JSPS Summer Program 2018

Research Report

1. Name: Steven Meyer DEMERS （ID No. SP18002）

2. Current affiliation:

Rice University, Physics & Astronomy Dept., PhD Candidate

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Osaka University

5. Host researcher: Prof. Katsumasa Fujita, Dr. Kentaro Mochizuki

6. Description of your current research

My current research at Rice is investigating how different molecules interact and insert into the lipid bilayer (the outer covering of the cell). While the composition of the lipid bilayers is known, due to it nanometer size scale for individual molecules it is very difficult to understand how the components interact with one another.

Current biological techniques (such as X-ray crystallography) that look at the bilayers normally hold the molecules in place, but this is contradictory to the fluid nature that the bilayers exhibit naturally. By using a process called Raman scattering, I observe the unique vibrations of the molecules caused by incident laser light. The molecule's orientations in the bilayer were then calculated by comparing the experimental Raman to different theoretical, rotational permutations of the molecules. By using Raman imaging, we only shine light onto the bilayer in its natural fluid state, allowing for a more accurate depiction of how the molecules are oriented in the bilayer. The molecules we investigate vary from common pain relievers such as aspirin and ibuprofen to powerful chemotherapy drugs, all of which are an enigma of how they interact with cells on the molecular level.

7. Research implementation and results under the program

Title of your research plan:

Understanding Cellular Structure by Raman Scattering

Description of the research activities:

Prof. Fujita uses the same Raman spectroscopy but, instead of looking at the cell at its molecular bilayer, he looks at whole, living cells to investigate distributions of cellular structures. Specifically, the project that I was investigating this summer was the use of a cyro-Raman set-up whereby HeLa cells were frozen with liquid nitrogen to -150°C and then put under a microscope. After checking the positions in the brightfield image, the lamp was turned off and the 532 nm line-laser was turned on in the set-up. With 5 second scan interval, the laser line was swept across the surface of the cell, gathering a Raman spectrum at each pixel point. These spectra were then compiled, and unique peaks of cellular components were given a color for the cellular image reconstruction.

The challenge with the cyro-Raman was twofold: keeping the cells frozen/intact even in the presence of a very strong laser scan and optimizing the medium amount to allow for enough laser to be admitted reaching the cells. As to the first challenge, while conventional cell freezing medium did better preserve the cells, in freezing the medium itself gave off very strong Raman signals as well as completely deformed the cells into an amalgamation of globular shapes. Instead, HBSS was found to give a clearer imaging of the cell, though the cells were ruptured by the ice crystals that formed intercellularly. For the second challenge, it was found that just by simply wiping away the excess solution as much as possible, the amount of ice formation was limited enough to allow for Raman measurements.

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

Osaka was a great place to do my fellowship, being able to experience the modern aspects of Japan in the city proper while being only a 1.5-hour train ride from historic Kyoto with its many landmarks. It was good to get most of the exploring done during the first few weeks of the program, that way I was able to focus on my research once I acquired all of the necessary knowledge and resources to do experiments.

9. Advisor’s remarks (if any):

We were really happy to spend a time with him. He studied and worked a lot so that we had more progress than we expected. Since the experimental setup have been shared with some other students, he had to spend some waiting time , but he used even those time efficiently by reading literatures, some calculations, data processing, etc. Besides research part, he and us (especially students) shared their cultures and traditions each other, resulting in another good study for them. Kentaro Mochizuki

JSPS Summer Program 2018
Research Report

1. Name: Haley J. Sheehan （ID No. SP18004）

2. Current affiliation: M.A. student at the University of Texas at San Antonio

3. Research fields and specialties:

Humanities

4. Host institution: Hokkaido University

5. Host researcher: Professor Masuhiro Nomura

6. Description of your current research:

Coming from a background of literary and linguistic studies, my research is centered around special forms of language and narratives; in my current projects I've been focusing on how individuals and groups experience language in tandem with affective atmospheres, particularly on the cognitive workings behind how we might be affected, and at times manipulated by these experiences. My research is influenced by affect theory, which examines external factors that help create and impact our emotions and our responses to things such as atmosphere, or the "feeling of the place", as some of my interviewees described it. Many daily encounters result from multi-sensory moments of shared intentionality, such as within the language and spaces of religion, or more obviously in marketing. In both realms there are deliberate and conscious efforts to create certain desired responses by utilizing language, picture, sound, objects, space, etc. My project in Japan looked specifically at language and spaces of liminality between the human and the non-human, such as religious sites, a few of which were also believed to be haunted; this was to obtain data related to the manipulativeness of these factors upon human perception. My questioning behind this aimed at that special "something" that is attached to certain language usage and certain spaces that convinces individuals that a thing or place is sacred or haunted. I chose the religious because of its closeness to emotional susceptibility, and because the physicality of shrines, temples, and churches hold a certain architectural sway over those that visit or worship at such spaces. My research time was split between looking at the phonology and grammar behind written and oral examples, and taking note of the affective atmospheres that accompanied the language and sites I encountered. By interviewing employees and other visitors at these sites, I was able to garner new insights into my project that ultimately demonstrated that within the sphere of the non-human, the many factors that contribute to affective atmospheres play more of a role in multi-sensory manipulativeness than language does upon altering human perception.

7. Research implementation and results under the program

Title of your research plan:
Understanding How Language Affects and Shapes Human Perception of the Non-Corporeal

Description of the research activities:
Textual research: For the first few weeks I started with texts concerning religious aspects of Japanese life and narratives containing yōkai, yūrei, and kami. I gathered insight on how the otherworldly has been viewed and talked about for the last hundred years in Japan. None of the data I pulled contained the linguistic data that I was originally looking for, but it did push me towards a deeper understanding of the affective impact of local folklore narratives upon individual and collective reception to religious/haunted atmospheres.
Shrines & temples: I visited many religious sites to find interviews and examples of the manipulativeness of religious language & atmospheres. I discovered that sound played a role in these atmospheres outside of structured language; I visited a Catholic service to compare and found this was also true there. During a Kyoto trip I visited more religious sites, such as the famous Yasaka (Gion) shrine. Yogen-in temple (which has bloody ceilings) was once considered haunted by one of the docents, but after years of tourism the atmosphere changed, also changing her feelings towards her workplace. Each place I gathered language data and questioned people on their reaction to the various atmospheres and surrounding paraphernalia; in the end my premise needs altered as the research points towards more than a linguistic basis.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): As my research involved traveling, I experienced quite a lot. From the giant Gion in Kyoto to the small Hokkai Heso in Furano, I enjoyed several omatsuri. I also stumbled across Sapporo's fireworks festival one weekend while I was exploring on my bike. For future fellows I recommend getting a bike! An enjoyable experience was meeting some of the other JSPS fellows, and expanding my knowledge of other fields and cultures. The wonderful grad student who assisted me from Hokudai helped me in many ways, and I'm glad I was able to experience karaoke with her and her friends! Japan is both beautiful and wonderful, and I can only hope I'll be back soon!

9. Advisor’s remarks (if any):
"Ms. Sheehan worked hard to show how the religious atmosphere and language affect human perception as well as emotions. The research outcome may not be exactly what she originally expected, which I hope will serve to reformulate her hypotheses and methods. I'm positive that she has gained enough insight, experience and data to pursue her project further at her home institution."

JSPS Summer Program 2018
Research Report

1. Name: Kara Wolfe （ID No. SP18005）

2. Current affiliation: University of Cincinnati College of Medicine

3. Research fields and specialties:

Biological Sciences

4. Host institution: Structural Biology Research Center at the High Energy Accelerator Research Organization, KEK

5. Host researcher: Dr. Toshiya Senda

6. Description of your current research

My current research focuses on the regulation of two enzymes involved in GTP biosynthesis, inosine monophosphate dehydrogenase (IMPDH) and guanosine monophosphate synthetase (GMPS). Preliminary analysis suggests these two enzymes are sensitive to changes in cellular redox conditions, and may undergo inhibition through oxidation of cysteine residues. The goal of this summer research is to assess changes in IMPDH and GMPS protein structure under oxidized conditions, such as oxidation of cysteines resulting in disulfide bond formation that may change enzymatic activity. The results from this study will reveal a novel form of regulation of these enzymes, which are highly active in certain cancers, and will provide the necessary insight to perform mutational analysis of these proteins in human cells.

7. Research implementation and results under the program

Title of your research plan: GTP Biosynthetic Enzyme IMPDH Senses Intracellular Conditions

Description of the research activities: Structural analysis of IMPDH and GMPS require high purity of protein samples. First, we performed protein expression using bacterial cultures, followed by protein purification using a His-Trap column. The protein collected from this purification was further purified using size-exclusion chromatography until the protein was >95% pure. This protein was then utilized for crystallography trials, in which protein was plated under various conditions to generate protein crystals that will then be utilized for x-ray crystallography. Currently, all three proteins (IMPDH1, IMPDH2, and GMPS) have formed crystals. Protein samples were also utilized for cryo-electron microscopy to assess changes in oligomerization status under various conditions. The culmination of this project is the optimization of crystallization methods, analysis of the crystals under x-ray crystallography conditions, and optimization of cryo-EM conditions, which will be ongoing after the end of the fellowship.

