN^-) cluster structure which can have different template anions in the center, depending on the molecule you are using during the synthesis. The final cluster-shell expansion was done by addition of an excess amount of perchlorate solution. After crystallization I finally got crystals of the different $\{V_{14}(Y)\}$ structures. Further modification is the incorporation of several redox-active metals like Ba, Fe, Cu, Mn, or Ni. I assume this incorporation of metal centers make the clusters even more suitable for the application in homogenous aerobic oxidation catalysis.

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 2019
Research Report

1. Name: Pauline LIESFELD （ID No. SP19312）

2. Current affiliation: Humboldt-Universität zu Berlin

3. Research fields and specialties:
Chemistry

4. Host institution: Nagoya University

5. Host researcher: Prof. Eiji YASHIMA

6. Description of your current research

My work as a graduate student focuses on using photoswitches to design intricate systems exhibiting new characteristics regarding information transfer. Photoswitchable molecules can be reversibly converted between two states using light, similar to an ordinary light switch. The irradiation with light of a specific wavelength causes the molecule to change its chemical structure by breaking or forming a bond, or by changing the configuration. Azobenzene for example can be isomerized from the thermodynamically stable *trans*-form (Z) using UV light (300-400 nm) to the corresponding meta-stable *cis*-state (E) which can then be switched back using visible light (>400 nm). Because UV light often causes inefficiency and fatigue it is desirable to shift the excitation wavelength towards the far-red region and beyond.

Therefore we are investigating the use of methylene blue as a photoinduced electron transfer agent for the indirect Z to E photoisomerization of azobenzene. Methylene blue allows switching quantitatively with an excitation wavelength of 655 nm and with high quantum yields due to the electrocatalytic nature of the process. We aim to expand this approach towards highly functional systems for the application in nanotechnological devices.

7. Research implementation and results under the program

Title of your research plan:

Design of Azobenzene Functionalized Polypeptides as Highly Efficient Nanowires

Description of the research activities:

For efficient electron transfer the chemical environment as well as the distance between the electron acceptor and donating moiety are very critical. The aim of my project was to synthesize a polypeptide chain with the ability to form a one-handed helix and incorporate appropriate functionalities in order to attach azobenzene and methylene blue. The group of Prof. Eiji Yashima provided me with the expertise and the building blocks to successfully synthesize a peptide chain based on amino acids with cyclohexyl residues. By incorporating a defined number of the corresponding piperidine analogons I was able to use the secondary amino functionality to attach two azobenzenes. The control of the distance between these units ensured the distinct arrangement and parallel alignment of the azobenzenes which was confirmed by NMR-spectroscopy. Further investigations by Uv-vis spectroscopy will determine the efficiency of the electron transfer.

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

The JSPS Summer program does not only offer great research possibilities but also the amazing opportunity to get to know Japan and experience the Japanese culture. The homestay was definitely one of the most memorable experiences. Numerous encounters with welcoming people led to great exchanges about Japanese food, values and traditions.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Eva-Maria L. MINARSCH （ID No. SP19313）

2. Current affiliation: Julius-Maximilians University Wuerzburg

3. Research fields and specialties:
Biological Sciences

4. Host institution: Research Faculty of Agriculture, Hokkaido University

5. Host researcher: Associate Prof. Yoshitaka UCHIDA

6. Description of your current research

My research interest is to understand the role of soil microorganisms in sustainable agriculture. Conventional agriculture puts a lot of pressure on the environment by the excessive use of synthetic fertilizers. This results in negative environmental impacts on soil microbial biomass, soil habitat functioning, plant species diversity, human health, air and water quality. Therefore, strategies for a sustainable agriculture are required to mitigate negative environmental impacts and provide food security. In general, sustainable agriculture tries to replace the application of synthetic fertilizers by e.g. the use of organic amendments (waste materials of plant and animal origin) and specific soil management practices. Such strategies can have an influence on soil microorganisms, their community structure and activity. By the degradation of organic materials and the fixation of atmospheric nitrogen, active soil microorganisms provide nutrients to plants and animals. As such they can help to reduce the application of synthetic fertilizers.

To study the effect of organic amendments and mineral fertilizer on soil microorganisms I conducted my master's thesis at the Helmholtz Zentrum Muenchen in the research unit for Comparative Microbiome Analysis. A short-term greenhouse experiment was performed and soil biological and chemical properties, microbial activity, bacterial diversity and plant performance indices were assessed to evaluate the effects. It was shown, that the soil quality was maintained across different fertilizer compositions. Only advantageous and no detrimental effects on the soil-rhizosphere microbiota and increased plant performance were observed. Furthermore, the bacterial community structure was driven strongly by plant growth.

7. Research implementation and results under the program

Title of your research plan:

Identification of nitrogen-fixing 'hot-spots' and the influence of tillage in natural rice paddy fields.

Description of the research activities:

Natural farming (agriculture without the use of chemicals) is receiving heightened attention as a sustainable option, but its keys for success are still not clearly known. One of the potential keys is the soil microbial activity. To understand soil microbial activities in the naturally farmed rice paddy soils, soil samples were collected from natural (0-, and 5-times tillage, no fertilizer) and conventional (no tillage, synthetic fertilizer) managed paddy fields from the Experimental Farm of the Field Science Center for Northern Biosphere, Hokkaido University. The samples were taken at different locations ('hot-spots') within each plot, including soil surface in plant vicinity and between plant rows as well as from 10 cm depth. The microbial DNA of the soils was extracted and analyzed regarding the bacterial community structure and quantitative gene abundance. Sequencing data analysis reveals strong seasonal changes, with increasing diversity towards mid-summer, compared to early summer. The 16S rRNA gene amplification by real-time quantitative PCR shows the lowest bacterial abundance in 10 cm depth and in part a higher abundance in natural managed, compared to conventional soils. Further analyses will be performed to investigate the role of the observed microbial communities.

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

Uchida-sensei and his team warmly welcomed me, helped me to settle in and supported me with my research throughout my stay. Conducting research in the lab of Uchida-sensei and working with rice paddy field soils was very interesting and broadened my knowledge on soil microorganisms. I enjoyed staying in Sapporo, especially due to its surrounding nature with mountains, rivers, lakes and the sea in close proximity.

9. Adviser's remarks (if any):

Ms Minarsch has significantly contributed to the research activities by our team over the last two months. She learnt skills to evaluate soil microbes at their molecular levels from the DNA extraction to the next-generation sequencing. Her high motivation to achieve her goals stimulated my other students to study harder and I am very thankful for her to bringing this atmosphere to our team.

JSPS Summer Program 2019
Research Report

1. Name: Anne PEIN (ID No. SP19314)

2. Current affiliation: Technical University of Munich

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Kyoto University, Research Institute for Mathematical Sciences

5. Host researcher: Prof. David Croydon

6. Description of your current research

I am interested in reinforced random walks (RRW) on graphs. Random walk is a central topic in probability theory with many applications in theoretical and applied areas. While the behavior of simple random walks is well understood by now, applications often demand that the walkers possess some form of memory. Random walk models can allow for such feature by adding a reinforcement to the walk. That is, at each time step the walker traverses a random edge incident to its current vertex, chosen according to a distribution, which depends on how many times each edge (Edge-RRW) or each adjacent vertex (Vertex-RRW) has previously been traversed or visited. The more often a walker has crossed an edge or visited a vertex, the more likely it will cross or visit it again. Such processes can exhibit a novel behavior: localization; that is the walker becomes trapped on a subset of the graph at all late times. This behavior never occurs for a simple random walk on an infinite graph. As mentioned above, one of the main reasons for the interest in theses processes is the widespread presence throughout real life phenomena as they capture an important feature in nature: learning from the past. They therefore show up in models of animal behavior, learning processes, image reconstruction, or as examples of industrial or consumer behavior.

Typical research questions in the area of RRW concern the long-term behavior under different assumptions on the reinforcement and the underlying graph. Many relevant problems in this area remain open; in particular, the question about localization behavior for VRRW with a linear reinforcement function on general graphs is still unanswered.

As my host professor is also interested in RRW, we have changed the emphasis of our research project during my stay at Kyoto University towards this topic.

7. Research implementation and results under the program:

Title of your research plan: Linearly reinforced random walks on trees

Pierre Tarres (2004) showed that linear VRRW on $\mathbb{Z}$ localizes almost surely on exactly 5 consecutive vertices. Our first goal was to understand the argument given by Tarres. Our next goal was to characterize the localization set for linear VRRW on trees; that is, graphs in which two vertices are connected by exactly one path. We conjecture that the linear VRRW on trees localizes almost surely on a subgraph consisting of a vertex plus its neighbors and their neighbors. Due to the special structure of trees, certain arguments that hold for $\mathbb{Z}$ can be recovered. We started to lift some of the propositions leading to Tarres's result to the case of trees. However, more work is necessary to prove our conjecture. We will continue working together on this project after my departure from Japan.

Description of the research activities: During my stay at RIMS I had weekly discussions with my host professor. Furthermore, I attended the probability seminar of the Department of Mathematics, which takes place every Friday. I also had the opportunity to attend the 12th Mathematical Society of Japan Seasonal Institute on Stochastic Analysis, Random Fields and Integrable Probability, which took place between July 31st and August 9th at Kyushu University. I have received financial support for this activity from the Research Support Allowance provided by JSPS.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): During my stay in Japan, I had the possibility to visit many different places on the weekends; for example Kamikochi, Hiroshima and Kagoshima. My cultural experiences included: watching a Kabuki play, staying overnight in a ryokan, visiting temples and shrines, bathing in an onsen and wearing a kimono in Kyoto's Gion neighborhood. This way, I have learned a lot about Japan, not only about university life, but also about the culture, history and everyday life at large.

9. Adviser's remarks (if any): As Anne describes, we have started work on a project to describe the localization set of vertex reinforced random walk (VRRW) on a tree. The latter process, which has many applications, is known to be an extremely challenging one to analyze, and very few detailed results have been proved about it beyond the one-dimensional lattice. Our project is an attempt to go beyond such results, and provide a stepping stone to the study of VRRW on more general graphs. Anne has worked hard on the project, and made good progress in learning and developing techniques in the area. We plan to continue working on the project after Anne leaves Japan to complete the proof of the conjecture she describes.

JSPS Summer Program 2019
Research Report

1. Name: Rebecca QUERFELD　（ID No. SP19315）

2. Current affiliation: Leibniz University Hannover

3. Research fields and specialties:

Radioanalytical Chemistry

4. Host institution: Fukushima University

5. Host researcher: Ass. Prof. Yoshitaka TAKAGAI

6. Description of your current research

The topic of the Ph.D. thesis is: Radioanalytical and chemical analysis of water samples near the Fukushima Daiichi nuclear power plant. The first step of this research was to establish an analytical protocol by evaluating various methods that are used to analyze ^{90}Sr and ^{137}Cs. Chernobyl water samples were used for this step. After choosing the most appropriate method, these analyses were also applied to water samples from Fukushima. These samples were taken on April 10, 2011, just one month after the accident (March 11, 2011). In addition, ^{3}H and ^{129}I could be determined. With the help of ^{129}I and ^{137}Cs, it was possible to retrospectively draw conclusions about the radionuclide ^{131}I, which is the most hazardous radionuclide for humans after a nuclear accident. Another project focuses on the 2020 Olympic Games in Tokyo, in the form of assessing the potential radiological hazards for athletes and visitors to the Olympic Games due to the radioactive releases from Fukushima. For this purpose, the Olympic sports and event facilities around Japan have been visited and the local air dose rates were measured. In addition, potable water in bottled form, as well as tap water samples from these locations have been sampled and collected. Also various surface waters were sampled (seawater and river water) from Olympic water sports venues. The aim is to provide evidence for a marginally low radiological risk for the athletes and visitors of the Olympic Games and communicate a picture of safe Olympic Games that is substantiated by profound analyses. The third project is the development of a method to measure ^{135}Cs via inductively coupled plasma triple quadrupole mass spectrometry (ICP-QQQ-MS). The ^{135}Cs/^{137}Cs ratio will allow establishing distinguishable signatures of the releases from each individual reactor of FDNPP (nuclear forensics). This makes it possible to attribute the distinct ratio in environmental samples to the various reactors [1,2]. Water samples are often unsuitable for method development of ^{135}Cs as they have only a very small amount of cesium and they tend to mix the signatures.

7. Research implementation and results under the program

Title of your research plan:

A project to separate and measure radionuclides such as fission products in moss that were taken from evacuated or non-evacuated areas in Fukushima province

Description of the research activities:

Mosses may become a suitable alternative, because some of them have the ability to accumulate large amounts of radionuclides. Additionally, the nuclear fuel particles ('hot particles') in mosses from the close vicinity to the nuclear power plant hold further interesting information. On six different sampling trips all over the prefecture Fukushima (Futaba, Okuma, Nihonmatsu, Inawashiro, Kitakata, Iwaki, Minamisoma, Aizu-wakamatsu, Fukushima, Otama, Kokoriyama, Shirakawa) 120 different moss samples were taken. Because of the expected high activity in the mosses out of the exclusion zone, the sample pretreatment was only drying and crushing the mosses and the powder was stabilized with kanten (agar jelly). All samples have been treated the same way (even the expected inactive ones). These samples will be shipped to Germany. The planned analysis will be: determination of radio-cesium using high-purity-germanium-detector and radio-strontium via liquid-scintillation-counter, searching for micro-particles using autoradiography, alpha-track-detection, scanning electron microscope, secondary ionization mass spectrometry.

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

Fukushima is in my opinion the most beautiful prefecture. The Japanese government is working hard on the decontamination work, so that most of the evacuated people can move back to their homes but of course the fear of radiation and the long lasting time had most of the people built up a new social life. Less than 3 % of the area of Fukushima prefecture is still evacuated.

9. Adviser's remarks (if any):

The Institute of Environmental Radioactivity (IER) of the Fukushima University is a good partner for any radio-analytical researches after the Fukushima accident.

JSPS Summer Program 2019
Research Report

1. Name: Andreas Ringleb （ID No. SP19316）

2. Current affiliation: Justus-Liebig-University Giessen, Institute of Applied Physics

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Yamagata University

5. Host researcher: Prof. Tsukasa YOSHIDA

6. Description of your current research

My present research is focused on the introduction of magnesium zinc oxide ($Mg_xZn_{1-x}O$ or (Mg)ZnO)) as an alternative to titanium dioxide (TiO_2) for the preparation of photoanodes in dye-sensitized solar cells (DSCs). (Mg)ZnO has been successfully used for photocatalytic and optoelectronic applications, such as light emitting diodes, laser diodes and ultraviolet photodetectors. Mg can be incorporated into the ZnO wurtzite-lattice up to $x = 0.3$ due to the similar atomic radii of Mg^{2+} (0.57 Å) and Zn^{2+} (0.60 Å). This allows the band gap of (Mg)ZnO to be tuned depending on the Mg-content and reduces injection losses ins DSCs in order to maximize efficiency.