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

The fellowship provided a great opportunity to experience work and life in Japan. Not only did I experience and learn from Japanese colleagues within the lab, but I also was able to travel to many cultural resources, including Miyajima, many temples and shrines within Kyoto, and various other locations in the vicinity of my research laboratory. Through my experiences during this fellowship, it is clear Japan has a rich cultural heritage and has convinced me to return for a true vacation at a later point.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Lisa ZAHRAY (ID No. SP18006)

2. Current affiliation: Massachusetts Institute of Technology

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Kazuyoshi YOSHII

6. Description of your current research

I am a current masters student at MIT, and am working on a few different projects. For my thesis, I am investigating techniques to extract information from prescription documents to automate data entry processes. Methods involved have included document deskewing, template matching, handwritten digit detection, and fuzzy string matching. I am also involved in a lab doing research with software-defined radios. I am exploring the network protocol 802.11 (used for WiFi) on USRPs to research improvements for packet transmission. Finally, I have been involved in the Music Technology Lab at MIT. I designed two music composition sandboxes in virtual reality for a summer project. For the JSPS Summer Program, I was excited to explore the field of Music Information Processing because it draws on the parts of my current research I've been enjoying the most. My thesis has involved a small amount of machine learning, but I was interested in gaining more experience with it. My favorite part of working with the software-defined radios is the signal processing algorithms, which are relevant when preprocessing songs for analysis. Finally, this summer project combines these technical interests with my love of music technology that I discovered working at the Music Technology Lab.

7. Research implementation and results under the program

Title of your research plan:

An Exploration of Deep Learning Techniques for Beat Tracking

Description of the research activities:

My project began with the goal of improving automatic detection beat and downbeat locations in a song. Existing research in this field has recently focused on deep learning techniques, specifically Recurrent Neural Networks with Long-Short Term Memory units. There are three main pieces to this process that could be improved: feature extraction, network architecture, and post-processing. For my first two weeks, I focused on learning how to use the PyTorch python library for deep learning and replicating one of the more recent beat tracking papers. I then experimented with using different features to train the network. For example, I added a tempogram (a feature that describes the tempo of the song over time) and performed frame-stacking (stacking features from adjacent time-steps). Frame-stacking seemed to improve my results. The rest of my time was spent investigating a new network architecture. My professor and I hypothesized that location of downbeats and beats would be related to the chords in the song. For example, beats may be more likely to happen when a chord changes, and downbeats may be more likely to occur on certain chords more than others. I investigated several models jointly trained to detect beats/downbeats as well as chords. These models were mostly still composed of LSTM layers, but I also investigated inserting a convolutional layer for chord detection. I also experimented with several different features for training. The joint model did improve downbeat detection fairly significantly, but unfortunately chord recognition remains fairly low. This semester, I plan to continue the project with hopes for further improvement.

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

This trip was a fantastic opportunity to experience Japan's culture. Some of my favorite activities this summer were my homestay at the beginning of the program, climbing Mount Fuji, visiting Universal Studios Japan, and being surprised by a close-up magic show in a bar where I made friends with some of the locals. It was a fun summer, and also very useful for my future research. I've realized that I really enjoy music information processing research and may want to pursue it for my Ph.D. I was exposed to many different techniques through my own project, talking with the other students in my lab, and a day visit to a lab in Tsukuba. All around, this was an amazing experience.

9. Advisor's remarks (if any):

She made a lot of effort to improving the performance of neural beat tracking from various kinds of viewpoints. She pioneered a way to integrate beat/downbeat detection and chord estimation and compared several architectures. The input features have also been carefully considered. Finally, she got promising results. We had meetings regularly and she presented a nicely summarized research report every time. She's definitely a distinguished researcher and I hope that we publish a paper based on her achievements in an international conference. I enjoyed this collaboration very much and appreciate her commitment. Well done!

JSPS Summer Program 2018
Research Report

1. Name: Angelica Castillo （ID No. SP18007）

2. Current affiliation: University of Texas Rio Grande Valley

3. Research fields and specialties: Mathematics and Physical Sciences

4. Host institution: Kyushu University Ito Campus

5. Host researcher: Professor Kenji Kajiwara

6. Description of your current research

The focus of our research is partitions. A partition of non-negative integer n is a non-increasing finite sequence of positive integers $\lambda_1, \lambda_2, \ldots \lambda_n$ whose sum is n. The λ_i are called the parts of the partition. We denote the number of partitions of n by p(n). The function which enumerates the number of partitions of n restricted to at most m parts is denoted by p(n,m). We were able to investigate Ramanujan-style congruence properties for certain families of restricted partition functions. Our results were obtained by q-series manipulation resulting in a quasipolynomial. We hope to find further generalizations of these results.

7. Research implementation and results under the program

Title of your research plan: Ramanujan-Style Congruences for Restricted Partition Functions

Description of the research activities: A partition of non-negative integer n is a non-increasing finite sequence of positive integers $\lambda_1, \lambda_2, \ldots \lambda_n$ whose sum is n. The λ_i are called the parts of the partition. We denote the number of partitions of n by p(n). A partition function can include restrictions from which we get a restricted partition function p(n,m) which enumerates the partitions of n into at most m parts. Quasipolynomials are an important class of counting functions and it is defined as: A function f(k) is a quasipolynomial if there exist polynomials $f_0(k)$, $f_1(k)$, … ,$f_{d-1}(k)$ called constituents, such that for all $k \in \mathbb{Z}$ one has

$$f(k) = \begin{cases} f_0(\mathrm{k}), & if\ k \equiv 0\ mod\{d\} \\ f_1(k), & if\ k \equiv 1\ mod\{d\} \\ \ldots & \\ f_{d-1}(k), & if\ k \equiv d-1\ mod\{d\}. \end{cases}$$

The process of establishing a quasipolynomial depends on a reciprocal polynomial. We use the partition function, quasipolynomials, and reciprocal polynomials to obtain our results. We start with the generating function of a partition function. We then perform q-series manipulation with reciprocal polynomials resulting in a quasipolynomial. This quasipolynomial can be used to determine the number of partitions. We focused on the restricted partition function $a(n, \ell)$ which enumerates partitions of n into sizes of 1,2, and ℓ. We were able to notice congruences in the quasipolynomials of this restricted partition function and we worked on proving the following theorem: Let ℓ be an odd integer $\ell \geq 3$, let $k \geq 0$ be any integer then for a particular constituent in the quasipolynomial the following is true:

$a\left(lcm(1,2,\ell)k + 3\left(\frac{\ell-1}{2}\right), \ell\right) \equiv 0\ (mod\ \ell)$ where lcm(1,2, ℓ) is the least common multiple among the numbers 1,2 and ℓ.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I was able to attend a festival in Fukuoka and it was incredible. I have not experienced anything like it before and I believe I will not experience anything like it anytime soon. The festival was called the Hakata Gion Yamakasa and I was able to experience it on the 15th of July in Hakata, Fukuoka.

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

Report

JSPS Summer Program 2018
Research Report

1. Name: Ohiremen Dibua (ID No. SP18008)

2. Current affiliation: Stanford 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: RIKEN AIP

5. Host researcher: Emtiyaz Khan

6. Description of your current research

The explosion in Machine Learning techniques over the past decade, has led to its use in many fields. One particular field of interest is the use of Machine Learning to augment models of physical systems using data. Our research is focused on using these techniques to create a framework for correctly modeling physical systems. We have gathered experimental data for two systems of interest. The first is an autonomous vehicle that is used to race around a track in an attempt to outperform human drivers. The second is a small microelectromechanical device called a comb-drive actuator, that is used to mechanically strain biological cells. Our framework should be able to do the following:

- Learn correction to models of physical systems without using too much data in different environments.
- Learn functional dependence of these corrections between environments.
- Quantify the extent to which our framework is learning real physics, by seeing how the predictions degrade as they are extrapolated to unseen environments

7. Research implementation and results under the program

Title of your research plan:

Framework for Data Driven Modeling Using Gaussian Processes

Description of the research activities:

During the summer I did the following:

1. Studied different methods of learning, including Gaussian Processes.
2. Developed a framework for learning to correct models of physical systems with data. The framework is as follows:
   a) Gather data about behavior of physical system in different environments.
   b) Learn the correction between models and real physical systems using Gaussian Processes applied to data at different environmental conditions.
   c) Learn the functional dependence of these corrections on their environment.
   d) Evaluate the extent to which our corrections learn real physics, based on their performance in unseen environments.
3. Applied most of the above framework to the toy problem of learning the true model of the force on the tires of a car (a-c), and am debugging these before completing the remainder of the toy problem

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

Culturally I have done the following:

- Gone to a festival with fireworks with my host-family.
- Joined and participated in Japanese Boxing Gym.
- Gone hiking.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Nathalie M. LUNA RIVERA （ID No. SP18009）

2. Current affiliation: University of Texas at Rio Grande Valley, USA

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Yamaguchi University

5. Host researcher: Dr. Fumihiko Hirosawa

6. Description of your current research

We are studying equations that describe how things oscillate. In particular, we are studying the Klein-Gordon Equation and the Dispersive Wave Equation. Our research plan is to find an appropriate transformation that would prove that a certain type of Klein-Gordon Equation is equivalent to a certain type of Dispersive Wave Equation.

Our end goal is construct and prove a theorem that would give the necessary conditions on the Klein-Gordon Equation to guarantee a blow-up solution. This is a solution to the equation that exists only up to a certain point in time. It is important because when these equations are used to model physical constructions (like building, for example), a blow-up solution implies that the structure is not stable.

7. Research implementation and results under the program

Title of your research plan:

Blow-up Solutions to the Klein-Gordon Equation

Description of the research activities:

I meet with my host professor once or twice each week to discuss our attempts to prove.

I was also able to visit Yamagata University for a workshop on a similar topic. My thesis adviser from my home institution was presenting his current work in this workshop and I had a chance to ask him for guidance on the summer research with Hirosawa-san.

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

During my stay in Japan, I was fortunate to be able to see towns with historic importance. I loved the Japanese landscape (those shinkansen rides never seemed long enough!) because they reminded me of the place where I grew up. I was also able to visit many temples and shrines and experience the Japanese mindset.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Austin Marstaller （ ID No. SP18010）

2. Current affiliation: Graduate Mathematics Student at The 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: Kyushu University

5. Host researcher: Kajiwara-sensei

6. Description of your current research

Examining the discrete Euler's Elastica and its applications to modelling the finger.

7. Research implementation and results under the program

Title of your research plan: Bifurcation of Discrete Euler Elastica

Description of the research activities:

My research activities included daily meetings with colleagues in the department to discuss research. We wish to create a discretized model of the finger by implementing an altered discretized form of Euler's Elastica. We begin by solving the problem of finding the *Critical Buckling Force* for the continuous and discrete versions of Euler's Elastica.

First consider the continuous case. The Lagrangian of our system is: $E\_\{total\} = \int[\ (\theta')\hat{}2\ EI/2\ +\ P * cos(\theta)]ds$

Where the first term of the integrand denotes the elastic energy of the elastica and the second term denotes the potential energy of the mass block P. Recall the following theorem:

Theorem: Let J[y] be a functional of the form $\int_a^b F(x, y, y')dx$, defined on the set of functions y(x) in C^1[a,b] and satisfy the boundary conditions y(a) = A and y(b) = B. Then a necessary condition for J[y] to have an extremeum for a given function y(x) is that y(x) must satisfy Euler's Equation:

$$F_y - (\ d/dx\ )F_y' = 0$$

Note: The integral curves of Euler's equation are called extremals.

In our case we have $F(s,\theta,\theta') = (\theta')\text{^}2\, EI/2 + P\, cos(\theta)$. Then,

by some simple calculations, we obtain the second-order ODE:

$$\theta'' + \mu \sin\theta = 0$$

with the boundary conditions: $\theta(0) = \theta_0$ and $\theta(L) = -\theta_0$. This exactly describes the continuous euler's elastica. One may derive this formula by simply examining an elastica and applying Hooke's Law. However, in this way we obtain a motivation for an elastica under a force which causes buckling.

The solution to the above ode is the Jacobi elliptic function $sin(\theta/2) = k * sn(q + \sqrt{\mu} * s, k)$. By noting the identity

$$sn(q + 2K(k), k) = -sn(q, k)$$

then we can proceed with some calculations to obtain the critical force condition for the continuous elastica:

$$P_{crit} = E * I * \pi^2/L^2$$

Now we must consider the discrete case as this is of interest to those who wish to apply this work to real world scenarios. A particular discretization by Sogo was the inspiration of the following variation:

$$S\_d\text{^}* = \sum_{m=0}^{N-1} \frac{1}{2}\left(\frac{4}{h}\sin\frac{\theta\_(m+1) - \theta\_m}{2}\right)\text{^}2 + \mu\cos\frac{\theta\_(m+1) + \theta\_m}{2}$$

This is an attempt to introduce physical properties to our discrete situation. We have not yet completed the formulation of the above as many details have yet to be resolved. In future work this will be done along with finding the respective critical buckling force in the discrete sense.

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

I have wonderful experiences while staying in Japan during my fellowship and have made many friends and colleagues.

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Fred Ariel HERNANDEZ （ID No. SP18011 ）

2. Current affiliation: University of California, Los Angeles

3. Research fields and specialties:

Social Sciences and Interdisciplinary Sciences

4. Host institution: University of Tsukuba

5. Host researcher: Professor Fumihiro KANEKO

6. Description of your current research

My dissertation focuses on three debates increasingly at the center of research on youth sports and public school sports coaching; policy and regulation of the coach-athlete relationship, coach certification and education, and sports participation as citizenship building. I focus on those debates to address: larger contemporary issues of youth athlete safety, coach preparation, and the conflict between competition vs participation in youth sports. My primary question is how school coaches engage with these issues in their practice. I am presently conducting a multi-sited, multi-method research project employing: ethnographic participant-observation fieldwork, archival research, and oral history methods to understand practitioners' daily/on-the-ground pedagogical decisions of public school sports coaches in Los Angeles. I draw from the fields of: coaching studies and critical education studies, as well as gender, feminist, and disability studies of sport. My goal in studying high school coaches in Los Angeles is to understand coach education and certification processes within the porous regulatory system of the school district. Based on research thus far, standardized coach education does not address the needs of marginalized athletes and leave these athletes vulnerable to coaches with little education and no consistent administrative supervision.

7. Research implementation and results under the program

Title of your research plan:

Athletes and Opportunities: History and Gender in Japanese Youth Sports

Description of the research activities:

Between June 22nd and August 17th, I conducted research on Japanese youth sports through ethnographic participant-observation fieldwork and interviewing university professors, sports researchers, youth sports activists, coaches, teachers, and parents. I also participated in two coaching and physical education workshops.

Ethnographic participant-observation fieldwork: I conducted fieldwork at 17 different sports sites in 4 kinds of sports with private and public school teams. The athletes ranged from 6 years old to university students, and beginner to elite competitive level. At these sites, I covered all stages of practice and/or competition. Of significance were ways age, gender, and competitive level altered coaching practice.

Interviews: I conducted 31 interviews with university professors, sports researchers, coaches, teachers, activists, and parents. The interviewees represented a range of expertise, geographic difference (Tokyo, Tsukuba, Hida, Takayama, Fukuoka, Kagoshima), personal reason for sports involvement, and time invested in Japanese sports. Interview topics included; Japanese youth sports history, government regulations, coaching certification, elite/private/school club sports differences, youth sports coaching philosophy, Para-Sports, LGBT issues in Japanese sports, age/gender appropriate coaching pedagogy, military-sports connections, Olympic education in Japan, sport for peace and development, sexual and power harassment in Japanese sports, teacher and coach responsibilities, high performance vs community sports.

Workshops: These events covered recent developments in coaching and teaching pedagogies for youth sports and physical education curriculum. At the workshops coaches and teachers were taught history of Japanese physical education, its didactic legacies and methods for improving individual practices.

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

Program comments: The opportunity for research provided by JSPS Summer Fellowship is the highest caliber. The support (academic, institutional, financial) offered me significant chances to expand my dissertation research and professional network.

Cultural experiences: Matsuri, Adachi fireworks festival, Fukuoka fireworks festival, onsen, travel on Shinkansen.

Cultural experiences related to sports research: Attended University of Tsukuba Women's soccer game, professional baseball games, Kyushu Junior High Badminton Championships, High School Undo Kai, Competed with University of Tsukuba badminton club.

9. Advisor's remarks (if any): Mr. Fred Ariel Hernandez was really keen to learn from our experience and tried to utilise this opportunity as much as possible. His attitude was really impressing to me. I think he could build up the network with key informants for his future research. Also he could learn Japanese sporting culture through his fieldwork. I strongly believe this summer program contributes to his current and further research.

JSPS Summer Program 2018
Research Report

1. Name: Acadia Larsen (ID No. SP18012)

2. Current affiliation: University of Texas: Rio Grande Valley

3. Research fields and specialties:
Mathematical and Physical Science

4. Host institution: Keio University.

5. Host researcher: Dr. Naonori Kakimura

6. Description of your current research

The presidential election in the United States is an example of a weighted majority game. Each state and the District of Colombia are the players with weights equal to the number of electors. A natural question is to ask how much influence does a single state have over the election? That is, in how many scenarios does a state change the outcome of the presidential race?

Binary Decision Diagrams (BDDs) and Zero-Suppressed Binary Decision Diagrams (ZDDs) are compact ways to store logical information and voting games are an economic model of elections. The Banzhaf index and Shapley-Shubik index are measures of how much influence a player has on an election. We apply BDDs and ZDDs to quickly compute these indices with the algorithms IndexBDD and IndexZDD. These are output sensitive algorithms to compute both the Banzhaf and the Shapley-Shubik index. We currently aim to create algorithms which are dependent on the size of the BDDs and ZDDs.