7. Research implementation and results under the program

Title of your research plan:

Preparation of Magnesium-doped Zinc Oxide Nanoparticles for Application in Dye-Sensitized Solar Cells.

Description of the research activities:

Multiple synthesis routes have been attempted for the preparation of MgZnO. Various zinc and magnesium salts have been used as reaction precursors, however, it was found that the resulting material was largely unaffected by the choice of precursor. The first route was based on microwave-assisted hydrolysis and is the preferred route for the preparation of pure ZnO nanoparticles due to its low required temperature of 60 °C. For this route, Mg solubility in the ZnO lattice was found to be low and a phase separation of pure magnesium oxide (MgO) was found for Mg concentrations below 10%. Moreover, it was found that the additions of Mg to this route increases the temperature requirement to over 400 °C, thus negating one of its biggest advantages. Additional measures such as the introduction of structure directing agents (SDAs) or an increase in temperature in order to promote the diffusion of Mg into the ZnO lattice brought no significant improvement. A second route was based on the addition of oxalic acid ($C_2O_2H_4$) to the Zn and Mg precursors. This route allowed for a greater Mg solubility of around 15%, which resulted in an increase of the band gap by 200 mV in comparison to pure ZnO. The increase was also found to be perfectly tunable by the ratio of precursors and the reaction achieved a near 100% yield. However, it was also found that conversion of the $MgZn(C_2O_4)$ intermediate to the final MgZnO product resulted in micrometer sized agglomerates consisting of spherical shaped nanoparticles in the range of 50-100 nm. The resulting decrease in surface area prevented the application of these nanoparticles in dye-sensitized solar cells.

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

The opportunities provided to me by the prolonged contact with Japanese colleagues has allowed me an insight into Japanese culture that I would otherwise never have been able to acquire. I was able to experience Japanese work and private life, the difference between life in urban and rural areas as well as the beautiful nature of the Japanese landscape.

JSPS Summer Program 2019
Research Report

1. Name: Karin Rustler （ID No. SP19317）

2. Current affiliation: University of Regensburg, Germany

3. Research fields and specialties:
Chemistry and Biological Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Itaru Hamachi

6. Description of your current research

Currently, I am pursuing my PhD at the University of Regensburg under the supervision of Prof. Burkhard König. We are working on photoswitchable scaffolds (e.g., azobenzenes, fulgides, dithienylethenes) used for the functionalization of biomolecules in order to provide light regulated activity control with high spatiotemporal precision. Light is beneficial as tool as it is an abundant, noninvasive fuel working orthogonal to cellular processes. Especially beneficial for azobenzenes as photochromic moiety is their synthetic accessibility, high photostationary states, cycle reversibility and large change in geometry and end-to-end distance upon light-induced *trans-cis* isomerization. One of the targets the König group is working on are heptahelical G protein-coupled receptors. Around 40% of the medications approved by the Food and Drug Administration (FDA) trigger less than 50 different GPCRs, albeit the human genome is expressing genes for around 800 to 1000 different GPCRs. 85% of the GPCR superfamily belong to family A. As a large amount of GPCRs are so-called orphan GPCRs of unknown function and with unknown endogenous ligands, it is likely that various untreated diseases might be provoked by their dysfunction. This emphasizes the importance of GPCRs, especially of class A, as research target. Beneficial for photochromic ligands is that they are acting on native receptors, but their kinetics are diffusion controlled and often lack subtype and cell specificity. Recently, the Hamachi group reported a chemogenetic approach using high-affinity metal complex-agonist conjugates (MACs) for the subtype and cell selective activation of class A GPCRs. In this German-Japanese collaboration, we envisioned, that *trans-cis* isomerization of a MAC incorporated azobenzene might lead to a change in the accessibility of the ligand to its binding site at the engineered receptor providing a light-triggered tool for deeper receptor investigation.

7. Research implementation and results under the program

Title of your research plan:

Photochromic Metal Complex-Agonist Conjugates (PMACs) for Light-Induced Activation of Class A G-Protein-Coupled Receptors

Description of the research activities:

The synthesis and photophysical characterization of a prefunctionalized azobenzene scaffold stable to the requirements of *in vitro* cell testing was performed at the home university under the supervision of Prof. König. During my internship in the Hamachi group at the Kyoto University this photoswitch could be successfully incorporated as tether between a GPCR agonist and a metal chelator. The synthesized PMAC was (photo-)chemically characterized using UV-Vis spectroscopy, NMR, and mass analysis. Under the supervision of Assist. Prof. Kubota I was taught how to cultivate cells and perform transfections and fluorescence imaging. By using those techniques, *in vitro* activity studies of the synthesized compound on transfected cells were performed by fluorescence Ca^{2+} imaging. The efficacy of both isomeric states of the PMAC at the engineered receptor in comparison to the native receptor could be tested in presence and absence of the metal required for high-affinity coordination.

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

I am very thankful to my host family for organizing fantastic days including a trip to Yokohama and the cup noodle museum, cooking, a tea ceremony, a school festival and a concert for violin and piano. I am grateful to Mino Takeharu and Assist. Prof. Ryo Kubota for teaching and guidance, Prof. Itaru Hamachi for supervision of the project and the whole Hamachi group for their warm welcome and assistance. We thank JSPS for the generous support which made this great opportunity possible.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Sarah-Kristin Thiel （ID No. SP19 318）

2. Current affiliation:
Department for Computer Science, Aarhus Universitet, Denmark

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution:
Tsukuba University, Tsukuba, Japan

5. Host researcher:
Assist. Prof. Sayan Sarcar

6. Description of your current research

My present research focuses on the relationship between gamefulness and creativity. Gamefulness is hereby an umbrella term for anything that either involves gaming (e.g. video games, analog games) or playing as well as game-like environments (e.g. gamification) or game-like processes (e.g. innovation games). Situated in the field of creativity research, my focus lies on collaborative innovation and ideation processes. In particular, I explore options to design creativity methods so as to improve the creative outcomes (e.g. the idea quality). Another interest in that regard are the group dynamics and collaborative behavior emerging during ideation processes. This includes analyzing how groups work together to generate ideas (e.g. time spent talking, type of brainstorming). Following recent studies that provided evidence that playing (video) games is linked to increased creativity levels and that play is a cradle for creativity, imagination and innovation, I developed gameful ideation method, named Gamebidea. Employing Gamebidea as a research vehicle allows me to investigate the influence of various concepts and design options on creative outcomes and collaboration.

Moreover, given the possibility to conduct this research in two distinct locations, an additional strand of this research endeavor is to conduct a cross-cultural comparison. To that end, I investigate whether a gameful approach has the potential to overcome cultural barriers as previously documented within collaboration research.

7. Research implementation and results under the program

Title of your research plan:

Activating Creativity Through Gameful Ideation Processes

Description of the research activities:

In order to undertake a cross-cultural comparison of the potential influence of gamefulness on both the collaborative behavior and creative outcomes of ideation processes, I organized a series of workshops at the Tsukuba University campus. The setup of those studies was kept identical to the workshop that I organized at my home institution end of May. Each workshop lasted about 2,5 hours and took place during the week. Mainly students from the host department were invited to take part in the study. Gathered data of the workshops were then coded and subsequently analyzed regarding cultural differences as well as the influence of gameful mechanics on creative outcomes. Apart from organizing and conducting the workshop study, I also conducted a literature search on relevant prior work in the field of cross-cultural studies within creativity research and in particular ideation studies. Both activities fed into the draft of a manuscript intended to be sent to a renowned conference in the field of Human-Computer-Interaction.

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

Organizing the studies described above turned out to be even more complicated than it usually is. Since I was not affiliated with a large lab at my host institution and me being a visitor to the institution and city with no prior contacts, finding study participants was rather challenging. Furthermore, since the JSPS program takes place during exam period and at the end of the semester, most students (= potential participants) were quite busy and did not have time to participate in a 2,5h workshop. The duration of the workshop certainly added to the challenge of finding participants. Furthermore, our Japanese participants (predominantly students) turned out to be rather unreliable and sometimes did not show up to the workshop despite having agreed to participate.

9. Additional remarks (if any):

Trying to use the JSPS Research Allowance for the research described above turned out to involve a high administrative overhead. Since it takes the host university (a lot of) time to process all expenses, we had to settle all our expenses with the university by end of July. This was not practical, since we still conducted a user study in August, where we wanted to remunerate participants.

JSPS Summer Program 2019
Research Report

1. Name: Manuel Maria Weber （ID No. SP19319)

2. Current affiliation:

University Clinic Essen, Germany

3. Research fields and specialties:

Medical, Dental and Pharmaceutical Sciences

4. Host institution: Nuclear Medicine and Tracer Kinetics, Osaka University Graduate school

5. Host researcher: Prof. Jun HATAZAWA

6. Description of your current research

I have taken a particular interest in molecular imaging and its impact on patient managing. In the long term I aim at becoming more proficient and knowledgeable as a physician researcher in order to pursue a career in medical academia with a high focus on the clinical implementation of emerging technologies. My current research focuses on a subtype of molecular imaging called positron-emission tomography (PET) in the context of brain tumors and prostate cancer. My latest projects focus on the diagnostic sensitivity of a diagnostic tool for prostate cancer called prostate-specific membrane antigen PET (PSMA PET) and its potential for treatment planning in patients with advanced prostate cancer.

7. Research implementation and results under the program

Title of your research plan:

The biodistribution of ^{18}F-PSMA 1007 for different routes of application with a special focus on the Tumor-to-kidney ratio in healthy and tumor-bearing mice.

Description of the research activities:

During my stay at the department of Nuclear Medicine and Tracer Kinetics at Osaka University the experiments were started. The tumor-bearing cohort was injected with a cancer cell line and the mice were observed until sufficient tumor-growth had been observed. Afterwards the rats were injected with a molecule that specifically binds to cancer cells (ligand) and is also linked to a radioactive agent. 4 different routes of application were chosen (intravenous, intraperitoneal, subcutaneous, oral). The emitted radioactivity is used to measure the uptake of the cancer specific ligand within the tumor tissue and the normal organs. After the experiments the organs and the tumor tissue will be examined microscopically. So far the results are pending and the research will be continued by the working group at Osaka University.

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

The preparation seminars at Shonan village center were organised very well, gave us a good introduction to Japanese culture and language and were held in a beautiful location. I particularly enjoyed the language lessons and the dinner party that facilitated networking with the other JSPS fellows that were going to conduct their research in the same region. I also enjoyed our trip to Kamakura. One of the highlights was the JSPS homestay during which I was able to learn a lot about everyday life in Japan. My host family was very eager to show me as much as possible and introduced me to different types of Japanese food. Summarising, the atmosphere during the the seminars was very positive and motivating.

During my stay in Osaka I was able to explore among others Kobe, Osaka, Kyoto, Himeji and Tokyo. Attractions that stood out for me were Himeji Castle and Fushimi-Inari-Taita Shrine. I was also particularly impressed with the entire area of Nara park and the surrounding temples, shrines and the nature. Other sight-seeing experiences that stood out were the visit at Universal studios Japan and Naniwa-Yodogawa firework festival.

I also enjoyed discovering national and local cuisine, such as okonomiyaki, takoyaki or Japanese barbecue. I loved the overall flair of Osaka and think that the city has a lot to offer.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Fernando Gustavo WIRTZ	（ID No. SP19 320 ）
2. Current affiliation: University of Tuebingen (Germany)	
3. Research fields and specialties:	
Humanities (Philosophy)	
4. Host institution: Kyoto University (Letters Department)	
5. Host researcher: UEHARA, Mayuko	

6. Description of your current research

My research deals with the question of myth. How myth operates in our presents society and which role did myth play in history?

As a continuation of the main topic of my previous research, my proposed project investigated the reception of Schelling's concept of myth within the philosophy of Miki Kiyoshi (1897-1945), one of the main figures of the so-called Kyoto School. My working hypothesis was that Miki strove to rehabilitate the concept of myth by rejecting the irrationalist German philosophy of mythology prevalent at that time

In the context of mid-1930's Japan, Miki's reflection on myth addresses deeper concerns as to the rise of fascism and neo-romanticism. In this sense, the fact that he was so intensively engaged with the philosophy of mythology, as pointed above, was hardly a coincidence. One thing important to have in mind is the development of the Japanese romantic school, specially those writers gathering around the journal *Cogito*, published between 1932 and 1944. Two aspects are here of relevance. Firstly, the anti-rationalism and praise of subjectivity paradigmatically incarnated by this group. Secondly, the re-actualization of German Romanticism done by this authors. This two dimensions should be understood in mutual relation. Miki was also strongly influenced by German idealism. Also his concept of *pathos* posses a strong anti-intellectual elements (although obviously it cannot be defined as mere anti-intellectualism). Therefore, the confrontation with Yasuda Yojuro and Matsushita Takeo should serve to refine better his own philosophical position and his reception of Schelling.

7. Research implementation and results under the program

	Title of your research plan: F.W.J.Schelling, Kiyoshi Miki and the Concept of Myth
	Description of the research activities: 1. I traced the constant characteristics of Miki's concept of myth, comparing his different texts (specially 『構想力の論理』, 1939 and 『哲学ノート』, 1941). 2. I compared Miki's understanding of the couplet of '*pathos* and *logos*' with Schelling's analysis of the dialectic between 'the dark principle' (*das dunkle Prinzip*) and 'understanding' (*Verstand*) in his *Philosophy of Mythology*. 3. Bibliographical research of the most relevant literature on Miki and myth during the Showa era. Here particularly Jun Sugawara's 『弁証法とイロニー』 (2013) and the newest anthology 『再考三木清』 (2019). 4. Presentation of a paper on the 28th Conference of the Schelling-Society Japan in Toyama University. 5. Took part at the weekly research meeting of Prof. Uehara's. 6. Took a seminar with Prof. Tomoharu Mizuno on Nishida Kitarô and Susuki Daisetsu. 7. Translation of Miki's text (『歴史的意識と神話的意識』, 1934)

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

-The guidance of Prof. Uehara deeply helped me to formulate my project in a more accurate way.

-I had very productive discussions with other Japanese researchers and PhD students.

-I got to know the Japanese working dynamics and its environment.

-The access to books on Miki that would be impossible to get outside Japan helped me to put my research up to date.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Jordan Harvey （ID No. SP19402）

2. Current affiliation: University of Alberta

3. Research fields and specialties:
Interdisciplinary and Frontier Sciences

4. Host institution: Tokyo Metropolitan University

5. Host researcher: Dr. Takehiko SUZUKI

6. Description of your current research

My area of research is tephrochronology, a field of Earth sciences that uses volcanic ash as a high-resolution dating tool. Volcanic ash (or tephra) has been erupted from volcanoes around the world since the origin of Earth itself. As a volcano erupts, volcanic debris is sent into the atmosphere, where it can be carried long distances from its source volcano and deposited on the ground, covering an area in ash. Over time, these ash layers can be buried and overlaid by other sediment, leaving a preserved horizontal layer of tephra in the subsurface. By applying the methods of tephrochronology, we are able to use these discrete tephra layers as dating tools by geochemically identifying each layer and correlating the layers to the volcanic ash deposits from their original source volcano. If the age of the source eruption has been previously determined, we can apply this age to our tephra layer to create a detailed chronology for the stratigraphy of a study site.

In the JSPS summer program, our main focus was to apply the concepts of tephrochronology to the ~700 m Fuchu boring core, one of 73 boring cores drilled in the Tokyo Metropolitan Area (TMA) by the Civil Engineering Support and Training Center, Tokyo Metropolitan Government. This application had already been done by Dr. Suzuki using other TMA cores, so a foundation of identified tephra layers was already available for reference. By identifying and correlating tephra layers between the boring cores of the Tokyo Metropolitan area, we can learn two important things. First, we can reveal new information regarding the frequency and distribution of volcanic events that have affected the TMA over the past ~2 million years. Second, we can examine the deformation of the tephra layers and their stratigraphic relationship to other geological features in order to better understand the recent crustal movements of the Kanto Tectonic Basin, which is still undergoing many tectonic processes (e.g. Tachikawa active fault). Understanding the volcanic and tectonic events in the past can provide valuable information for risk management purposes in order to better predict geologic hazards that may affect the TMA.

7. Research implementation and results under the program

Title of your research plan:

Application of volcanic ash deposits to predict future geologic hazards in the Tokyo Metropolitan Area, Japan

Description of the research activities:

The majority of my time spent at Tokyo Metropolitan University (TMU) was focused on observing and collecting tephra samples from the 706 m Fuchu boring core. This involved one field outing to inspect the core boxes before transporting them back to TMU. Most of the core (depth of 240 to 706 m) was observed at TMU, with the generous help of Dr. Suzuki and his research group. Once the core had been logged and samples were collected, we had to clean the samples in order to prepare them for analytical analyses. This involved removing any fine-grained sediments through the assistance of an ultrasonic bath. Once fully cleaned, the six highest priority samples were selected, and analyzed using a refractive measurement system (RIMS) to determine the glass shard's refractive indices. In addition, the same six tephra samples were analyzed using electron probe microanalysis (EDS-EPMA) to gather their chemical composition. Using this data, we compared our sample's geochemical characteristics to previous studies to identify some of the tephra layers.

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

Thanks to JSPS and Mitacs, I have had one of the most memorable research experiences of my life. Dr. Suzuki and his students were always willing to help with my research and were very welcoming. During my stay in Japan, I was able to have a sushi party with my host family on my birthday, go to an izakaya and do karaoke with my office mates, and explore many areas of Tokyo during my free time. I am very thankful to Dr. Suzuki for taking the time to teach me the Japanese methods of tephrochronology.

9. Adviser's remarks (if any):

In general, I am judging that this project done by Jordan Harvey was extremely successful and the original purpose was well achieved. This project's results are able to provide new data that can contribute to the studies on underground geology in Tokyo area, that is, the newly identified three well-known volcanic ash layers in Fuchu core. Jordan did his best in learning skills and practicing work, and had a good opportunity to handle an ideal core.

JSPS Summer Program 2019
Research Report

1. Name: Heather WILLIAMS （ID No. SP19403 ）

2. Current affiliation:

University of Alberta

3. Research fields and specialties:

Engineering Sciences

4. Host institution:

Osaka University

4. Host researcher:

Dr. Matija Milosevic and Dr. Taishin Nomura

6. Description of your current research

Millions of people worldwide suffer from motor impairment due to aging and/or neurological injuries, such as stroke or spinal cord injury. Upper limb deficits can impede manual dexterity, whereas lower limb deficits can impede individuals' ability to walk. My MSc research focuses on the validation and application of a new upper limb assessment, which will provide insights into the effectiveness of various interventions, such as prostheses for individuals with amputations. Although my research at the University of Alberta focuses on devices used in upper limb rehabilitation, my research at Osaka University focused on lower limb rehabilitation, specifically gait restoration. Functional electrical stimulation (FES) is a technique that applies small electrical charges to a muscle that has become paralyzed or weakened and offers a means to regulate gait deficits. It has already been demonstrated that closed-loop control of FES can be used to artificially contract lower limb muscles and improve independent standing in individuals with neurological impairments. In such a system, the FES controller's input is automatically adjusted based on feedback about the state. A system that applies similarly controlled FES to regulate gait would also be beneficial. Furthermore, as robotic exoskeletons offer promising outcomes in neurological gait rehabilitation, it is believed that together these technologies can be used for the rehabilitation of walking in individuals afflicted with lower limb motor impairment. As such, my research at Osaka University, which focused on the development of a state-based, closed-loop FES controller, will lead to further development of a device to rehabilitate/restore walking after impairment.

7. Research implementation and results under the program

Title of your research plan:

Development of a state-based, closed-loop FES Controller for Gait Rehabilitation

Description of the research activities:

My research challenge was to discover how a lower limb robotic exoskeleton's hip and knee servo motor angle position data could be used to trigger FES of a patient's leg muscles. To determine when muscles need to be stimulated in the gait cycle, muscle activation exhibited by individuals with healthy gait was examined. Lower limb electromyography (EMG) was used to record the muscle activation patterns of non-disabled individuals walking on a treadmill, and activation patterns in gait literature were investigated for comparative purposes. From this information, three distinct muscle activation states within the gait cycle were identified in which FES should trigger the muscle activation sequence: 1) late stance; 2) early swing; and 3) late swing/early stance. Then, EMG and joint (hip and knee) angle data from gait literature sources were used to determine the joint angle events indicative of the beginning of each muscle activation state. Next, the exoskeleton's servo motor angle position data were compared to the physical joint angle data, to identify the corresponding servo motor angle position maxima and minima triggers. Finally, a state-based, closed-loop FES software controller was programmed to activate the corresponding muscles during each gait state. Overall, a first prototype towards the development of an assistive system for gait rehabilitation was implemented during my stay at Osaka University.

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

The entire JSPS experience was well organized and has left me with great memories and new friends. I appreciated my warm welcome at Osaka University and the help of fellow researchers there. During my stay in Japan, I was able to explore Osaka, Kyoto, and Tokyo, visited many temples and shrines, and enjoyed Tenjin Matsuri and Gion Matsuri. I even got to climb Mount Fuji! I enjoyed tasting a variety of delicious Japanese food and my visit to an onsen. I especially loved my homestay where I experienced the weekend lifestyle of a Japanese family – complete with a 2-year-old who had boundless energy.

9. Adviser's remarks (if any):

During her Mitacs-JSPS Fellowship, Heather was a huge asset to our gait rehab team. Heather helped us develop a prototype of a closed-loop FES system for walking which included developing a state-based muscle activation controller that uses a robotic exoskeleton to identify gait states and FES to activate the muscles. I trust that Heather will be successful in her future research endeavors in Canada and that we will continue collaborating to publish her research from Osaka University.

JSPS Summer Program 2019
Research Report

1. Name: Kevin Murray （ID No. SP19404 ）

2. Current affiliation:

McGill University

3. Research fields and specialties:

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

4. Host institution: KEK

5. Host researcher: Peter Schury

6. Description of your current research

For the broader context, my research is concerned with neutrinoless double beta decay, and in particular, the nEXO experiment. My work is focused on a potential upgrade to nEXO called Barium-tagging. Barium-tagging is a system by which the sensitivity of nEXO can be increased through the elimination of experimental backgrounds. I have designed and simulated a Multi-Reflection Time-of-Flight Mass-Spectrometer (MR TOF) for the Barium-tagging system.

Simulations of the MR TOF show a mass resolving power over 10^5, which is sufficient for its intended purpose in the Barium-tagging system. Throughout 2019, the MR TOF is slowly being machined and assembled, and will hopefully be commissioned by the end of the year. The RIKEN facility in Wako is one of the few facilities in the world where practical experience with an MR TOF can be gained. Thus, the purpose of this internship was to gain insight into the operation of such a device, that could then be applied to the MR TOF being constructed at McGill University.

Also, this internship provided a valuable opportunity to benchmark the optimization procedures used for the McGill MR TOF, on a physical MR TOF at RIKEN. Which will help to troubleshoot the commissioning process that will take place later in the year.

7. Research implementation and results under the program

Title of your research plan:

Implementing the method of Time-Focus Shifting for the KISS MR TOF at RIKEN

Description of the research activities:

Work began with simulation of the KISS MR TOF using the software SIMION 8.1. This was first used to calculate the available mass resolving power. Afterwards, the optimization procedure was adapted to be compatible with the RIKEN MR TOF design, so that a new optimization for the mirror electrodes could be obtained. The new MR TOF settings required additional hardware (circuits) to be implemented. This hardware was designed and ordered by the Host professor. With the new optimization, the MR TOF will require less tuning, and will potentially become easier to operate. This claim will be tested in the final week. In the interim, research primarily consisted of gaining experience in operating the MR TOF with its current settings, as well as fine-tuning these setting to achieve the maximum resolving-power possible. When the new optimization settings are used, after the hardware upgrade, this process of fine-tuning to obtain the maximum mass-resolving power will be repeated. As a side-project, simulations were used to shed light on a mystery that occurred during the commissioning of the MR TOF. The efficiency of the device would drop dramatically as a function of the number of reflections. It was eventually found that the entrance mirror of the MR TOF was not closing, and this was fixed. However, if the entrance mirror never closed, how could reflections take place? This was answered through simulation, although the details are too technical for this report.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I have learnt a great deal during my time in Japan, about research, about the culture here, and about myself as well. It is no exaggeration to say that this has been a life changing experience

JSPS Summer Program 2019
Research Report

1. Name: Ladan ESKANDARIAN　　(ID No. SP19406)

2. Current affiliation: University of Toronto

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Professor Takeshi Kikutani

6. Description of your current research

Increase in the aging population, changes in lifestyle, the need for healthcare cost containment and the need for improvement and monitoring of healthcare quality are some of the challenges society is currently facing. Today smart textiles contribute to new trends in “hospital extension” through all-day monitoring of vital signs, professional activities, entertainment and home-based activities. Smart garments are considered as the second closest surrounding in contact with the body after human skin, which help to improve the patient’s living conditions and to avoid the cost of long hospitalization by continuously measurement of the activity and behavior of the patient via embedded sensors. The main goal of my project is to develop multi-functional electro-active yarns that can be knitted/woven to create dry-textile electrodes embedded in garments (e-textiles). These multi-functional fibers are going to be manufactured using functional polymers and conductive fillers through melt-spinning process. These polymers and extruded fibers will be characterized by various mechanical, thermal, electrical and microscopic techniques. The dry-textile electrodes will be used, for fully sensing human electrophysiological signals using textile-based wearable technology. This platform targets sensing and processing specific electrophysiological signals, namely, Electrocardiography (ECG) and Electromyography (EMG).

7. Research implementation and results under the program

Title of your research plan: Development of Electroactive Multi-functional Fibers

The following work is intended to contribute to the further development of elastomer/carbon composite fibers towards the manufacture of sensing materials. The focus of this work lies on the fabrication of polymer fibers capable of sensing not only one but multiple external stimuli, specifically bio-signals and mechanical strain, and to evaluate their performance. Other properties of interest such as electrical resistivity and mechanical properties will be characterized in order to ensure the capability of the fibers for working as sensing materials.

Description of the research activities:

Melt-spinning has already proven to be a reliable technique to draw polymer/carbon composites onto fibers. In this study, melt spinning was used as a main procedure to produce conductive fibers; therefore, the spinnability as the capability of a polymer to be spun, the melt spinnability of polymer/carbon composites was investigated. Two types of carbon contained conductive thermoplastic elastomers (TPE) were selected for fiber fabrication.

Single-component fibers were extruded in this research under different conditions. Several factors such as extrusion temperature, using water bath for solidifying the fiber and dilution of conductive filler content, spinneret die hole diameter were investigated. Before each experiment, the pellets were dried under vacuum at 80°C for 24 hours. The properties of extruded filaments were studied using differential scanning calorimetry (DSC), wide-angle X-ray diffraction (WAXD), Optical microscope, multimeter to measure electrical resistance and tensile testing instrument

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I've had several great experiences in Japan such as climbing mount fuji, watching hanabi, watching Kabuki, trying different Japanese food, attending several classical concerts and making lots of friends. I enjoyed the home stay that JSPS arranged for us very much, I met the family who were hosting me twice after that and I'm planning to meet them in Canada and anytime I come to Japan again. My supervisor at TiTech, Professor Takeshi Kikutani is an amazing and knowledgeable person and I was honored to get an opportunity to work with him.

JSPS Summer Program 2019
Research Report

1. Name: Mohammad T. CHAUDHRY （ID No. SP19407）

2. Current affiliation: University of British Columbia

3. Research fields and specialties: Chemistry

4. Host institution: University of Tokyo

5. Host researcher: Professor Mitsuhiko SHIONOYA

6. Description of your current research

The objective of this project is to prepare a molecular gear with higher rotational and transmissional efficiency, along with smooth rotation. We envision this is possible *via* simple substitution of the molecular gear, through the addition of methyl groups to the triptycene arene rings (Figure 1c). Substituent of methyl groups on the triptycene phenylene groups would prevent conrotatory slippage motion to realize efficient disrotatory geared rotation. Coordination of a RuCp* to the more sterically encumbered gear will likely halt all rotation of the triptycene groups, due to the larger steric demand of motion. Replacement of internal alkyne groups with phenylenes will be investigated to expand the distance of the circularly arranged gears for smooth rotation. As well, the steric repulsion between CH_3 and arene groups of adjacent triptycenes will be increased, and attractive π-π interactions will be weakened, allowing for quicker rotation.

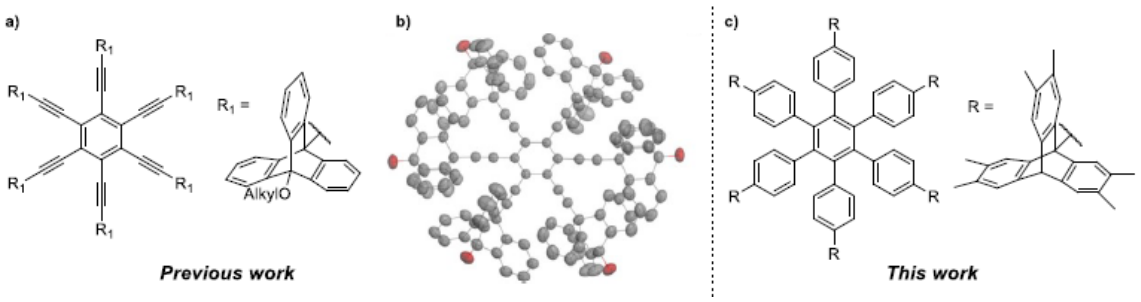


Figure 1. Previously reported gear by the Shionoya group b) solid-state molecular structure of the gear, and c) Proposed molecular gear.