7. Research implementation and results under the program

Title of your research plan:

Application of a Zero-Suppressed Binary Decision Diagram to Voting Games

Description of the research activities:

We started by reviewing the game theoretic formulation of the (simple) weighted voting game and Banzhaf index and Shapley-Shubik index. To compute these indices is a computationally hard problem. We focus on using a Binary Decision Diagram (BDD) and a Zero-Suppressed Binary Decision Diagrams (ZDD) to solve this problem From there, we reviewed literature surrounding computing the number of integer points in a lattice polytope, a topic closely related integer partitions. In particular, a (simple) weighted voting game can be described by a 0/1 polytope. This lead to the discovery that in practice for enumberation of the number of integer points that a Binary Decision Diagram or a Zero-Suppressed Binary Decision Diagram is appropriate for solving the voting game problem.

With this computationally difficult task, traditional efforts have focused on using dynamic programming and probabilistic methods to solve the problem. Applying these data structures and some known algorithms on these data structures, produces algorithms that in practice are fast for computing for computing both the Banzhaf index and Shapley-Shubik index different from previous algorithm. We describe these algorithms.

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 2018
Research Report

1. Name: Candice Ashmore-Harris	（ID No. SP18101）
2. Current affiliation: King's College London	
3. Research fields and specialties:	
Biological Sciences; Medical Sciences	
4. Host institution: Yokohama City University 5. Host researcher: Professor Takanori Takebe	
6. Description of your current research	

Hepatocytes are the most abundant functional liver cells, responsible for many vital functions such as protein and lipid synthesis, glycogen storage, drug detoxification and metabolism. As a result, transplants of primary hepatocytes have become well established as a safe cell therapy for patients with liver disease when whole organ transplants are not available. Wider use of this therapy is prevented by poor cell engraftment into host livers due to limitations in hepatocyte quality [as primary hepatocytes used in these transplants are typically isolated from livers deemed unsuitable for whole organ transplant the quality of cells cannot be guaranteed]. A potentially unlimited source of hepatocyte-like cells (HLCs) can be produced from human induced pluripotent stem cells (hiPSC) by stimulating the cells to follow the developmental pathway of the liver using small molecule and growth factor cues. HLCs are considered a promising alternative to primary hepatocytes suitable for transplant, but little is known about their behaviour *in vivo*.

My research focuses on tracking the potential of these cells in animal models (with a particular interest in their distribution in the body after transplant, level of engraftment, survival, maturity etc) in particular through the use of whole-body *in vivo* imaging using SPECT/CT and PET/CT imaging. This allows us to non-invasively monitor the transplanted cells in real-time in the short- and long-term.

To achieve this I have used a virus to enable HLCs to express the human sodium iodide reporter gene (hNIS), a gene which is capable of taking up certain radiotracers when expressed. This allows hNIS-HLCs to be tracked via PET/CT and/or SPECT/CT imaging. We have characterised these hNIS-HLCs relative to non-hNIS HLCs to ensure they retain their hepatocyte characteristics and tracked them via SPECT/CT in a murine model.

Building on the viral gene transfer strategy we have also directly edited the genome of a clinical grade hiPSC line to express hNIS in the AAVS1 locus. This means each cell contains only 1 or 2 copies of the gene, and we know it will not have an impact on any surrounding genes because it is a safe locus of the genome. This also allows us to track not only immature HLCs but progenitor HLCs and other supporting

	cell types derived from hiPSCs such as endothelial cells (blood vessels) or stromal/connective tissue cells.
7. Research implementation and results under the program	
	Title of your research plan: **Exploring the use of *in vivo* trackable human induced pluripotent stem cell derived liver buds**
	Description of the research activities: We have used the hNIS-expressing hiPSC line developed at KCL and combined this with the technology from the Takebe group at Yokohama City University, which can produce liver buds in a dish. We first demonstrated that we could differentiate the three progenitor populations necessary for producing liver buds from these hiPSCs (hepatic endoderm, endothelial cells (blood vessels) and septum transverse mesenchyme (connective tissue-type progenitor cells)). We then combined these populations to produce liver buds made up of all three cell types (all expressing hNIS). These multilineage liver buds result in a more mature hepatocyte over time than culturing differentiated hepatocytes without these supporting cells and can be scaled up in number to be suitable for human transplantation. We transplanted these hNIS-expressing liverbuds into the kidney of a mouse. 5 days post-transplant we imaged the mice by PET and demonstrated that the cell population was present in the region of the kidney. 2 weeks later we imaged the mice by PET again and found signal in kidney region, again, indicative of continued cell survival. To verify this we harvested and fixed the kidney of one mouse and showed by antibody staining that human endothelial cells and mature human hepatocytes were still present. We also analysed the blood serum and found that the mice with the highest signal in the kidney region in the PET scan (indicating the largest surviving cell population) also had the highest concentration of human albumin (a protein secreted by hepatocytes) in their blood. Overall this study has provided important evidence to show that iPSC-derived hepatocyte populations can be tracked longitudinally *in vivo* using radionuclide imaging. This is an important strategy that will allow improved assessment of hepatocyte engraftment and long-term monitoring in a non-invasive manner; all of which are important steps in the path to these cells being used in the clinic.
	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 2018

Research Report

1. Name: Helen Brabham （ID No. SP18102）

2. Current affiliation: The Sainsbury Laboratory, Norwich Research Park, Norwich, UK

3. Research fields and specialties:
Biological Sciences and Agricultural Sciences

4. Host institution: Kyoto University, Kyoto and Iwate Biotechnology Research Centre, Kitakami, Iwate

5. Host researcher: Prof. Ryohei Terauchi

6. Description of your current research

The focus of my research is on understanding the genetic basis of multiple pathogen recognition in barley (*Hordeum vulgare*). The *Mla* locus, located on chromosome 1H of barley, contains multiple resistance gene families and harbours the resistance gene *Mla* which confers isolate-specific resistance to the pathogen barley powdery mildew. This genomic region has also been associated with resistance to several different pathogen species including resistance to rice blast (*Rmo1*) caused by the fungus *Magnaporthe oryzae* which is the most destructive disease of rice, threatening worldwide production. During my PhD, I have generated a mapping population to confirm the genetic coupling of *Mla3* and *Rmo1* and have sequenced resistant cultivars to identify candidate genes, which I have cloned and transformed into susceptible barley cultivars to test their function. By separating the resistance genes through transformation, I will be able to test if recognition to multiple pathogens is conditioned by a single gene or multiple individual genes.

The majority of plant resistance genes identified to date confer resistance to a single pathogen species, or a specific isolate of a species. Understanding the molecular basis of multiple recognition is the first step in mining natural variation and developing synthetic resistance genes that provide resistance of multiple pathogens. During this JSPS fellowship I aim to begin to identify *AvrRmo1*, the secreted protein from the fungal pathogen *Magnaporthe oryzae* that elicits the defence response from barley containing the resistance gene *Rmo1*. Once identified, *AvrRmo1* will allow for further experimentation including characterisation of the method of recognition and it will be compared to other *M. orzyae* Avr genes as part of broader research into the continuing evolution of *M. oryzae* pathogenicity.

7. Research implementation and results under the program

Title of your research plan:

Towards the identification of a recognised effector in the plant fungal-pathogen *Magnaporthe oryzae*, the causal agent of rice blast disease

Description of the research activities:

During my time at the laboratory of Prof. Ryohei Terauchi, I inoculated barley cv. Baronesse containing the *Rmo1* resistance gene with a diverse collection of *M. oryzae* pathogen isolates. The phenotypes were then collected and isolates sorted into virulent and avirulent strains. Using genomic sequencing information from this association panel we will be able to identify candidate Avr genes by correlating phenotypes with gene presence/absence; only avirulent strains will contain *AvrRmo1*. I tested multiple inoculation methods to characterise pathogen recognition, both spot inoculation and punch assay methods. Alongside this, I learnt the protocol for *M. oryzae* mutagenesis and have a potential positive mutant – a individual that has gained a mutation in the *AvrRmo1* gene rendering it unrecognisable to the plant, and therefore is able to infect. Comparing the genome of this individual to the unmutated wild type will provide candidate genes that have been mutated.

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

I have thoroughly enjoyed my stay in Japan. My research trip was split between time in Kyoto and Kitakami in Iwate, enabling me to compare life in different areas of Japan and benefit from a cooler climate up north! I was also able to travel to Hokkaido to visit Sapporo to learn about the brewing industry and barley production in Japan and sample native *M. oryzae* from barley fields around Furano to increase the diversity collection.

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Benjamin Chapman	（ID No. SP18103 ）
2. Current affiliation: Centre for Fusion, Space and Astrophysics, University of Warwick	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: Kyushu University	
5. Host researcher: Dr. Yusuke Kosuga	

6. Description of your current research

My research focuses on the physics of plasmas, specifically its application to magnetic confinement fusion (MCF), in which a plasma is suspended by magnetic fields (either in a “tokamak” or a “stellerator”) and vast amounts of energy are produced by fusing two light nuclei together to form a heavier nucleus (the process which powers the sun).

I focus on the effect of electromagnetic waves, such as light, in MCF plasmas, with an emphasis on “Ion Cyclotron Emission” (ICE), a process in which positively charged particles emit electromagnetic waves as they move around magnetic field lines. The positively charged particles produced in next generation fusion devices will be capable of damaging the vessel walls and halting the energy producing reactions. It is proposed that ICE be used to monitor the behaviour of these particles.