7. Research implementation and results under the program

Title of your research plan:

EFFICIENT MOTION IN CIRCULARLY ARRANGED SEXTUPLE TRIPTYCENE MOLECULAR GEARS

Description of the research activities:

The majority of my time at UTokyo was spent preparing precursor compounds to finally make the target molecular. The overall synthesis involved 8 sequential steps, and at the time of this report I am at step 5.

My research in the Shionoya group involved the preparation of anthracene based molecular *via* a variety of organic transformations, and characterization was conducted using nuclear magnetic resonance spectroscopy. All new compounds that were prepared were characterized fully and documented in standard ACS format.

Purification of compounds was done using medium pressure liquid chromatography, gel permeation chromatography, flash column chromatography, or recrystallization.

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

I really enjoyed my time in the lab, and in Japan, but I wish the summer program was a bit longer. It is very difficult to start and finish a new project in just two months.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Guillaume PETERSON ST-LAURENT （ID No. SP19408）

2. Current affiliation: University of British Columbia

3. Research fields and specialties:

Social Sciences & Biological Sciences

4. Host institution: Forestry and Forest Products Research Institute (FFPRI) & Institute for Global Environmental Strategies (IGES)

5. Host researcher: Dr. Kanako MORITA & Dr. Hiromitsu SAMEJIMA

6. Description of your current research

My current research focuses mainly on evaluating the tradeoffs associated with climate change mitigation and adaptation options and policies for forest and natural resources management. In particular, by integrating aspects of both social and natural sciences, my various research projects aim at providing policy recommendations through the implementation of structured decision-making processes. Of most relevance to my research in Japan, one of my current projects aims at documenting the perceived risks and benefits associated with potential climate change adaptation options in British Columbia's forests in order to highlights prevalent tradeoffs. In another related research project, I also use the case study of British Columbia to better understand the relationship between climate change adaptation and mitigation policy in the forests. Drawing on the review of existing policy and a survey and semi-structured interviews with government officials, I address two major research objectives: (1) to what extent do current climate and non-climate forest management policies effectively integrate adaptation and mitigation objectives? And (2) what challenges and opportunities are associated with the joint consideration of both objectives when developing forest management interventions and policy?

7. Research implementation and results under the program

Title of your research plan: Exploring Climate Change Adaptation Options for Japan's forests

Description of the research activities: My research project aimed at (1) identifying the potential benefits, opportunities, risks and barriers to assisted migration, a possible climate change adaptation option for Japan’s forests, and (2) documenting public and experts' views on a range of climate change adaptation options and policies for Japan’s forests. To do so, I carried out more than 40 expert interviews with researchers and government, NGO and forest industry representatives across Japan. In collaboration with colleagues, I also developed an online survey aimed at documenting public perceptions regarding different climate change adaptation options in the forests. The survey will be distributed by the end of 2019.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I enjoyed each and every moment spent in Japan as part of the JSPS Summer program. There is no doubt that it provided the critical in-person foundation for developing many new professional relationships that will surely lead to many future collaborations. All of the researchers I met—most of whom I now consider colleagues—went out of their way to make sure I had a memorable experience in Japan. I am particularly thankful to my two host researchers and their extraordinary colleagues for their warm welcome and outstanding support for my research. The nature of my research project also allowed me to visit research centers (and forests) in many regions of Japan (e.g., Kyoto, Tokyo, Nagano, Yamanashi, Kanagawa, Hokkaido). During these travels, I learned about and experienced many aspects of Japanese culture and had the unique opportunity to learn from some of the most eminent Japanese researchers.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Noah Fleming （ID No. SP19409）
2. Current affiliation: University of Toronto
3. Research fields and specialties: Mathematical and Physical Sciences
4. Host institution: National Institute of Informatics
5. Host researcher: Yuichi Yoshida

6. Description of current research: My research is in computational complexity theory, which focuses on understanding the amount of basic computational resources (such as time, space, or randomness) needed to solve computational problems. At the heart of this is the *P versus NP* question, a resolution of which would have profound consequences in the field of computer science. At a high level, this question asks whether it is easier to verify a proof of a (propositional) statement than it is to prove the statement. *Proof Complexity* provides a promising program for resolving by studying the related question of whether there are short propositional theorems for which no short proof exists. A positive resolution of this question would resolve the P versus NP question. Proof Complexity suggests to make progress towards this by studying this question for restricted *propositional proof systems*, systems of propositional reasoning, to make progress towards understanding the general question.

My research studies propositional proof systems, with a focus on proof systems which employ algebraic reasoning. Besides being natural in their own right, algebraic proof systems have close connections to algorithms used in practice, and therefore results about them deepen our understanding of the related class of algorithms. Examples of classes of algorithms where this connection has been used to great effect include SAT solvers, wide classes of semi-definite programming solvers, and integer programming solvers.

7. Research implementation and results under the program

Title of your research plan: Property Testing Linear Threshold Functions

Description of the research activities: The first property testing algorithm was developed for testing whether a Boolean function is linear or far from being linear, where distance is measured according to the uniform distribution. This result had profound impacts on the study and design of *probabilistically checkable proofs*, and birthed the field of property testing. In this work we develop a property testing algorithm for determining whether a *real-valued* function is linear, or far from being linear where distance is measured according to any Gaussian distribution. This algorithm only needs to observe the value of the function in question on a *constant* number of points sampled from the Gaussian distribution in order to accurately predict its linearity. The choice of Gaussian distribution is natural, as the uniform distribution cannot be defined on the real numbers. However, it would be ideal to develop such an algorithm which is *distribution independent* in the sense that it works regardless of under what distribution the distance is measured. We believe that the techniques developed are give a promising approach to extending this work to the distribution independent domain, and we intend to explore this in future work.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I have thoroughly enjoyed my time in Japan. The food is outstanding, the people are friendly and helpful, and the nature is breathtaking. I especially appreciate the introductory week organized by JSPS, which was very useful in understanding Japanese culture and language. The homestay was really special, and was a highlight of my trip. I'm sad to be leaving!

9. Adviser's remarks (if any):

JSPS Summer Program 2019
(SP19410) Research Report

1. Name: Steven Tran （ID No. SP19410 ）

2. Current affiliation: University of Alberta

3. Research fields and specialties:
Engineering Sciences

4. Host institution: National Institute of Advanced Industrial Science and Technology

5. Host researcher: Dr. Kenjiro Iida

6. Description of your current research

My current research is focused on analyzing particle emissions from aircraft engines fueled with various types of fuel. To decrease CO_2 emissions, alternative fuels such as biofuel fuels which are produced from more sustainable sources like natural feedstock are being considered to replace current fossil-fuel based jet fuels. Although biofuels may result in a decrease in CO_2 emissions, it is also important to know how these alternative fuels affect other emissions such as particle emissions. Two sets of flight campaigns were conducted by the National Research Council Canada (Canada); in the first flight campaign emissions from commercial flights were sampled burning conventional Jet A1 fuel and a biofuel blend (Hydrotreated esthers and fatty acids), in the second flight campaign emissions from a research aircraft fueled with Jet A1 fuel, JP-5 fuel and an Alcohol-to-Jet biofuel were sampled. My research is focused on calculating the particle emissions for total particles and non-volatile particles to examine if the biofuels had any effect.

7. Research implementation and results under the program

Title of your research plan:

Calibration of optical particle counters

Description of the research activities:

Calibrated two optical particle counters (OPC) by measuring particles of various sizes and comparing the particle concentrations to a reference instrument (condensation particle counter (CPC)). Using a separate instrument called Aerodynamic Aerosol Classifier (AAC), particles of a specific size were selected and sent to the two instruments. By repeating the experiments with different sized particles, the counting efficiency of the OPCs were determined as a function of particle size.

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 2019
Research Report

1. Name: Mathieu Couillard
（ID No. SP19411）

2. Current affiliation: Concordia University

3. Research fields and specialties: Mathematical and Physical Sciences

4. Host institution: Okinawa Institute of Science and Technology

5. Host researcher: Dr. Síle Nic Chormaic

6. Description of your current research

For the past few decades, scientists have been studying whispering gallery mode resonators. These resonators are interesting because they can store large amounts of electromagnetic radiation normally requiring powerful lasers to produce and, because their moderately small volume, allow us to study the wave nature of light which have many applications such as sensors.

These resonators work by sending light along the edge of a round dielectric object like a glass sphere. As the light propagates around the curved object it reflects making many round trip of the cavity. Because of the wave nature of light, at every completed round trip, the light must have the same phase as when it entered in order to build up. Since the light can travel many times around the cavity, any small deviation in the frequency will produce a large difference in phase. This is seen as a very narrow peak in the spectrum. Since the wavelength of this peak depends on the environment which the light propagates through, changes to the environment like temperature, pressure, presence of nearby material or rotation will change the position of the peak. These narrow peaks are desired because a shift due to a change in the environment will produce a more noticeable shift in wavelength. My work is to study these resonators to better understand their behavior which can lead to new technologies.

7. Research implementation and results under the program

Title of your research plan:

Nanoparticle detection and filtering in bottle resonator

Description of the research activities:

If we hollow out a cavity and pump a fluid containing nanoparticles inside, the large energy built up will pull the particles to the edge, through optical trapping, and push them around the interior of the cavity in a carousel motion. My project was to study the motion of these particles as they move around the cavity and understand the dynamics between the light and particles. Specifically, I studied why the particles move out of the light at a specific location during the carousel motion. We also found that, given enough power, we can boil the water inside the microbottle and push the water vapors around the cavity. Finally, I tested is a new way to couple light in and out of the cavity using a nano-antenna for which we observed enough coupling to interact with the water inside the microbottle but less than the previous methods, giving a spectrum with less modes making it easier to interpret.

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

Being able to study at OIST has been an amazing experience that allowed me to meet many great people and learn interesting science. During this time, I've also had the opportunity to explore much of the beautiful island of Okinawa and learn about the culture and history of Japan and the Ryukyu.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Kyle W. REITER （ID No. SP19412）

2. Current affiliation: University of Calgary

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Yusuke EBIHARA

6. Description of your current research

Activity originating on the Sun causes variations in the Earth's magnetic field. This activity, called space weather, can induce harmful geomagnetically induced currents (GIC) in power networks, and damage power transformers. The economic and societal impact of power network disruption makes monitoring GIC predictors of critical importance for ensuring a resilient and uninterrupted power supply. To improve our ability to predict the impacts of space weather on infrastructure, statistical modelling or physical modelling may be used.

My research at the University of Calgary has focused on the use of statistical methods for predicting space weather impacts on power infrastructure. Use of multivariate statistical techniques such as Principal Component Analysis (PCA) or Canonical Correlation Analysis (CCA) can find links between geomagnetic drivers of GIC, and their secondary effects, such as harmonic distortion, as well as studying the geographic extent of harmonic distortion throughout the Hydro-Québec network.

Kyoto University, where I have been continuing my research, has developed finite-difference time-domain (FDTD) modelling techniques for geomagnetically-induced electric fields (GIE), which are direct drivers of damaging GIC. I have been working to extend the currently existing GIE model to new geographic areas of interest, specifically the province of Québec in Canada, notably impacted by severe space weather in March 1989, causing a province-wide blackout. The use of GIE modelling in conjunction with my existing statistical work will provide an improved capacity for space weather forecasting.

7. Research implementation and results under the program

Title of your research plan:

Geoelectric Field Modelling for Space Weather Forecasting

Description of the research activities:

In order to accurately simulate ground electric fields, models of electromagnetic field strength which are derived from modeled ionosphere source currents require a ground conductivity profile. The area of interest for this study is the province of Québec, in Canada. Topographical, bathymetric, and geological survey data summaries were adapted, along with estimates of subsurface conductivity for different layers from Quebec, to produce a 3D profile of conductivity for the region of interest. This 3D heterogeneous conductivity profile has been adapted for use with the existing Fortran FDTD code previously developed at Kyoto University.

Additionally, work to adapt the FDTD code to multithreaded processing using the Message Passing Interface (MPI) in Fortran is ongoing, to improve the processing time for FDTD simulations. As the simulation space encompasses a space extending approximately 100 km below and above the ground level, and across 100's of kilometers in the east-west and north-south directions, this is necessary for timely execution of the model.

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

The JSPS summer program was an excellent opportunity to experience Japanese culture, both through the homestay and orientation week, as well as the opportunities to experience Japanese culture and society throughout the internship. My host research institute was very welcoming and inclusive.

9. Adviser's remarks (if any):

Mr. Reiter has been working very well during his stay at Kyoto University. He is a very good student of insight, and has an excellent technical skill. I am convinced that he will provide scientifically correct interpretation of the generation of GIC and related geomagnetic variations with realistic ground conductivities.

JSPS Summer Program 2019
Research Report

1. Name: Cole Christopher Armitage　（ ID No. SP19413 ）

2. Current affiliation: Concordia University

3. Research fields and specialties:

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

4. Host institution: Yokohama National University

5. Host researcher: Dr. Akiko Sugawa-Shimada

6. Description of your current research

My current research focuses on the agency relations between characters, as non-humans that populate our current media ecologies, and human readers/viewers/players that live amongst them and are surrounded by them. How do nonhumans (even if they are representations of humans) circulate and move within Japan's media mix, and what happens when these movements come into contact with attempts to capture or possess these nonhumans? How does the combination of media divergence and character-centricity in Japan's current media ecology contribute to a tangible sense of character vitality in Japan? Moreover, are fan efforts to control and possess the nonhuman character, by playing games or collecting figures, in fact in opposition to that movement, or are fans more akin to conduits of movement themselves? When it comes to animated characters in Japan's media ecology, do fans ultimately become like animated media, in so far as the 'liveness' or vitality of the nonhuman travels through them, themselves?

This research is part of a broader MA thesis project at Concordia University that theorizes the agency relations between nonhuman media and human readers/viewers/players, that will become part of a thesis tentatively titled "Deanimation: The Experience of Nonhuman Agency in Animated Media". This project will explore works of media across webcomics, games and anime which 'animate' or breathe life into themselves in ways that subvert the established sense of the reader/viewer/player as master, simultaneously becoming more 'animate' as the human becomes less so. Key examples include Horang's *The Bongcheon-*

Dong Ghost (2011), *Nier: Automata* (Square Enix, 2017), and Toby Fox's *Undertale* (2015). The thesis both considers the de-centering and de-animating of the human, both in terms of media as text, and media as environment or ecology. Though the larger portion of the thesis work will focus on the former, the research conducted in Japan primarily contributes to the latter. At the same time that works across multiple media forms experiment with techniques to limit the autonomous control of the viewer/reader/player, the media ecologies in various parts of the world are becoming increasingly filled with autonomous and animate characters.