To study ICE, I employ large scale computer simulations of the nonlinear kinetic physics associated with ICE using the Warwick developed particle-in-cell (PIC) code “EPOCH”. This code solves the full Maxwell-Lorrentz system of equations for millions of particles, allowing us to resolve physics that happens during a signal ion gyro-orbit, and the nonlinear wave-wave interactions that arise as a result.

These simulations, in conjunction with experimental data analysis from the KSTAR tokamak in Korea, have led to the observation of an unexpected conjunction between the physics of “ELMs” (a burst of plasma in the edge region of the tokamak) and fast ion physics. From this we have obtained submicrosecond time resolution of the evolving local density associated with the motion of ELM “filaments”.

7. Research implementation and results under the program

Title of your research plan:

Nonlinear effects in turbulent magnetic confinement fusion plasmas

Description of the research activities:

The flows of most plasmas in the universe are turbulent, for instance, the origin of earth and sun's magnetic fields, the propagation of cosmic rays, and space weather are deeply linked to turbulence. On a laboratory scale, turbulence observed in magnetic fusion devices has a large impact on their performance and ultimately, the ability of the device to produce energy from fusion.

This project involved analysis of existing data sets obtained from the in house linear plasma device "PANTA" at Kyushu university. A variety of turbulent phenomena are routinely observed in PANTA, such as drift wave turbulence - due to gradients in the plasma density, and sheared flow turbulence - due to the flow of plasma along field lines. By using bicoherence analysis, we were able to shed light on the nonlinear interactions between the waves excited as a result of these different types of turbulence, and the possible influence said interactions have for energy spreading. The beginnings of a search for the topical "Zonal flow" was undertaken, and more work is in progress in order to determine the possible existence of such flows in the PANTA device.

In addition to this, the new analysis techniques I learned here have been applied to some existing PIC simulations of ICE, and more work will be done to further utilise these techniques in future research.

I was very happy to present some of the research I have done at Warwick in a group seminar at Kyushu, and before I leave Japan I will give similar presentations at Japan's National Institute for Fusion Science (NIFS) and Kyoto university.

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

The host stay was amazing, I had so much fun playing with the children and being bombarded with a continuous supply of food. During my time in Fukuoka I have had the pleasure of enjoying many museums and the beautiful surrounding areas.

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Zoë E. DAVIDSON （ID No. SP18104）

2. Current affiliation:

University of Strathclyde, Glasgow, Scotland

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Advanced Laser Group, Kansai Photon Science Institute, QST, Kizugawa, Kyoto

5. Host researcher: Dr. Alexander PIROZHKOV

6. Description of your current research

I am a second year PhD student from the Physics Department at the University of Strathclyde, Glasgow, Scotland. My PhD research is in the field of laser-plasma interaction physics. Plasma research involves the investigation of the fourth state of matter, which occurs in many natural phenomena in the universe, such as within stars, the Aurora Borealis and lightning. It can be generated under extreme conditions by high power lasers which can result in the production of ionising radiation. Because of its unique properties, plasma is of profound interest in astrophysics and applied plasma research, which spans across a wide range of science and technology sectors.

The overall objective of my project is to better understand the ultra-fast dynamics that affect the generation of plasma and the quality of the subsequent radiation produced by implementing a new imaging system. Recently we have developed a new approach using multi-channel encoded probe beams to image the evolution of a single laser plasma interaction by shadowgraphy at varying picosecond ($1x10^{-12}$) intervals. Measurements using this method are the first of their kind to provide both 2D spatial and picosecond temporal resolution. Previously this has been challenging to achieve due to limitations in imaging diagnostics paired with the ultra-fast timescales at which the dynamics of interest occur, many of which occur over several femtoseconds. It is hoped that in the remainder of my PhD I will develop this concept further and extract new temporal data from a range of laser-plasma regimes.

7. Research implementation and results under the program

Title of your research plan: **Femtosecond scale time resolved optical measurements of intense laser-plasma interactions**

Description of the research activities:

My research at KPSI has involved collaborating on an experiment using the J-KAREN-P laser system, to implement a multi-channel optical probe for use on their x-ray generation experiment. Using this facility has enabled me to test the multi-channel probe concept to higher temporal resolution than previous, as the J-KAREN-P laser operates at 30 femtosecond pulse durations. It has also enabled me to adapt the set-up and temporally resolve a different type of laser-plasma dynamic, which will be included in my future research and thesis. This experiment was led by Dr. Alexander Pirozhkov, a Senior Principal Researcher in the Advanced Laser Group at Kansai Photon Science Institute. The results from this project are hoped to have provided insight into the evolving laser propagation dynamics that occur when coherent x-rays are generated under a new mechanism, named BISER (Burst Intensification by Singularity Emitting Radiation).

8. Please add your comments, including any cultural experience during your stay in Japan (if any): During my time in Japan, I have enjoyed learning about their culture, history and trying many Japanese cuisines. I have visited Nara, Kyoto, Osaka during my stay at my host research institute and I look forward to exploring Tokyo during the farewell conference hosted by JSPS next week. My favourite sightseeing trip was to Lake Biwa with a new friend I made on the programme.

9. Advisor’s remarks (if any): Zoë's project required to setup and precisely align four channels of femtosecond optical probes. This was very challenging due to the high required accuracy and time constraint, but Zoë worked really hard and finally implemented all four channels. This contributed to the experiment greatly and gave interesting and important data about the laser propagation and plasma evolution. We are going to publish the project results in two papers: a paper about the femtosecond four-channel probe itself, including pulse duration and alignment accuracy considerations, and a paper about the physics of intense laser propagation through relativistic plasma.

JSPS Summer Program 2018
Research Report

1. Name: Kay A. DEWHURST （ID No. SP18105）

2. Current affiliation: The University of Manchester

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Yoshihiro ISHI

6. Description of your current research

I study particle accelerator physics. In particular, I am researching ways to transport electrons from a new method of acceleration known as Laser-Wakefield, to useful devices.

Laser Wakefield Acceleration (LWFA) is a novel method where a high-power laser is shone onto a gas causing it to become ionized. Energy is transferred from the laser light to electrons produced in the ionization process, causing them to be accelerated to high energy (>1 GeV). The main advantage of Laser Wakefield Acceleration over conventional methods is the short accelerating distance; 1 GeV electrons can be produced in 3cm, compared to 100s of meters in conventional machines. This has the potential to reduce the size and cost of future accelerators making them more accessible to users.

I am investigating different ways to transport LWFA electrons to useful devices such as an Undulator or Free Electron Laser (FEL). I design beam-lines consisting of configurations of magnets and use computer simulation to track the changes to the electron distribution as it travels through these magnets. The aim is to end with a bunch of electrons that has good properties for use with a Free Electron Laser: small bunch size, short bunch length, and small emittance. The electron bunches produced by LWFA initially have some good properties, but they are difficult to transport due to their large divergence (the electrons spread out causing the bunch size to grow) and large energy spread (higher energy electrons will be less affected by the magnetic fields).

Several research groups around the world are designing beam-lines to couple LWFA electrons to FEL devices using conventional single-function magnets. During the JSPS Summer Program I am studying the use of combined-function magnets known as FFAGs (Fixed Field Alternating Gradient) as these should allow for the successful transport of a large energy spread bunch. I am applying this knowledge to my research area by designing and simulating an FFAG beam-line for the transport of LWFA electrons to an FEL device.

7. Research implementation and results under the program

Title of your research plan:

Transporting Electrons from a Laser-Based Accelerator using FFAG Magnets

Description of the research activities:

During the JSPS Summer Program I have learned much about Fixed Field Alternating Gradient (FFAG) magnets by studying the circular machines at my Host Institution, as well as the straight-scaling prototype that was designed and demonstrated there. I have designed an accelerator beam-line based on a straight-scaling FFAG suitable for LWFA electrons with energies around 1 GeV, and modeled this using the accelerator code “G4beamline”. I have shown a suitable energy range of 10% can be successfully transported as well as a suitable charge for use with a Transverse Gradient Undulator (TGU). Other bunch properties require more investigation before it can be concluded whether the TGU would be able to produce the intense radiation of a Free Electron Laser. The knowledge gained during my time with my Host has been extremely valuable in progressing my research.

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

The JSPS Summer Program has been an amazing experience and I would recommend it to anyone. The activities during orientation week give you a good taste of Japan. During my stay, my Host Researcher has been extremely helpful and welcoming. Together with others from the Lab I have enjoyed BBQ, okonomiyaki and somen noodle parties, Japanese sweets, visiting other Labs, visiting onsen, visiting shrines and singing at Karaoke! I have really enjoyed my time here in Japan.

9. Advisor’s remarks (if any):

The researcher Kay A. Dewhurst has proposed the idea which adopts a straight FFAG beam line to transport the electron beams from LWFA to TGU. Her point of view is very ingenious. During the program, she acquired knowledge and techniques to carry out her research project further by discussing with colleagues in the Host institute. We look forward the development of her study.

JSPS Summer Program 2018
Research Report

1. Name: Troy Dion (ID No. SP18106)

2. Current affiliation: University College of London and Imperial College London

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Kyushu University

5. Host researcher: Prof. Takashi Kimura

6. Description of your current research

I study magnetization dynamics in patterned ferromagnets on the nano to micro-scale. One can picture ferromagnets as consisting of many interacting tiny magnets. When placed in a magnetic field all these magnetic moments or spins will align with the magnetic field direction. If an oscillating magnetic field is applied perpendicularly a torque is exerted on the spins which then precess around the direct magnetic field. When pushing someone on a swing if you push too quickly or slowly most of your energy is not transferred to the swinger. If you push at the point where the swinger is nearest to you the maximum amount of energy is transferred from you to the swinger. This is called resonance and the frequency at which this occurs is the resonant frequency. The same occurs in the above described experiment with magnets and is called ferromagnetic resonance. When the frequency of the oscillating magnetic field, which is provided by microwaves (GHz), matches the resonant frequency of the magnet, energy is absorbed by the system which is measured as a reduction in power of the applied microwaves. By changing the magnetic field strength, it is possible to extract properties such magnetization saturation (M_S) which is the field required to force all the spins to point perfectly along the field direction and damping which is analogous to friction that causes the swing to come to a halt when pushing has ceased. Imagine multiple swings connected to their neighbours by pieces of rope. Now if I push the first swing it will cause the next swing to start swinging and that in turn moves the next one and so on. A wave is created which can be detected at the other end of the swing set by another person measuring how the last swing is moving. The aim of my research is to investigate how altering the shape and nanostructure of the magnet influences the behaviour of these spinwaves for next generation information processing and storage.

7. Research implementation and results under the program

Title of your research plan:

Spinwave propagation in waveguides with artificial broken inversion symmetry

Description of the research activities:

Sample preparation, fabrication and characterization. Chevron shaped holes are patterned into a ferromagnet (CoFeB). Two copper waveguides are fabricated on top of the sample, each can be a spinwave injector and detector. Waveguide separation is varied to characterise spinwave decay. A continuous film was also fabricated for comparison. M_S for the continuous sample was found to be 1.61 ± 0.04 T. The spinwave velocity is extracted for both continuous and patterned samples, $v_g^{cont} = 45.1$ km/s and $v_g^{patt} = 75.2$ km/s at 60mT. The main aim of this project is to investigate the differences between spinwaves travelling in positive versus negative direction due to patterning. Spinwaves excited in the experiment have some intrinsic non-reciprocity in amplitude, 50% and 78.1% less for the continuous and patterned film respectively. It appears patterning exacerbates this effect. The patterning also shifts slightly in frequency (about 200MHz) depending on the direction of propagation indicating promise as a candidate for a spinwave diode realisation.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I have spent a few weekends seeing parts of Japan, namely Okinawa, Nagasaki and exploring Fukuoka city and the surrounding countryside. I visited shrines and museums. I have learned a lot of Japanese culture and history and have especially enjoyed sampling the delicious cuisine. I have also been privileged to collaborate with the group members who helped with sample fabrication. The language classes and the book we were given have been useful in allowing me to get by in Japanese daily life quite well. I look forward to visiting Japan again.

9. Advisor’s remarks (if any):

I am sure that he obtained the excellent results about the spin wave propagation in the patterned ferromagnetic film. Although there are several unexpected trouble in the sample and the measurement, he was able to overcome the obstacles by proposing new structure. So, I think this program is quite successful. But, I think that longer period such as a half year is more effective for developing the challenging project.

JSPS Summer Program 2018
Research Report

1. Name: Louise Elstow （ID No. SP18107 ）

2. Current affiliation: Lancaster University

3. Research fields and specialties:
Social Sciences

4. Host institution: University of Tokyo

5. Host researcher: Professor Fujigaki

6. Description of your current research

My PhD considers how people live in a contaminated aftermath; specifically, navigating the provision and use of radiological contamination information following a nuclear incident.

The response to nuclear incidents typically includes evacuations, the cessation of economic activities and restrictions on food production and consumption in a hazardous area. This is then followed by the phased return and recovery of social and economic life. The challenge that interests me is to understand how scientific information is produced and used to navigate this return to life in contaminated places over a period of years.

Radiological contamination (of individuals, non-humans and the environment) is almost entirely invisible to the human body. Information about such contamination and risks must therefore be mediated by a variety of human and non-human actors, such as radiation detectors or contamination maps, for it to be made visible. Each of these tools filters information into a more simple form in order to show it in a particular way.

From an STS perspective, this simplification into maps, thresholds and standards (referred to as ‘formal representations’) has a politics to it (Star, 1995). They make some things visible whilst hiding others. The ways in which the information is translated into formal representations is dependent on the makers’ approaches to expert science and communication, and on who is allowed to contribute to the making of them (Kuchinskaya, 2014, Alexievitch 2016). This has consequences when considering the ‘social’ dynamics of the response to nuclear incidents. How information is deciphered by lay-persons will go on to influence what they do with it and what it means to them. A line on a map could be determined to mean the difference between ‘safe’ and ‘not safe’; a mushroom can become ‘deadly’ to the young but remain a tasty cultural treat for the elderly.

7. Research implementation and results under the program

Title of your research plan:

The social use of scientific information in contamination emergencies: a Science and Technology Studies (STS) approach using Fukushima, Japan as a case study

Description of the research activities:

During my time in Japan I collated data using a mixed methods approach:

First, I charted the deployment of different kinds of scientific information after the 2011 nuclear disaster in Fukushima Daiichi, by collating different types of formal representations issued to citizens, including maps of contamination, instructions for decontamination, guidance on thresholds for radiation levels in food or how to prepare food safely. This database will become the primary source of texts, representations and images that I will examine later on in more detail in my PhD research.

As well as collecting examples of formal representation, I conducted 18 in depth interviews with a range of individuals from a variety of organisations involved in the creation and dissemination of scientific information to citizens. In addition I attended a number of meetings, tours, a conference, workshops and training sessions, which provided me with opportunities for networking and expending my contextual and social understanding of disasters in Japan. At the same time I was able to build relationships upon which to base a further ethnographic study in a future visit to Japan, exploring further the use of scientific information in the community.

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

I had a great time in Tokyo, and an even better time getting to explore parts of Japan as a JSPS fellow as part of my field work and in my free time. This was a fantastic opportunity for me and my field of research. I was particularly thankful for the structure and support provided by the program, my host supervisor and other JSPS Summer Program attendees.

9. Advisor's remarks (if any) I introduced her 6 interviewees and 1 NPO as a starting points of her interview survey. She developed her networks and visited Fukushima two times. I think that she have succeeded in building a trust, in making networks for her a further ethnographic study in the future, and in gathering data for PhD thesis.

JSPS Summer Program 2018
Research Report

1. Name: Louis Charles EVANS (ID No. SP18108)

2. Current affiliation: University of Greenwich

3. Research fields and specialties:

Chemistry

4. Host institution: Nagoya University

5. Host researcher: Professor Kenichiro ITAMI

6. Description of your current research

I am undertaking my Ph.D under the supervision of Prof. Adrian Dobbs at the University of Greenwich. The Dobbs group focuses on heterocycles; such types of molecule are frequently encountered in pharmaceuticals and natural products and consequently there is great interest and demand in finding novel synthetic routes for their preparation. One reaction used to make a wide range of heterocyclic compounds is the Prins reaction. Many natural products have been prepared utilizing this synthetic method, demonstrating the versatility and power of the reaction. However, despite finding such wide application, there is still a dispute as to the reaction mechanism, with three prevailing approaches having been proposed - direct cyclisation, allyl-transfer *via* [3,3]-sigmatropic rearrangement and aldehyde incorporation.

In my research, I have used computational chemistry, guided by experimental observations, to help determine the mechanism of the Prins cyclisation reaction. My work has so far shown the direct cyclisation and allyl-transfer routes to be plausible and a complete energy profile for these routes has been produced, supported by experimental data. The aldehyde incorporation route has been shown not to take place through oxygen-18 labelling studies. Additionally, new observations on the role of the Lewis acid have been shown, contrary to the existing proposed routes. It is hoped that through this comprehensive investigation of the mechanism, further developments of the reaction can be discovered, leading to even greater synthetic potential in the preparation of heterocyclic compounds. The remainder of my Ph.D will aim to include the silyl-Prins reaction (a variant leading to dihydropyran products) as there are no mechanistic studies to date.

7. Research implementation and results under the program

Title of your research plan:

Preparation of Mixed-Heteroarenes *via* Developments to the Annulative π-Extension (APEX) Reaction

Description of the research activities:

My research at Nagoya University has built upon existing chemistry carried out by the Itami Group – the APEX reaction. This reaction is a powerful route to making large aromatic molecules in one step, thus eliminating the requirement of multi-step syntheses. Polyaromatic hydrocarbons (PAHs) and heteroaromatic compounds are finding use in an increasing range of scientific fields, such as optoelectronics (e.g. OLEDs), materials science, batteries and medical applications.