This research considers characters specifically, and media objects more broadly, both in ontological/philosophical terms as well as in political terms. While much of OOO (Object-Oriented Ontology) considers the animacy or vitality of objects, through thinkers such as Jane Bennett, seldom is the object(s) under consideration a media object in particular. This project then seeks to take more seriously the 'object'-ness of the media objects under consideration, and their potential to act upon, in direct autonomous ways, upon the humans that interact with them. One possible conclusion, is that both the subversion of the animator-as-master model as well as the de-centering of the human in varying media ecologies may be congruous with a politics of dismantling what Mel Chen (2012) refers to as an "animacy hierarchy", a hierarchy of things in the world based on their capacity to act, and the binaries that construct its categories. The inability, for instance, to construct an ontology of characters in a media ecology such as Japan's, as one example, makes them difficult to categorize in terms of agency and animacy. Characters may then, in certain circumstances, be revealed to resist animacy hierarchies altogether. Chen provocatively points to the animacy hierarchy as being intimately intertwined with issues of race, gender and the environment, and therefore there is great value in experiences that, even if not consciously, deconstruct those implicit hierarchies, particularly in a moment in time where the ripples of human agency gone awry is so readily apparent.

7. Research implementation and results under the program

Title of your research plan: Animator Agency in Japan's Character-Centric Media Mix

Description of the research activities:

In terms of literature review, daily research activities included researching the existing lineage of animation theory, as well as theories of control and perception. Scholars such as Mel Chen (2012) for animacy theory and Thomas Lamarre (2015, 2018) for sensation and perception were explored in-depth. Additional research on foundational theories of control, through authors such as Heidegger and Nietzche complimented these authors. Direction and recommendations were provided by Dr. Akiko Sugawa-Shimada. Research was presented in late July at Yokohama National University, and feedback was obtained from the students and colleagues of Dr. Akiko Sugawa-Shimada.

Field work included visiting sites of fan interaction with characters and character goods, as well as exhibits focused on individuals with crucial involvement in the creation of Japan's current character-centric ecology, such as the Takahata Isao exhibit in the Tokyo Museum of Modern Art. The marketing strategies for non-narrative characters, such as the original characters for the popular LINE platform, as well as events for internationally-recognized characters, such as the Pikachu Outbreak in Yokohama, provided additional opportunities for research. In early August, I also had the opportunity to attend DiGRA (Digital Games Research Association) in Kyoto, and participate in workshops and attend panels that can have a strong impact on my current thesis project. Also in Kyoto, I had the opportunity to attend the Kyoto International Manga Museum and witness a *kamishibai* performance, which was thematically invaluable for my first chapter on the agency relations of webcomics, given that both media forms build suspense by slowly revealing subsequent panels. I also had the opportunity to meet with Patrick Galbraith, a well-established anime/manga scholar, as well as Shunsuke Nozawa. Nozawa's work on *seiyuu* or voice acting in Japan was particularly influential for its emphasis on ensoulment and effacement, or more simply, "Who was giving voice to who". His work on characterization in Japan was also particularly relevant material for the current research that I have conducted in Japan, and so having the opportunity to meet and speak with both him and Patrick was invaluable.

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

Thanks to my host supervisor Dr. Akiko Sugawa-Shimada, I was able to participate in a Japanese class at Yokohama National University, which helped me to greatly improve my understanding and comfortability with the Japanese language. Moreover, I was able to remain in touch with the host family that I was connected to through JSPS, and had subsequent opportunities to meet and learn from them about Japanese culture.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Emma Yasui （ID No. SP19414 ）

2. Current affiliation: University of Toronto

3. Research fields and specialties:

Social Sciences

4. Host institution: Hokkaido University

5. Host researcher: Dr. Katsunori TAKASE

6. Description of your current research

My current research is on the Jomon Period (ca. 16,500 – 2,300 BP) in southern Hokkaido, primarily from the modern-day Hakodate City region on the Kameda Peninsula. I am examining questions related to the use of plant resources and stone tool technology through the application of starch grain analysis on ground stone implements. Jomon subsistence has long been a popular topic with academics and the Japanese public, but several interpretations of Jomon food practices and resource use have yet to be properly supported by multiple lines of evidence. Starch grain analysis can provide evidence for the presence of many plant families, including those rarely seen in macrobotanical studies (ie. tubers, bulbs, roots), as well as more direct evidence for how these resources were processed and consumed.

My dissertation research thus focuses on the microscopic evidence for processing activities adhering to grinding slabs (ishizara) and grinders (suri-ishi) as a way to connect palaeoethnobotany studies to technological perspectives, and to explore the range of functions that ground stone tools served in Jomon communities. Grinding tools are quite common at Jomon sites, and are often abundant at sites in southern Hokkaido, but the range of variation and what this means for how they were used has not been studied in detail. In particular, my ongoing work addresses the idea that grinding stones are associated with edible nuts, since the presence and frequency of grinding technology has been used as a proxy for the importance of plant resources in general, and nuts more specifically. Based on perspectives from ground stone studies and the evidence so far from residue analyses, it is more likely that grinding tools were used for a variety of tasks, many of which did not involve starchy plants. Grinding stones have not shown clear patterns in morphology and use, and often yield starch grains from multiple families of plants. Edible nuts have not been prominent in my samples.

7. Research implementation and results under the program

Title of your research plan:

Exploring Jomon Period Food and Ground Stone Technology through Starch Residues in Hokkaido, Japan.

Description of the research activities:

For this project, I focused on artifacts from the Middle to Final Jomon, Epi-Jomon, and Satsumon periods to compare with my dissertation research. I observed and analyzed a range of grinding slabs from these periods, as this large category of tools is underrepresented in my current work, and Jomon studies overall. I was also able to expand my study region, adding data from Sapporo and Matsumae peninsula to my previous research in the Hakodate city area. This involved meeting archaeologists from across Hokkaido, seeing more local expressions of Jomon culture, and learning about periods after the Jomon. I processed and analyzed the collected samples at Hokkaido University. The results were largely similar to my previous findings, where many of the starch grains appear to be from roots, tubers, bulbs, and legumes, but many of the artifacts do not yield clear evidence of any plant processing. For the final week, I analyzed modern plant materials to expand my reference collection and improve my ability to identify ancient starch.

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

This was both a productive research trip and an enjoyable experience. Time outside the lab was spent at museums, including small local displays, larger museums, and several Ainu culture centres. This was great for understanding local history, culture, and archaeology, but also to see how the public engages with these topics. Being at the university gave me insight into academia in Japan, and the archaeology community at Hokudai.

9. Adviser’s remarks (if any):

The researcher used time efficiently for sampling new specimens and visiting museums and archaeological sites. Staying in Hokkaido for two months will greatly contribute to an improvement of the quality of the dissertation using larger number of samples from wider areas with a deep understanding on the current status of Japanese archaeology.

JSPS Summer Program 2019
Research Report

1. Name: Victoria BERNDT (ID No. SP19416)

2. Current affiliation:

Concordia University

3. Research fields and specialties:

Humanities

4. Host institution: Yokohama National University

5. Host researcher: Dr. Akiko Sugawa-Shimada

6. Description of your current research

My current research project develops a paper written for my home supervisor, Dr. Marc Steinberg, where I discuss what I term the 'empty narrative world' of the 2018 anime *Pop Team Epic* by animation studio, Kamikaze Douga. *Pop Team Epic* is a property that makes use of the popular culture around it to carry out its own jokes and parodies, however the show has very little original content outside of its parody routines of other properties and even of its own fanbase. This is what it means for the narrative world to be empty, or without any original narrative world where the characters can exist in something recognizable and desirable for audiences. Building off of Otsuka Eiji's ideas of narrative world and Marc Steinberg's understanding of the character-driven marketing of anime goods, my research proposes that *Pop Team Epic* fractures this typical approach to anime franchises by having the show pull other narrative worlds *into* itself rather than bringing its own narrative world *to* other things.

The paper discusses elements of audience and production that I needed additional research on, which the JSPS Summer Program was able to facilitate. Research in Japan manifested in the form of visiting various anime or character goods hubs in Japan, specifically those around Tokyo and Kyoto, where I investigated the presence of *Pop Team Epic* in those spaces. The goal of this research was to determine the role that the anime played in industry merchandise production compared to fan merchandise production, and what the venue indicated about the type of merchandise that was sold. Focusing on character merchandise was valuable for my research due to its unique role in Japanese media, also due to what it can indicate about the perceived narrative world of the anime's marketing.

7. Research implementation and results under the program

Title of your research plan:

Negotiating the Space of Franchise: *Pop Team Epic's* Fan-Focused Cultural Productions

Description of the research activities:

Research activities consisted of visiting otaku/anime fan and character goods stores and districts around Japan, notably Akihabara, Nakano Broadway, Harajuku, Shibuya, Nishiki Market, and the Kyoto International Manga Museum. These locations provided me with an understanding of character marketing and the perception of the role of *Pop Team Epic's* protagonists through understanding how they were marketed and where. I also received advice from my host supervisor on where to search for fan-made merchandise or fan responses to the anime, of which digital art website Pixiv played a large role. My findings concluded that officially licensed *Pop Team Epic* merchandise pushed the idea that the anime retained a recognizable narrative with memorable scenes and behaviours. This approach suggests that *Pop Team Epic* sees their main characters as able to retain meaning when transferred to merchandise. The message is lost when this happens, because relying only on *Pop Team Epic* as the only source of meaning significantly downplays the parodic and referential qualities the show really has. I also found that *Pop Team Epic* was known for participating in brand deals with other character franchises such as Sanrio or *BanG Dream!* (Bandori), which are also franchises that exist in flux with other collaborative products. On the other hand, fan creations emphasized *Pop Team Epic's* aesthetic style and transposed it onto other media properties, furthering the parodic nature of the anime and extending its interpretations. The habits between both forms of merchandising can blur at times, due to the complex place that *Pop Team Epic* occupies in decoding popular culture, however it remains necessary to look critically at how its characters are regarded by the industry, because this demonstrates how the anime thinks creatively, and how it might inspire marketing habits of anime that also use parody and make reference to more popular culture down the line.

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

The JSPS Summer Program enabled me to meet several researchers in my field living in Japan, as well as attend the DiGRA (Digital Games Research Association) conference in Kyoto. I had the opportunity to travel and experience several impressive festivals, architectural marvels, and other valuable aspects of Japanese fan culture simply by being in the country, opportunities which I may not have been able to experience without this program. My host professor was also kind enough to organize a lecture where me and my colleague presented our current research with JSPS aided by her translations. This was a valuable opportunity for me to engage with other students and learn how to present my work.

9. Adviser's remarks (if any):

N/A

JSPS Summer Program 2019
Research Report

1. Name: Fares BADR （ID No. SP19417）

2. Current affiliation: McMaster University

3. Research fields and specialties:

Engineering Sciences　　Biological Sciences

4. Host institution: Shizuoka University

5. Host researcher: Prof. Keiichiro KAGAWA

6. Description of your current research

At the Fang lab at McMaster University, we are interested in measuring fluorescence lifetimes for biological applications such as high-content drug screening. One of the technical challenges is detecting low levels of fluorescence light and intensity decay on the order of a few nanoseconds. The imaging devices laboratory at Shizuoka University has developed a novel CMOS detector that can bin photoelectrons into one of 4 storage diodes and rapidly switch from one storage diode to the next in roughly 1 ns. This allows fast gated detection of fluorescence decays.

I investigate which fluorescence lifetime retrieval algorithms are compatible with the 4-tap detection and research methods of optimizing the lifetime retrieval. One proposed method was to optimize the time width of the bins used in the detector depending on the fluorescent target being investigated. I simulate fluorescence decays and readouts from the 4-tap detector and apply different algorithms for lifetime retrieval at varying total photon counts. We excite a fluorescent target and apply the algorithms to fluorescence decays as measured by the detector to investigate the viability of this detector at its current stage for a fluorescence lifetime microscope at McMaster University.

7. Research implementation and results under the program

Title of your research plan: Dynamic Time Gates in Multi-tap Detector for Fluorescence Lifetime Imaging

Description of the research activities: The first phase of the research was learning how to operate the 4-tap detector, which involves grabbing frames, adjusting tap timing and delays and interpreting the raw ADC output. Next, the temporal response of the detector was estimated by imaging a short laser pulse at different delays. This gave an estimate of the response time and random temporal noise. This data was then used in a simulation of fluorescence decays being measured with the given temporal response and random noise. Rapid lifetime determination, linear least squares, phasor analysis, and maximum-likelihood estimation were applied to the simulated decays and to measured decays. The results show that the most significant source of uncertainty in using 4-tap data to retrieve lifetimes is the difference in gate timings and response times of the pixels. Maximum-likelihood Estimation can compensate for differences in gate widths between different pixels, and thus is likely the most viable lifetime retrieval approach using 4-tap data, out of the 4 algorithms that were investigated.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): In addition to the experiences granted in the orientation week, I had the pleasure of visiting Osaka Castle and Nara Park. Other cultural experiences include eating unagi and gyoza, navigating the train and bus systems, and casual chats in Japanese with other graduate students.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Edward DeWit （ID No. SP19420）

2. Current affiliation: Queen's University

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Nihon University, College of Science and Technology

5. Host researcher: Dr. Tomohiko ASAI

6. Description of your current research

I study plasma science and engineering with the application to nuclear fusion energy. A common approach to harnessing nuclear fusion energy is called magnetic confinement fusion (MCF). In MCF reactors, an extremely hot and tenuous plasma is confined using an array of powerful magnetic field coils. If the magnetic configuration can sustain the hot plasma in a stable state for long enough, then the reactor will produce net energy gain.

I am currently studying a plasma configuration known as the compact toroid (CT). The CT is a toroidal plasma with small aspect ratio and high plasma density. It has unique features that make it a viable candidate for a nuclear fusion reactor including magnetic field efficiency and compact geometry. In addition to nuclear fusion, the CT has other applications including ion propulsion and atmospheric science.

The plasma lifetime in an MCF device is often limited by destructive instabilities which lead to disruption of the confined plasma and a loss of confinement. In order to extend the plasma lifetime, the focus of my research is the design and development of technologies which mitigate these harmful instabilities. We are pursuing a few possible avenues of research including MHD simulation, theoretical studies, and experimental work.

In addition, my advisor has experience in the field of CT injection for refueling of MCF reactors. He studied CT injection at the University of Saskatchewan on the STOR-M tokamak, another type of MCF reactor. CT injection is being considered as a possible refueling method for the world's largest tokamak called ITER. We are exploring further work in this area.

7. Research implementation and results under the program

Title of your research plan:

Edge-Biasing of a Field-Reversed Configuration Plasma

Description of the research activities:

The field-reversed configuration (FRC) is classified as a compact toroid (CT), that is typically formed in a cylindrical confinement chamber. The simple linear geometry of the confinement chamber provides the possibility of direct conversion of plasma energy to electricity. The FRC research device at Nihon University forms FRCs by the method known as collisional merging, whereby two magnetized plasmoids are injected into a central confinement chamber and merged into an FRC.

The aim of the edge-biasing experiment is to investigate a possible control method of FRC rotation that will lead to longer plasma lifetimes. In fact, the FRC lifetime is considered limited by the onset of what is known as the rotational instability. This unstable mode is observed by an elliptical deformation in the plasma cross-section and oscillation in the line-integrated plasma density.