Specifically, my research has aimed at developing a novel APEX reagent containing sulfur, to react with nitrogen-containing aromatics, thus producing a π-extended heteroaromatic compound. Such compounds are less reported in the literature and therefore their properties are less understood; more facile routes to the synthesis are required to enable the investigation of their potentially unique features.

I have successfully developed an S-based APEX reagent to form S-N heteroaromatic compounds during my time at Nagoya University. In addition, the reaction has been optimized from existing conditions, whereby the yield has been increased from 33% to 51%. Furthermore, the scope of the reaction has been preliminarily investigated by using different N-based precursors, showing the versatility of the reaction.

To conclude my extended time in Japan I will carry out a double APEX reaction to form a much larger π-extended molecule in just one or two steps, demonstrating this reaction to have great potential in the production of novel mixed-heteroaromatics.

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

The work ethic of Itami Group "Work hard, play harder, dream even more!" is something that will stay with me forever and has inspired me to return to Itami group following my Ph.D studies. I have made great friends here whom I will dearly miss when I leave. Additionally, the Summer Vacation of Itami Group enabled me to explore Japan, having made trips to Kyoto, Osaka, Hiroshima and Mt. Fuji, all of which have been incredible cultural and life-changing experiences for me.

I am greatly thankful to JSPS for the Summer Program opportunity and hugely grateful to the Itami Group for being such amazing hosts for me!

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Jack Flower （ID No. SP18109)

2. Current affiliation: University of Strathclyde

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Benjamin C. McLellan

6. Description of your current research

My research project is concerned with conducting a comparative analysis study for Japan and the UK, focusing on assessing the cost-effectiveness of implementing domestic (residential) electrical heating and cooling technologies (such as electric heat pumps). This study will essentially be assessing the key technologies that can be implemented in order to contribute to national CO2 emissions reductions in order for both Nations to meet their 2030 targets in a cost-effective way. The cost effectiveness of a mitigation measure at reducing carbon emissions is also known as the Marginal Abatement Cost (MAC).

The aim of this short research project is to provide the groundwork for future research studies and collaboration between Japanese and UK research institutions. The findings from this economic study will be used to assess the relevance of current energy policy related to decarbonizing domestic heating and cooling, highlight areas where two-way learning can take place between Japan and the UK, and, to highlight areas where further research is needed.

7. Research implementation and results under the program

Title of your research plan:

Japan-UK Comparative Analysis of Marginal Abatement Costs for Low Carbon Electric Heating and Cooling Technologies for the Residential Sector

Description of the research activities:

Research activities conducted during placement:

1. Understanding the methods that can be applied to achieve the research aims, then choosing which one is most suited.
2. Data gathering. For the Japan MAC analysis, this included drawing on the knowledge of team members of the Economic Laboratory to help identify data sources. Much of the data would not be found if searching in English, therefore, language translation was provided by team members.
3. Data processing. The data gathered needed to be assessed and procces into a format usable for the MAC analysis.
4. Once mitigation technologies were chosen, they needed to be characterized (cost, efficiency, typical consumption etc.) as well as all of the possible reference technologies that the mitigation measure was replacing.
5. Cost effectiveness calculations were conducted for mitigation measures against all reference technologies.

Alongside the above, I was also able to attend an International Energy Agency Event in Tokyo which was based on investment in energy related aspects in Japan. This was an excellent event to allow me to understand the nature of the Japanese energy system in more detail by listening to key speakers from the Japanese Government (METI) and discussing my project with various people at the networking event.

All expectations from the project have been met. The research conducted during the placement has already led to research questions to follow up on. The project will be completed on return to the UK. Professors from both institutions are keen to obtain research findings from this project when complete, which is expected to be in another 2-3 months.

The analysis conducted so far has already highlighted areas where two-way learning can take place between Japan and the UK. The relevance these findings has been assessed against current research activities and requirements in both nations. It is expected that this project should lead to future research collaboration between Japan and the UK.

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

Cultural Highlights:

- Homestay – Taking part in the HIPPO language club was a great experience as well as living with a Japanese family. During the HIPPO language club I met many Japanese people here who were vere keen to find out about my home country and also keen to share with me their knowledge about Japan.
- Kumano Kodo Pilgrimage – Myself and two other UK JSPS Fellows completed the ancient Kumano Kodo Pilgrimage which links sacred sites in the Kii Peninsula. Along the way we met many Japanese people who could not do enough to help us. for two nights we were provided food and beer by strangers who were camping nearby. Excellent experience.
- My research is based on residential sector energy use. Through various experiences during the JSPS program an appreciation has been gained for energy use in homes in Japan. This has directly benefitted my research activities and will continue to do so as I apply what I have learnt to the UK.

To note: this short placement through the JSPS Summer Programme has provided an excellent taste for Japanese culture and research. I am very keen to return to Japan and build on the research links I have now made.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Alexander GASPER （ID No. SP18110 ）

2. Current affiliation: Centre for Doctoral Training in Additive Manufacturing and 3D Printing, University of Nottingham

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Joining and Welding Research Institute, Osaka University

5. Host researcher: Prof. Masahiro Tsukamoto and Dr. Yuji Sato

6. Description of your current research

My research investigates the formation of spatter and oxides in laser powder fusion processing of Nickel-base superalloys. The laser powder bed fusion (PBF-LB) process is an additive manufacturing process utilising a high powdered laser to fuse metal powder, layer-by-layer, to produce complex 3D components. During the melting of the metal powder by the laser beam, material is ejected from the melt pool, which is commonly referred to as spatter. This can be seen as the sparks which are produced during the welding of materials. The PBF-LB process is conventionally performed in an inert chamber to minimize the oxidation of the materials produced. My research has discovered that oxides are produced during the processing of certain Nickel-base superalloys. These alloys are commonly used aerospace alloys and are being pursued for additively manufacturing aerospace components from. Quality is therefore an important consideration as defects are unacceptable for these applications. My research investigates the effects and quality considerations of spatter and the oxides formed during the processing of these alloys.

7. Research implementation and results under the program

Title of your research plan:

Investigation of oxidation and spatter formation of Nickel-base superalloys processed in a vacuum laser powder bed fusion system

Description of the research activities:

During my time at JWRI I have been working with Dr Yuji Sato to process three Nickel-base superalloys (Inconel 718, Hastelloy X, and Inconel 625) in their vacuum laser powder based fusion system. Previously their work has investigated Titanium alloys. We had to conduct a process parameter optimisation study for each material to establish suitable processing parameters. This was based off the processing parameters used in conventional machines, which was shown to be far off what was required for processing in the vacuum system. The processing parameter investigation was also tracked with a high speed camera to provide information of spatter generation. It has hoped that this will be able to be used to compare spatter generation between materials, and the effect of different processing parameters. The parts and spatter produced has been collected for investigation of oxides. Initial results indicate there may still be oxides present, despite processing in the vacuum chamber. However, full analysis will be conducted back at Nottingham to ensure results can be compared with previous results.

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

I was fortunate enough to visit many areas of Japan during my fellowship. I was able to visit the Tenjin and Gion festivals. I also visited Hiroshima for the peace ceremony and festival and was able to have lunch with a hibushka (A bomb survivor) and discuss his experiences and life. Hiking the pilgrimage trail of Kumano Kodo was a highlight and visiting Koyasan were great for gaining an appreciation of Japanese culture, religion, and times of old. My hosts and research group were excellent for introducing me to many amazing restaurants and providing me with many cultural experiences. They have been my biggest learning experience.

9. Advisor’s remarks (if any):

The Osaka Northern Earthquake occurred the day before Alex’s visit of our institute, which caused the experimental equipment used to fail. Although a significant delay in the research plan had occurred, not only did he grasp the delay but also gained new knowledge.

JSPS Summer Program 2018
Research Report

1. Name: Danielle MCLEAN （ID No. SP18112）

2. Current affiliation: University of Oxford

3. Research fields and specialties:

Chemistry

4. Host institution: Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

5. Host researcher: Prof. Jun-Ichi KIMURA

6. Description of your current research

Volcanic ash (tephra) deposits are routinely identified in sedimentary (palaeoclimate and archaeological) archives in and around Japan. These layers provide important markers able to precisely synchronise distal records and also provide insight into the tempo, behavior and dispersal of explosive volcanism.

My PhD research has focused on the identification and geochemical characterisation of the ash layers preserved in the sediments of Lake Suigetsu (central Honshu). This is the most precisely dated palaeoenvironmental record for Japan, and the visible tephra sequence provides a key record of volcanism over the last 150 ka. We have identified that four times as many ash layers are preserved as non-visible markers (cryptotephras) through the sequence, which provides a very detailed catalogue of smaller and more distal eruption events (see McLean et al., 2018).

Volcanic glass shards can be extracted from the lake sediments (using density separation techniques) and counted to identify peaks in their concentration. These peaks represent non-visible ash layers preserved in the core. The compositions of the glass shards within these layers can be used to correlate them to their volcanic source and/or particular eruption.

McLean. et al. 2018, Integrating the Holocene tephrostratigraphy for East Asia using a high-resolution cryptotephra study from Lake Suigetsu (SG14 core), central Japan. QSR 183: 36-58.