My work at Nihon University has been twofold: to better understand the nature of FRC plasma confinement and to assist with the design of components that will be installed on the FAT-CM device for the biasing experiment. My focus was the design of a plasma flow diagnostic using a device called a Mach probe. Additionally, I presented the status of the biasing experiment at a plasma science workshop at the National Institute for Fusion Science (NIFS).

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

The JSPS Summer Program provided an excellent opportunity to experience Japanese culture and research systems. I was able to travel in Japan and interact with many researchers in my area. The orientation program at SOKENDAI was enjoyable and a perfect exposure to life and research in Japan. I would like to thank Prof. Asai for helping me learn about Japanese culture and to be successful at my research and in my career.

9. Adviser’s remarks (if any):

Mr. Edward Dewit has studied experimental plasma physics as a member of a research team consisting of a plurality of students. He is proactive in communications with other students and tackles research tasks during his stay. I believe his visit will strengthen the Japan-Canada research partnership.

JSPS Summer Program 2019
Research Report

1. Name: Morgan Richards （ID No. SP19421 ）

2. Current affiliation: McMaster University

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Shizuoka University

5. Host researcher: Dr. Keiichiro Kagawa

6. Description of your current research

Recent literature shows the design of high signal to noise time-gated pixels capable of collecting as many as eight time gates in a single-pixel cycle. This configuration, known as a multi-tap pixel, can record different time windows allowing the sampling of a single fluorescence emission profile at enough time points to allow multi-exponentials to be decomposed. The pixels use electric potential shaping elements called lateral electric field charge modulators, to produce potential distributions that ferry photoelectrons at the photodiode to extra storage diodes. The storage diodes act to hold the charge of a specific time gate for the duration of the exposure period. The buildup of charge across the exposure time allows low signal events to be observed.

We wish to show that the multi-tap pixel enables the efficient collection of multi-exponential decays. From these multi-exponential decays, we can demonstrate that a multi-tap pixel outperforms other time-resolved solutions in low signal environments and is compatible with multipoint confocal microscopy.

7. Research implementation and results under the program

Title of your research plan:

Multi-Tap Multi-point confocal microscope for rapid lifetime acquisition

Description of the research activities:

While at Shizuoka University, I produced a multipoint confocal system for fluorescence lifetime measurements. The system was designed using a microlens array, fast scanning mirror system, many lenses and filters, as well as a multitap camera provided by our host institution. My time was split into 3 primary tasks; electrical hardware fusion, optical system design, sensor implementation and image acquisition. The system designed was modelled off the system at my home institution, with reproducibility in mind. First, I designed the scanning relay and characterized the scanning error. Next I implemented a demo system to verify my models. I ordered the components for the epifluorescence section and assembled the remaining portion of the microscope. With Shizuoka's camera, I made modifications to the GUI provided to include the signal delay controls as well as the scanner API. Modifications to the cameras were made to its FPGA, and the cameras noise and temporal performance were characterized. The camera was integrated into the optical system, and the first scans were collected.

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

Japan is a beautiful and unique country to explore. During my stay I visited several different and distinct cities, including Tokyo, Osaka, and Nara. Every city is a new chance to discover cuisine, culture, and heritage of the Japanese people.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Min Xia （ID No. SP19422）

2. Current affiliation: University of British Columbia

3. Research fields and specialties:
Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Yoji Okabe

6. Description of your current research

My current research focuses on data-driven machine health monitoring through machine learning methods. Manufacturing system reliability is significant in modern industry that requires high production speed, low maintenance cost, and enhanced operation safety. With the rapid development of sensors and communication technologies, more and more industrial machines and devices are connected and monitored in real-time. The generated massive data form the sensors contain abundant information about the condition of the machines. My research is to establish a systematic and applicable approach for condition monitoring of key machinery (e.g. bearings, gearboxes, motors) through data fusion from multiple sensor and data mining with deep learning approaches. Sensory information from various types of sensors can be fused by sensor fusion algorithms. Deep learning, as an emerging technique successfully applied in many areas is utilized to automatically extract the knowledge inside the massive sensory data. My research investigated various type of deep learning approaches, including supervised learning such as convolution neural network and recurrent neural network, transfer learning, reinforcement learning, etc. After training of the diagnosis or prognosis model, the intelligent machine fault diagnosis and prognosis system can be developed to achieve increased accuracy and reliability in fault detection and remaining useful life prediction of the monitored machines.

7. Research implementation and results under the program

Title of your research plan:

Structural Health Monitoring of Carbon Fiber-reinforced Plastic using Ultrasonic and Deep Learning

Description of the research activities:

Composite material has been widely and increasingly used in many industrials such as airplane and automobile to reduce the weight of the vehicle so as to achieve lower fuel consumption. In this research, we have investigated data-driven structural health monitoring of carbon fiber-reinforced plastic with data-driven approaches. First, ultrasonic waves exited by laser sources are collected from the carbon fiber-reinforced plastic plate which contains pre-manufactured defects inside the plate at different depth. Then, wavelet transform is carried out on the ultrasonic waves. The produced two-dimensional figures are then used as input of convolutional neural network-based classification model. After training, the deep learning-based fault classification model can achieve precise detection of defects.

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

The experience of this program is extraordinary. Especially, the connection I built with the host researcher and students. Also, the host family during my homestay is very nice. We got together several times during my stay.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Chak Hong Andy UN （ID No. SP19 423）
2. Current affiliation: University of Victoria
3. Research fields and specialties: Chemistry
4. Host institution: Osaka University
5. Host researcher: Prof. Sensuke OGOSHI
6. Description of your current research Novel transformations of heterocycles are demanded in order to yield diversity in three-dimensional space, and such development can prove to be beneficial in advances of drug discovery or improved material properties. Based on understandings from literature precedents, we strategically proposed novel transformations based on said findings, and seek to prove its feasibilities.

7. Research implementation and results under the program

Title of your research plan:

Nickel-catalyzed [3+2+1] synthesis of 2-pyridones

Description of the research activities:

The aims of this project were to utilize known processes of nickel-catalysis in order to synthesize nitrogen-containing heterocycles. Unfortunately, the lofty goals were not accomplished. Initial mechanistic analysis revealed that pi-coordination of either imine or aldehyde moieties with nickel(0) was facile under ambient temperature; however, interaction of the ester moiety was absent as revealed by control experiments. Substitution of the ester moiety into ketone allowed C-C bond formation; however, annulation via carbonylation was not feasible despite forcing conditions. Despite the significant setback, limitations were understood and may be helpful in other catalytic transformations. Development of novel designer ligands may prove to be beneficial for modulating reactivity and thus circumventing currently encountered issues.

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

I have grown fond of living in Japan as it is very convenient living here. 24/7 convenience stores offer a sense of comfort and diets of balanced nutrition. The dense network of public transit was beneficial for travelling for either personal or business purposes, although background research is highly recommended in order to understand the big picture. Furthermore, the amount of historical heritage allows one to immerse into how the culture of Japan developed over historical events. In fact, this exchange program has stimulated me to consider working or perhaps retiring in Japan in the future.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Rayendra Anandika
（ID No. SP19501）

2. Current affiliation: Lulea University of Technology

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Prof. Sohichi Hirose

6. Description of your current research

My research is about finding a way to monitor near-surface cracks in railheads. Near-surface cracks is a type of crack that typically caused by wheel-track interaction. Mostly this cracks are located at the gauge corner.

In order to remove the cracks and to standardizing the worn rail profile, the rail is ground. To determine the most optimum thickness, prior rail grinding, an inspection is conducted.

An inspection of near-surface cracks in railhead has been conducted by using phased array ultrasonic testing (PAUT). From this experiment, it shows that PAUT is able to detect not only the depth of crack tips but also the path of crack propagation from the rail surface to the crack tips clearly. Being able to do this, the growth stage of the crack can be estimated. By knowing the crack growth stage, the severity level of cracks can be known. Hence, the depth of rail grinding can be adjusted based on this information. The grinding does not necessarily need to remove all cracks. Several cracks can be remained in the rail head after grinding, with assuming that the remaining cracks are not severe so it is safe to leave it there.

This result can lead to a saving of rail maintenance budget which is an important thing for railway industry. In the future, it is possible to use our inspection methods to inspect near-surface cracks in the used rail tracks in the field.

7. Research implementation and results under the program

Title of your research plan:

Development of phased array ultrasonic simulation on inspecting near-surface defects.

Description of the research activities:

The study was begun with the simulation of single element ultrasonic probe. The first stage of programming code has been created by the host supervisor. Then, the simulation has been being developed with multiple element of ultrasonic probes as it is a phased array probes. This work will be continued after the summer program over, we will try to find out the way to apply other research grant to establish other research collaboration with Japanese researchers.

Some times were also used to visit some researchers in the same topics in Tokyo, such as visitation and presentation to Department of Research and Development Japan Rail East Company in Nisshin, and also presentation to the lab of Prof. Saitoh in Gunma University. Some precious insight and comments were given at the presentations.

Next October, one of our research work will also be presented in a conference in Tokyo that held by Railway Technical Research Institute (RTRI). Hence, these occasions become proves that by this summer program my networks become effectively broaden.

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

Japan is marvelous, especially Tokyo! Everything I need and everything I want is in my surroundings. Luckily my Professor is also very supportive with all I do here, and assist all things I need here. Certainly, I will be missing a time to come back here again in the future!

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Dauren MUSSABEK （ID No. SP19502）
2. Current affiliation: LTH, Lund University
3. Research fields and specialties: Engineering Sciences
4. Host institution: Nagasaki University
5. Host researcher: Prof. Kei Nakagawa
6. Description of your current research My present research work is focused on sorption and transport of per- and polyfluoroalkyl substances (PFAS) in aquatic environment. I investigate the source/drinking water contamination at the sites affected by PFAS release. Due to surfactant nature, it is often difficult to predict the behavior of PFAS in solid-water interfaces. Furthermore, with intermittent contamination, the environmental investigation and assessment become a challenging tasks. The research combines field investigation, analysis, and modelling. Environmental samples, collected and analyzed, are used to study the contamination state and conditions. With combination of sorption, transport and hydrogeological models, the analysis data is used to develop a retrospective contamination model.

7. Research implementation and results under the program

Title of your research plan:

- Groundwater quality and nitrate pollution in Shimabara region
- Sorption and transport of per- and polyfluoroalkyl substances

Description of the research activities:

- Field study

  The groundwater sampling was carried out in Shimabara area of Nagasaki prefecture. During the sampling, water samples were collected at the selected locations, including private wells, observations wells and springs. Several measurements were performed on site, including alkalinity, ORP and TDS. Collected samples were delivered to the laboratory and analyzed using IEC. Results were used to evaluate and map the groundwater quality in Shimabara region.

- PFAS mass balance in groundwater

  Results of the recent study on passive sampling in groundwater were evaluated and summarized in a report.

- Sediment analysis

  The sediment samples from PFAS contaminated site were analyzed using XRF spectrometry. Obtained results will be used to evaluate the impact of inorganic content on PFAS sorption and combined with previous study on sediment core analysis.

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

JSPS Summer program gave us a great opportunity to experience life and culture in Japan. I enjoyed my stay in Nagasaki, a small town with its history and heritage. I am thankful to Nagasaki for patience and kindness. It was very exciting to live a student life at the campus, have lunch, dinner and do many things in a group. Our journey during fieldwork, was particularly interesting, I had a chance to see all states of Shimabara, from farmers and rice field to fancy traditional houses and administrative offices. It was fascinating to see how locals and authorities were willing to support and contribute to ongoing research.

9. Adviser's remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Karl Olofsson （ID No. SP19503）

2. Current affiliation: KTH Royal Institute of Technology

3. Research fields and specialties:

Mathematical, Physical Sciences and Biological Sciences

4. Host institution: Tokyo University

5. Host researcher: Prof. Madoka TAKAI

6. Description of your current research

Cell behavior and cell state is governed by the micro-environment surrounding the cells. Regular cell culture techniques, which uses flat surfaces to culture cells in 2D, does not model the complex in vivo environment. This is also true in solid tumors where the microenvironments in and surrounding the tumors are known to influence immunological and therapeutic response. Multicellular tumor spheroids (MCTSs), which are 3D cultured spherical tumor cell aggregates, are appreciated as tumor models since they reproduce the tumor microenvironment through cell–cell contacts, biochemical and biophysical cues.

We have developed an ultrasound based MCTS culture platform which takes advantage of ultrasonic radiation forces to form and culture MCST in microwells. The aim of the research project is to address current limitations in MCTS imaging and analysis by using the excellent imaging possibilities of our platform. Another aim is to form layered co-culture MCTS which would enable new and exciting solid tumor models.

In collaboration with Björn Önfelts lab we are using these techniques to study the interaction between MCTS and human Natural Killer (NK) cells which have cytotoxic capabilities against tumor cells. Understanding these interactions and dynamics might reveal novel routes towards NK cell-based immunotherapy and NK cells role in regulating the environment surrounding a solid tumor.

7. Research implementation and results under the program

Title of your research plan:

A novel tumor 3D cell culture approach for optimized for live cell microscopy analysis.

Description of the research activities:

As mentioned above, one of the main challenges when working with MCTS and 3D cultures is overcoming the imaging issues. Each cell in a spheroid acts as a light-scattering object which limits the imaging depth and thus the retrievable information about cell state and cell behavior from within the spheroid. To perform whole MCTS imaging it is necessary to fix and clear (e.g. make the MCTS transparent) the MCTS which can only serve as an end-point assay in which time dependent dynamic events cannot be captured.

Cell state and cell behavior in the MCTS depends on gas- and nutrient gradients which are distributed in 3D (Figure 1A), where cells in the outer layer will have access to high levels of nutrient and oxygen compared to the inner core. To cover the full spectrum of gas- and nutrient gradient dependent cell behavior, the fluorescence excitation and emission of fluorescent dyes must be able to penetrate all the cell layers in between the culture substrate and the MCTS center, where the full MCTS width can be captured (Figure 1B). Cells in between the substrate and MCTS center will not be subjects to the full width of the gradients (Figure 1C). It is usually impossible to retrieve fluorescent signals from the MCTS core with conventional confocal microscopy.

The proposed project for the JSPS Summer Program 2019 was to design, fabricate and characterize a device in which 3D cultures can be formed where the gas- and nutrient gradients varies in 2D instead of 3D (Figure 1D). This could be achieved if cells are shaped into a cylinder, instead of a sphere, where the top and bottom is attached to gas impermeable glass (Figure 1E). Imaging through the glass would give direct optical access to cells experiencing the full gradient (Figure 1F) and thus allow observation of dynamic behavior which change over time.

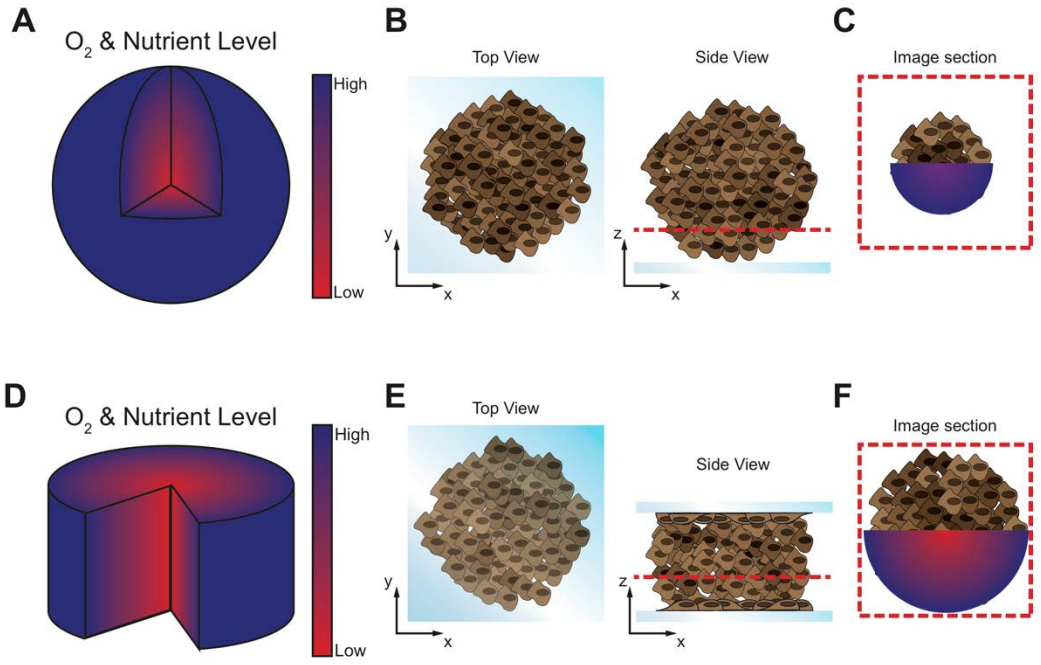


Figure 1: Schematic overview of the novel 3D culture concept.

During the JSPS summer program I was able to fabricate the proposed microchannel out of PDMS glass which work well in terms of the fluidics. In order to shape the 3D culture into a cylinder, showed schematically in Fig. 1, I used a protein repellent polymer coating where I tried to block certain areas in the microchannel for allowing cells to adhere specifically to the blocked and thus uncoated areas. The agarose blocking strategy was successfully developed during the summer program and was optimized on cover glasses but due to the limited time this was unfortunately not translated into the microchannel. This work will continue at KTH where Takai lab will supply me with the materials needed to finish the work.

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

During the summer program I had plenty of experiences with Japanese culture; both traditional and modern. The highlight of my stay was returning to my host family for bon matsuri (traditional dancing festival) where I experienced a neighborhood community festival and tried traditional dancing.

JSPS Summer Program 2019
Research Report

1. Name: Ilian Häggmark （ID No. SP19504 ）

2. Current affiliation: KTH Royal Institute of Technology, Stockholm, Sweden

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Japan Synchrotron Radiation Research Institute (JASRI)

5. Host researcher: Dr. Kentaro UESUGI

6. Description of your current research

X-ray phase-contrast imaging is a set of techniques with the potential to greatly improve medical research and clinical imaging. While conventional techniques rely on absorption of x-rays to produce image contrast, phase-contrast technique use both absorption and phase shift of x-rays. This can greatly improve image contrast for biological specimens of medical relevance. Two technique are possible to implement with small-scale laboratory source and thus feasible for clinical imaging in hospitals. One is grating-based imaging (GBI), which measures the phase shift by inserting gratings in the x-ray beam path. The other is propagation-based imaging (PBI), which does not require any additional optical elements. The absence of optical elements in PBI is a very desirable feature, but it comes with the need for brighter x-ray sources and a more complicated post processing. My current research effort concerns the latter problem. This is a well-known inverse problem where the mixed signals from absorption and phase shift should be separated. The most common approach today is to acquire one image, that is, too little data to theoretical be able to calculated the two signals, and then via an approximation obtain a sufficient answer. Collecting two or more images to accurately calculate the two signals is rarely done and is complicated for typical laboratory source due to their polychromatic nature and non-parallel beams. I am investigating solution to this problem to enable quantitative imaging using PBI in a clinical setting.

7. Research implementation and results under the program

Title of your research plan:

Energy phase retrieval in x-ray phase-contrast imaging.

Description of the research activities:

The activities have consisted in acquiring different kinds of x-ray images and then performing post processing (phase retrieval) using multiple energies (spectral imaging).

Simulations of x-ray images have first been used to test different scenarios. Experimental data (images) have then been acquired at the BL20B2 beam line at SPring-8 to compare and verify the simulations. Data acquire on laboratory sources has also been used.

The processing methods tested have been both modifications of old methods and recently proposed methods. To be useful a method needs to have both high precision and good stability with respect to the noise level (SNR) in the data (images). This second criterion is particularly challenging for the target application (lab sources).

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

Japan is a very friendly country so this summer has been very enjoyable both during and after work. I find Japanese history and culture interesting, so this summer I made a few short visits to the Sanin region and Shikoku.

9. Adviser's remarks (if any):

He is sincerely engaged in the research, and I have a good feeling about it. He is also interested in Japanese culture, including Japanese language, and this is also a good trend. However, the support of the receiving side might not have been enough, and it would be a point which should reflect in our facility. In the future, we would like to continue to have relationships that provide information to each other.

JSPS Summer Program 2019
Research Report

1. Name: Rajnish KUMAR （ID No. SP19505 ）

2. Current affiliation:

Karolinska Institutet, Stockholm, Sweden

3. Research fields and specialties:

Medical, Dental and Pharmaceutical Sciences

4. Host institution: National Institutes of Biomedical Innovation, Health and Nutrition, 7-6-8 Saito-Asagi, Ibaraki City, Osaka 567-0085, Japan

5. Host researcher: Prof. Kenji MIZUGUCHI

6. Description of your current research

Alzheimer disease (AD) is a progressive, non-reversible devastating neurodegenerative disorder affecting more than 50 million people worldwide. Despite several remarkable achievements made during these years, the pathophysiology of AD still remains elusive and not fully understood. It is becoming more evident from the recent studies that AD is a complex, multifactorial disorder, which can be seen as a hurdle to discover novel therapies for AD. Also, the recent big failure of anti-amyloid therapeutics in clinical trials in several stages indicated that the we need to explore the other amyloid independent targets such as calcium dyshomeostasis, tau-mediated neurodegeneration, mitochondrial dysfunction, inflammatory pathways and glucose metabolism related pathways.

In order to discover novel therapeutics for the treatment of AD, we are taking a novel approach to explore the potential of molecular chaperones as a legitimate drug target for the treatment of AD. Using a combined structure-based drug design strategy, we are designing and developing small molecule inhibitors of molecular chaperones. We started with solving the crystal structure of one of the molecular chaperone complex reported to be involved in neurodegeneration. And further using this crystal structure, we screened a commercially available large library of small molecules using molecular docking based virtual screening. In vitro screening of these prioritized compounds led us to identify several structurally diverse small molecules with a high potency and selectivity against the target. Our current efforts are devoted to validate these identified hits and to optimize them into pre-clinical drug candidate.

7. Research implementation and results under the program

Title of your research plan:

Exploration of protein-protein interaction networks to identify novel drug targets for Alzheimer's disease

Description of the research activities:

With the latest advancement in the drug discovery and development techniques, it has become possible to target the tough-to-target protein-protein interactions (PPI). System biology-based network analysis can be helpful to identify novel drug targets among the PPI network. Since, the current failure of clinical trials in the AD filed, there is an unmet need of finding new drug targets to expand the coverage of drug discovery.

I have used the TargetMine, developed by the laboratory of Prof. Kenji Mizuguchi at National Institutes of Biomedical Innovation, Health and Nutrition, Ibaraki, Osaka, Japan. It is an integrated data warehouse system primarily developed for target prioritisation and early stage drug discovery. Using TargetMine, I have analysed RNAseq differential gene expression data to identify potential genes and protein targets. I further explored the protein-protein interaction network information to identify legitimate new drug targets of AD.

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

It was a wonderful experience to do a short-term research work in Japan under JSPS summer fellowship. The first week of introduction to the Japanese cultures and language as well as the home stay experience was amazing. The working atmosphere at the Prof. Mizuguchi's lab is very pleasant as well as productive and rewarding.

9. Advisor's remarks (if any):

Dr Kumar interacted well with all the members of our lab and we found his expertise in computer-aided drug design and ours in biological data integration highly complementary. We hope to keep in touch and develop a larger collaborative programme in the future.

JSPS Summer Program 2019
Research Report

1. Name: Anna Asratian （ID No. SP19506）

2. Current affiliation:

Center of social and Affective neuroscience (CSAN), Department of Clinical and Experimental Medicine (IKE), Linkoping University (LiU)

3. Research fields and specialties:

Biological Sciences, Interdisciplinary and Frontier Sciences

4. Host institution:
Advanced Telecommunications Research Institute International (ATR)

5. Host researcher:
Dr. Takeshi Ogawa

6. Description of your current research

As a research engineer, I am involved in multiple projects measuring behavior, psychophysiology and biological molecules for the sake of understanding social and affective psychiatric disorders better for the possibility to improve current treatment.

The most recent projects that I have been involved in investigates the change of the levels of a molecule (anandamide) in an innate system (the endocannabinoid system) by a mutation (C385A) on the enzyme that breaks down anandamide. Our goal has, firstly, been to investigate if the increase of anandamide will facilitate fear conditioning and/or act as a stress protector, and then, secondly, to explore the possibility to pharmaceutically tweak the system to improve treatment for PTSD patients.

7. Research implementation and results under the program

Title of your research plan:

Finding psychiatric biomarkers for future clinical treatments

Description of the research activities:

Our data set consisted of resting-state functional MRI (fMRI) and demographic data including clinical evaluation scores from 191 individuals. To be able to process the data, I first had to learn how to program in MATLAB and understand basic statistics using parametric/non-parametric analysis and its visualization methods.

After the initial analysis, I applied a general linear model to find linear relationships between the demographics, the clinical data and resting-state functional connectivity obtained from fMRI data. We used seed-based correlation analysis from 6 brain regions (subregional amygdala) that were provided to us from previous study (Wu et al., Sci Rep, 2016).

During my time in Japan I had the opportunity to visit the annual conference of Japan Neuroscience Society (Neuro2019) in Niigata. There, I had the chance to

network with other neuroscientists and listen to the frontiers in neuroscience.

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

My stay in Japan has been rich in experiences and networking. My most colorful memories are learning more about the Japanese ninjas dressed up as a ninja in the Ninja city, Iga, and learning the Bon Odori to the rhythm of a Taiko dressed up in a beautiful Yukata arranged by the town people of Seika-Cho.

Together with some other JSPS fellows we travelled every weekend to experience as much as we could of Japan. I travelled all the way to the top and visited Sapporo and Otaru (for the famous 7-layer rainbow ice cream) in the chilly Hokkaido, walking through the majestic castle in Himeji and to the far south to enjoy the beautiful beaches of Okinawa.

Except for trying the multiple flavors of ice cream existing in Japan, I tried a variety of food experiences from miso ramen, the kaisen-don/donburi to the convenient store onigiri. My supervisor introduced me to the Tokyo and Osaka way of eating Soba noodles and, in general, made me experience many ways of Japan, such as going to a baseball game and releasing the balloon at the 7th inning.

I won't be able to forget living and bicycling between the rice fields in the Japanese countryside, and the hospitality of all the Japanese people I met.

9. Adviser's remarks (if any):

Ms. Asratian have worked on a project to understand sex-age differences of functional brain structure associated with emotional regulation underlying mechanisms of psychiatric disorders. We have discussed roles and mechanism of emotion regulation based on Amygdala, then we hypothesized that the functional brain network should be different depending on sex and age. This is the first time for Ms. Asratian to program statistics in MATLAB for large-scale data and functional MRI data (fMRI), but she implemented MATLAB codes to visualize effects and significances with multiple variables. Based on these results, we have analyzed fMRI data at rest to identify networks related to psychiatric symptoms. This is an important step to achieve the project to clarify network functions of emotion regulation using large-scale brain data repository in near future.

JSPS Summer Program 2019
Research Report

1. Name: Laura Barbieri （ID No. SP19507）

2. Current affiliation: Karolinska Institutet

3. Research fields and specialties: Biological Sciences

4. Host institution: University of Tokyo

5. Host researcher: Norihiko Takeda

6. Description of your current research

My research project aims at investigating the impact of physical activity on the immune system, and specifically on the immune response in the context of cancer. Epidemiological data from both clinical and pre-clinical studies indicate that exercise reduces the risk of incidence, progression and recurrence of several types of cancer. My research is focused on understanding the molecular mechanisms behind exercise's antineoplastic effects. We have preliminary data suggesting that a specific immune population, the CD8+ T-cell population, might be mediating the antineoplastic effect of exercise. For my PhD project, I am investigating the role of intracellular metabolism on CD8+ T-cell function, focusing on bio-energetic pathways, i.e. glycolysis and oxidative respiration. My goal is to find a link between exercise, exercise-derived factors including lactate, and T-cell metabolism. Lactate is the end product of glycolysis and can be used as an alternative carbon source to glucose by several cell types. I am interested in the potential role of lactate as energy fuel and *immunometabolite* for CD8+ T-cells. In Prof. Takeda's laboratory I am investigating the role of an essential glycolytic enzyme, LDH-B, on CD8+ T-cell function. LDH-B is responsible for the conversion of lactate into pyruvate, which is, in turn, necessary to the incorporation of lactate into the intracellular energy-generating metabolic pathways. To this purpose, I am using a tissue-specific knock out (K.O.) mouse of LDH-B that Prof. Takeda has previously generated in his laboratory. By isolating CD8+ T-cells from this model and treating them with lactate, I will investigate whether the LDH-B enzyme plays a role in the overall effect and eventual utilization of lactate from CD8+ T-cells. In addition to this, I will characterize the cells from W.T. or K.O. animals in terms of proliferative, differentiation and cytotoxic capacity.

7. Research implementation and results under the program

Title of your research plan:

Lactate as an alternative fuel for CD8+ T-cells: effect on intracellular metabolism, immune function and implications for cancer immunotherapy.

Description of the research activities:

I isolated CD8+ T-cells from W.T. or K.O. animals and cultured them *in vitro* in the presence of different compounds, including lactate. I then measured proliferative capacity and cytotoxicity, which is a main feature of CD8+ T-cells and indicates their capability of killing undesired organisms or malignant cells (like cancer cells). I also performed a metabolic real time assay using a Seahorse XF Analyzer, which allows to identify alterations in metabolic activity of live cells. No difference was observed in proliferation, differentiation or cytotoxic activity of W.T. compared to K.O. CD8+ T-cells, indicating that LDH-B might not be involved in the phenotypical and functional effects of lactate. The overall metabolic activity of CD8+ T-cells was consistently and significantly altered by lactate administration and this effect was completely reverted in the K.O. cells, suggesting a role of LDH-B in the incorporation of lactate into CD8+ T-cells metabolism.

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

I feel honored for having had a chance to live and work in such a welcoming and revealing country as Japan. Every person I met here has manifested the deepest kindness and availability, and always tried to make me feel at home. I especially enjoyed working with my colleagues and exchanging opinions and different points of view. I believe that this experience has had, and will keep having, a strong influence on my future life.

9. Adviser's remarks (if any):

It was a great honor for us to work with Laura Barbieri. Honestly, we all lab members really enjoyed our time with her. First of all, she did a really great job in her study, and characterized the roles of lactate metabolism in T cell function very thoroughly. Secondly and more importantly, she gave us an incredibly positive impact to our lab. We learned a lot from her very friendly and positive attitude and her networking skills. I do believe she will be an excellent scientist in the near future.

JSPS Summer Program 2019
Research Report

1. Name: Filipa Santos Viegas （ID No. SP19508 ）

2. Current affiliation: Karolinska Institutet

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

4. Host institution: Osaka University

5. Host researcher: Prof. Tamotsu Yoshimori

6. Description of your current research

Mitochondria-associated ER membranes (MAM) are subdomains of the ER that face mitochondria and where mitochondria-ER contact sites (MERCS) are established. MAM has been linked to several fundamental physiological processes, e.g., lipid metabolism, modulation of Ca^{2+} signaling, APP processing and autophagosome formation. Interestingly, it has been suggested that neurodegeneration observed in Alzheimer's disease (AD) could be caused from malfunctioning of the MAM since the processes mentioned before are altered in the pathology. Our current work focuses on uncovering MERCS ultrastructure and possibly altered MERCS function in mouse embryonic fibroblasts (MEF) lacking either Presenilin 1 (PS1), Presenilin 2 (PS2) or both. Presenilins (PS) are enriched in MERCS and constitute the catalytic core of y-secretase, an enzyme responsible for the generation of amyloidβ-peptide (Aβ) from amyloid precursor protein (APP) cleavage. Familial AD, a hereditary form of AD, is caused by mutations in APP, PS1 or PS2. So far, we have detected differences in these models regarding MERCS ultrastructure and the expression levels of proteins linked with MERCS, suggestive of altered function.

How the altered function of MERCS, in these cell models, impacts autophagy and autophagic flux is yet to be uncovered. Measuring basal levels of autophagy and upon different autophagic stimulus, such as inhibition of autophagy and induction of autophagy (through starvation), could explain such interactions.

7. Research implementation and results under the program

Title of your research plan:

Autophagic flux measurements in Presenilin-deficient mouse embryonic fibroblasts

Description of the research activities:

Yoshimori's lab has developed a probe that is capable to enlighten on what level the autophagic flux is altered. The tfLC3 (mRFP-eGFP-LC3) probe utilizes the quenching of the fluorescence of eGFP at the acidic pH achieved after an autophagosome fuses with a lysosome, whereas mRFP remains stable at such pH. Contrarily to other LC3 probes, this construct enables a more accurate identification of autophagic structures and thus which stage(s) of the autophagic pathway might be affected: autophagosome formation, fusion with lysosomes and/or maturation/autophagosome clearance. Thus, in the two months I have tried to transfect the presenilin-deficient mouse embryonic fibroblasts with this probe. More time is needed to optimize the experiments for this type of cells. Even though I was not able to come up with answers to my project within the time frame. I have learned about the different approach that one must consider when studying autophagy, including handling of cells itself. I have also learned how to use different types of microscopy and new ways to improve acquisition of images, processing and analysis. Overall, my experience at Yoshimori's lab proved to be an enriching professional experience by not only learning new techniques and methods, but also by working through language barrier issues.

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

I will never forget my time in Japan, which was filled with so many amazing new experiences. In my free time, I was able to do kimono dressing, snorkeling in Okinawa, have an *onsen* experience, hiking, *sake* tasting, and even watched *hanabi* (japanese fireworks) wearing a *yukata* at the summer festivals during *obon* week. Japanese are very kind and friendly. Even though most people don't speak/understand english, they always tried to help me anyway they could.

JSPS Summer Program 2019
Research Report

1. Name: Gravina Giacomo
（ID No. SP19 509）

2. Current affiliation: Institute of Physiology and Neuroscience, Sahlgrenska Academy, University of Gothenburg, Sweden

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

4. Host institution: The University of Tokyo, Japan

5. Host researcher: Professor Okabe Shigeo

6. Description of your current research

Staphylococcus epidermidis (SE) is the most common nosocomial pathogen in neonatal intensive care units and responsible for up to 50% of all cases of late-onset neonatal septicaemia. Emerging clinical evidence suggests that SE play a role in several inflammation-related neonatal morbidities including brain injury (Dong, Virulence. 2018). There is however a lack of understanding of underlying mechanisms of SE-induced organ damage, especially in the brain. Extreme prematurity (infants born before 28 gestational weeks) is associated with poor neurodevelopmental outcome (Serenius, Kallen et al. 2013) and clinical and experimental evidence link perinatal infection/inflammation to subsequent neurological and developmental sequelae (Hagberg, Mallard et al. 2015). Both term and preterm newborn infants are highly susceptible to infections. Epidemiological studies showed that children that had experienced late-onset neonatal sepsis had lower total and verbal intelligence quotients as well as memory and attention impairments. Furthermore, preterm infants exposed to late-onset sepsis showed abnormal motor outcome at school age (van der Ree et al, 2011). However, despite epidemiological findings, more research is needed to determine the exact pathophysiological mechanisms underpinning the neurodevelopmental impairments in children with late-onset sepsis. Immune dysfunction in connection with synaptogenesis has been suggested as a contributing mechanism to theneurodevelopmental disorders (Mead, J. and P. Ashwood, 2015). Our preliminary data indicates that infected mice show signs of hyperactivity at juvenile age suggesting that transient mild bacterial infection can lead to significant long-term neurological consequences. Thus, our data supports findings in human studies where children with neonatal infections are 3 times more likely to be diagnosed with attention deficit

hyperactivity disorder (Rand, Austin et al. 2016). Accordingly, the aim of my research is to investigate the mechanisms that drive inflammation in the immature brain and thereby give insights into the pathogenesis of neonatal brain damage and provide a platform for the future development of novel preventive or therapeutic interventions in a targeted manner.

7. Research implementation and results under the program

Title of your research plan:

Role of perinatal infection in neural circuit dynamics

Description of the research activities:

Neurodevelopmental disorders associated with preterm birth and neonatal sepsis remain a leading cause of morbidity in children, with long-term suffering to the children and a large cost for the society. Inflammation has emerged as a common driving force in the development of brain injury in newborn infants, a condition strongly associated with developmental impairment and permanent neurological deficits, such as cognitive, motor, and sensory disabilities. However, despite epidemiological findings linked inflammation and prematurity with neurological impairments, more research is needed to determine the exact pathophysiological mechanisms underpinning the neurodevelopmental impairments in children with late-onset sepsis. The overall aim of the JSPS project at the University of Tokyo was to understand the morphological changes in spines dendrites subsequent perinatal infection. During my stay at the University of Tokyo, I´ve learned the thin-skull technique in juvenile and old mice and, subsequently, to acquire images with the Two-photon microscopy. Accordingly, through the thin-skull technique in juvenile mice, we will be able to trace the morphological changes of spines dendrites.

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

Since I have always believed that international experiences are the best way for me to increase my interpersonal skills as well as for creating international research network, I was willing to participate to the JSPS summer program. Now, as a JSPS fellow, I would say that it was a great experience both personally and professionally, learning new things every day. During my stay in Japan, I enjoyed quite every moment doing different activities, travelling and discovering as much as I could Japanese culture and traditions. I also appreciated the time spent with my host family.

JSPS Summer Program 2019
Research Report

1. Name: Steffen Marc Brülls （ID No. SP19510 ）

2. Current affiliation:

Chalmers University of Technology, Gothenburg

3. Research fields and specialties:

Chemistry

4. Host institution: Kyoto University, Graduated school of Science, Kyoto

5. Host researcher: Prof. Dr. Hideki Yorimitsu

6. Description of your current research

My research at Chalmers is in the interdisciplinary field of chemistry between organic chemistry and material research on graphene. On one hand, I am working on organic synthesis in our laboratories, which is fundamental research. And on the other hand, I can use the synthesized molecules in order to functionalize the promising material graphene. By that, novel 2D materials on the basis of graphene can be created. The application in sensors on a nano scale seems to be a promising direction for those materials.

I work especially on the design of such pH sensitive sensors, which could have a broad application. The focus of my research is on the synthesis of pi-systems of various size. For the synthesis of these molecules a broad variety of different chemical reaction can be used

7. Research implementation and results under the program

Title of your research plan:

Optimization and further development of lithiation reactions

Synthesis of novel organic compounds via lithiation reactions

Description of the research activities:

In the context of my visit at Kyoto university, I wanted to learn new methods and strategies to build up various pi-systems. I used given reactions and optimized them to receive the desired products in higher yields. After some good parameters where defined, I started to synthesis novel compounds by using the optimized reaction conditions for the lithiation reaction. These novel compound were used amongst others for stability tests. This yielded in new information about the stability of these novel compound and can be taken into account for further research on related compounds.

Reactivity test with different starting materials were performed to get insight about the optimized lithiation reaction. This will help to understand the formation of new various pi-systems.

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

The JSPS summer program 2019 offered me the possibility to experience Japan from different point of view. Especially the home stay experience during the introduction week at the beginning of the program, will remain in my memory. I felt welcome to Japan, could try to speak some Japanese words, could try some typical Japanese food and also could experience the Japanese nature. To put it into a nut shell, a very good beginning of the JSPS summer program 2019. Arrived at my host institute I also felt welcome from the beginning on. My new colleagues went out for dinner with me and gave me useful tips for my stay in Japan. Kyoto is a very nice city with many historical important buildings and was therefore for me a very nice place to stay. By public transportation the surrounding of Kyoto can be easily discovered as well as cities like Kobe, Osaka and Nagoya visited. I highly recommend the JSPS summer program to everyone, who wants to learn about research in Japan, foreign cultures and an unforgettable adventure, because that is what I had during the summer 2019. Thank you.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Evgeniy Lokharu （ID No. SP19511）
2. Current affiliation: Linköping University, Sweden
3. Research fields and specialties: Mathematical and Physical Sciences
4. Host institution: Keio University
5. Host researcher: Prof. Tatsuo IGUCHI
6. Description of your current research My current research cocerns mathematical studies of fluid motion and wave propagation. I am studying traveling waves with vorticity in two and three space dimensions. Existence and qualitative properties of solutions are among central questions I am interested in.

7. Research implementation and results under the program

Title of your research plan:

An analysis of the Isobe-Kakinuma model for water waves

Description of the research activities:

During the JSPS summer program 2019 I worked at Keio University with professor Tatsuo Iguchi. The subject of our research is related to the mathematical modeling of water waves.

During 1990-2000 Prof. M. Isobe and Prof. T. Kakinuma introduced an approximate model for water waves as a simpler alternative for Euler equations. The latter model has been studied intensively by Prof. T. Iguchi, who obtained several important results concerning the model. In particular, it was proved by Prof. Iguchi that Isobe-Kakinuma model provides a great level of accuracy in the shallow water regime. That is for waves whose depth is relatively smaller than the wavelength. It was also proved that solutions to the Isobe-Kakinuma model equations are close to “real” solutions. This makes Isobe-Kakinuma model an important tool for applications.

There are exist many other approximate models for water waves, such as Korteweg -De Vries equation, Green-Haghdi equation and many others. All of them provide a reasonable level of accuracy in different situations. However these models do not allow extreme waves, for which the surface profile forms an angle at the crest. Such waves are proved to exist as travelling wave solutions for Euler equations with free boundary. In contrast to other models it seems that Isobe-Kakinuma model equations admit this type of solutions, both periodic and solitary extreme waves. A mathematical justification of that was one of my goals during the summer program.

Another fundamental question about Isobe-Kakinuma model is it's asymptotic behaviour when the number of equations tends to infinity. We expect that in some mathematically precise sense the model converges to the full water wave problem.

The results obtained during the program can be summarized as follows.

- We were able to explain theoretically the behavior of the problem in the linear case when the number of equations tends to infinity.
- For the case N=1 we succeeded in reducing the problem to an ordinary differential equation, which allows to analyze the properties of the problem in a better way.
- We found a mathematical argument for proving the existence of extreme solitary and Stokes waves.

Obtained results provide an important contribution to the field and imply an intensive future collaboration with prof. Iguchi.

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

During my stay in Japan I participated to two workshops in my field in Kyoto and Sapporo. This was a great opportunity for not only scientific purposes, but also gave me a chance to discover different parts of Japan. I visited several museums, watched incredible fireworks in Yokohama, took a bath in a hot spring in mountains near Sapporo and of course, enjoyed a lot of Japanese food.

9. Adviser’s remarks (if any):

JSPS Summer Program 2019
Research Report

1. Name: Märta-Linn SAGISAKA	（ID No. SP19512 ）
2. Current affiliation: Karolinska institutet	
3. Research fields and specialties:	
Medical, Dental and Pharmaceutical Sciences	
4. Host institution: Tokyo Medical and Dental University	
5. Host researcher: IWATA Takanori	

6. Description of your current research

I am a medical student at Karolinska institutet in Stockholm, Sweden, and haven't conducted any research before arriving in Japan. In Japan, I have been conducting research at the department for periodontal disease at Tokyo Medical and Dental University. My supervisor, prof. Iwata Takanori, is a researcher in the field and has developed a method for treating periodontitis, using PDL-derived cell sheets to regenerate periodontal tissue.

7. Research implementation and results under the program	
	Title of your research plan: Periodontal Regeneration with PDL-derived Cell Sheets
	Description of the research activities: In Japan I have been involved in two types of research activities. First of all, since I didn't have any former research experience, Tsumanuma-sensei, a dentist working and conducting research at TMDU tought me some basic research methods. She helped me grow a cell culture that we analyzed using different types of microscopes. The cells that we used were mesenchymal stem cells. We cultured them, cleaned them, counted them etc. When we looked at them in the microscope, we were able to see how well they had grown, how many they were, the shape of the cell soma and nucleus. Apart from the practical experiments, Iwata-sensei gave me the task of writing a review article on tendon and ligament regeneration. I have been analyzing current research on the subject (tendon/ligament tissue engineering) and writing an article. The field of tissue engineering is expanding rapidly and gaining a lot of attention. My review article focused on research from 2014 onwards. I found that there are many different approaches that are showing promising results, such as the use of different types of scaffolds (natural, synthetic, decellularized, combined), growth factors and cell seeding. We are submitting my review article to the Interntional Journal of Molecular Sciences, and hopefully it gets admitted.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): Since I lived in Japan for 7 years prior to the internship, I was already familiar with Japan and its culture. However, it was still a very rewarding experience for me, staying with my host family and conducting research at a Japanese University. It has been an amazing experience that I will cherish and that will allow me to grow as a person and researcher. Thank you!
9. Adviser's remarks (if any):