7. Research implementation and results under the program

Title of your research plan:

GEOCHEMICAL FINGERPRINTING OF EXPLOSIVE ERUPTIONS DISPERSED OVER CENTRAL JAPAN

Description of the research activities:

By using the Laser Ablation-ICP-Mass Spectrometer at JAMSTEC, we were able to generate trace element glass compositions for many ash layers identified in Lake Suigetsu. These datasets allow us to determine the source of many new eruption events which have been previously undocumented or poorly studied. These new correlations mean that we can precisely date many eruption events that have dispersed ash over central Japan and possess a better understanding of the eruption frequency from several different centres across Honshu.

With Prof. T. Suzuki (Tokyo Metropolitan University), we spent three successful days in the field sampling from outcrops close to volcanoes in central Honshu (e.g. Akagi, Hakone). These samples will be analysed during the final part of my PhD to assess their potential as widespread marker layers for palaeoclimate research.

I was able to present my research at seminars at JAMSTEC and TMU.

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

My host family were incredibly generous and organized two fantastic visits near Hakone. We visited Odawara and Owakudani Valley, and I also joined an English lesson with their daughter. We tried many traditional Japanese foods, my favourite being homemade Okonomi-yaki. I am very grateful to Prof. Kimura, Prof. Suzuki, and colleagues at JAMSTEC who have made this a remarkable experience personally and professionally.

9. Advisor’s remarks (if any):

Danielle’s activity has been quite productive. She completed much more than originally planned. The analytical results and new samples will successfully be involved in her PhD work. Her interaction with the JAMSTEC peoples We thank JSPS for the generous support which made this great opportunity possible.

JSPS Summer Program 2018

Research Report

1. Name: Stuart MACPHERSON （ID No. SP18113）

2. Current affiliation: University of Cambridge

3. Research fields and specialties:
Mathematical and Physical Sciences

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

5. Host researcher: Assoc. Professor Keshav M. DANI

6. Description of your current research

Organic-inorganic halide perovskites (OHPs) are the rising stars of photovoltaic and optoelectronic research. With power conversion efficiencies surging from 3.8% to 22.7% in under a decade, perovskite solar cells may form fierce competition to the incumbent silicon-based technology in the coming years. Advancements in perovskite-based LED devices are also gathering momentum, with output efficiencies rising across the whole colour spectrum. Nevertheless, the performance of state-of-the-art OHP devices is still limited by defects, introducing non-radiative recombination pathways through which energised charge carriers lose their energy to heat, rendering them useless for the generation of electricity. Surface defects can be the most dominant limit on efficiency in thin films of OHP, due to their high *surface* defect density and inherently high surface-to-volume ratio. My research at the University of Cambridge is focused on characterising the effects of passivation treatments, which act to cure these surface defects, improving the photoluminescence and device efficiencies of OHP films.

One key method of defect passivation is the incorporation of a chemical species into the perovskite lattice, to occupy or eliminate potential sites of charge recombination. Whilst the addition of alkali metals such as Rubidium and Cesium into OHP compositions is known to improve the stability and efficiency of photovoltaic and LED devices, potassium has been shown to bind to halide ions at the surfaces of OHP films, hindering the formation of vacancies and interstitials at the edges of the crystal lattice. My aim is to discover how this treatment is affecting the behavior of charge carriers such that future passivation methods might be tailored to further optimise efficiencies, avoiding the need for an approach of trial-and-error.

7. Research implementation and results under the program

Title of your research plan:

Dynamics of Trap States in Passivated Halide Perovskite Films

Description of the research activities:

Using photoemission electron microscopy (PEEM) to image surface defect states on my perovskite samples, we successfully mapped the distribution of defects on the surface of passivated and unpassivated OHP films. We also carried out time-resolved PEEM to observe the trapping dynamics of carriers in each film. This data will provide steps towards developing a comprehensive trapping model for OHPs. Photoemission spectra were also acquired to reveal how potassium passivation alters the nature of surface defects. This combination of findings will aid the quest for efficient OHP solar cell and LED devices with minimal parasitic losses.

Additionally, we probed the effects of light exposure on surface defects in different atmospheric conditions. Given that photo-stability and air-sensitivity are major flaws of current perovskite technology, our observations of the nanoscale effects of exposure will offer valuable insight on the role of defects in OHP film degradation.

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

My experience in Japan has been incredible. My host supervisor and research group were so welcoming and have encouraged and aided me throughout. I have taken every opportunity to explore Okinawa - the island is a tropical paradise with such friendly people! I loved learning about both Okinanwan and Japanese culture. Highlights: Visiting the shrines of Kamakura with the wonderful Kato family, eating takoyaki and watching a boat music festival in Osaka, exploring the ancient forest and mountain of Daisekirinzan.

9. Advisor’s remarks (if any): Stuart’s visit to our unit has been absolutely wonderful. He has shown maturity in his research capabilities well beyond that of a ‘usual’ graduate student. He certainly exceeded expectations on his JSPS project. Stuart is also a great person to work with, and in his short time here, he has become a part of our OIST family. We hope he returns to Japan, and we thank JSPS for selecting such excellent interns.

JSPS Summer Program 2018
Research Report

1. Name: Kane T McQuaid (ID No. SP18114)

2. Current affiliation: University of Reading/Diamond Light Source Ltd.

3. Research fields and specialties:

Chemistry

4. Host institution: Frontier Institute for Biomolecular Engineering Research (FIBER)

5. Host researcher: Prof. Naoki Sugimoto/Dr. Shuntaro Takahashi

6. Description of your current research

Many medicines used as part of a chemotherapy course to treat degenerative neoplastic diseases do so by binding to, and damaging, the structural and chemical characteristics of the DNA stored within the target cells. This DNA is not always canonically wound into a duplex and can form many different secondary structures, such as the G-quadruplex. This particular higher order structure has gained significant interest as a therapeutic target since they have been shown to be selectively overexpressed in the majority of human cancers. Stabilization of the quadruplex by small molecules has been shown to inhibit transcriptase activity which ultimately leads to cell apoptosis, allowing for a more cancer-selective DNA target. Therefore, the design of small molecules that can selectively bind to and stabilize the G-quadruplex is a highly important area of research. As a result of their modular photophysical properties and inherently low ground state toxicity, ruthenium polypyridyls are heavily studied for their potential use as sensitizers for photodynamic therapy and more recently, their quadruplex specific binding. Using primarily macromolecular X-ray crystallography our research strives to bring structural knowledge of these binding interactions to the literature and provide rationale for observed solution state behaviour. Our group has shown before the sequence specificity of such compounds to duplex DNA both in solution and structure, but previous to our work no one had elucidated the precise binding modes of mononuclear ruthenium polypyridyls to G-quadruplexes despite the deep academic interest.

The consolidation of solution and solid state observations allows us to make informed conclusions on the mode of binding of these complexes to DNA in isolation. I have shown that my novel complexes synthesized in our lab can, in an enantiospecific manner, bind to, selectively luminesce, and control the topology of, a range of G-quadruplex forming sequences. However, before we can make any assertions on the potential therapeutic efficacy of such complexes, further study is necessary to elucidate the compounds biological activity; a catalyst for this UK-Japan collaboration.

7. Research implementation and results under the program

Title of your research plan:

Targeting the G-quadruplex: Using the Klenow fragment in the analysis of ruthenium polypyridyl complexes as topology specific binders.

Description of the research activities:

Using a range of biophysical techniques such as circular dichroism, UV-Vis spectroscopy and denaturing polyacrylamide gel electrophoresis, the efficacy of a range of ruthenium polypyridyl complexes were tested as their ability to disturb the replication of DNA (via the klenow fragment) by stabilizing secondary structure (primarily the G-quadruplex) in a topology specific manner. It was found that the handedness of the complex plays a large role in the ability to stall the replication, where the lambda hand is largely dominant, and that simple alterations to the intercalating ligand can also largely affect the rate of replication. In addition this replication was also tested after irradiation of a subset of the photodynamic complexes, where the complexes are shown to covalently link to the DNA yielding in magnitudes decrease in replication rate. These results have helped us to understand the binding mechanics of these complexes and have yielded a handful of very promising candidates for next stage trials for both photodynamic therapy and topology specific binding.

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

A once in a lifetime opportunity that was well worth pursuing. Work hard/play hard is often used to describe Japanese culture and it is true. Many hours were spent using world-class facilities and building strong collaborations but many hours were also spent diving into the rich and diverse culture and exploring the seemingly endless natural beauty on offer with some of the friendliest and welcoming people on earth.

9. Advisor’s remarks (if any):

Kane did really worked hard for his research in Japan. He was very enthusiastic for learning our biophysical treatment and biochemical skills. He also gave a nice presentation for the international symposium held in Konan university. Thanks to his hard work, we got a lot of interesting data, which will absolutely lead to continuous collaborations with him in the future. I think this program is very successful and his excellent talent and behaviours were so stimulating to all the members of us.

JSPS Summer Program 2018
Research Report

1. Name: Ines NEARCHOU （ID No. SP18115）

2. Current affiliation: Quantitative and Digital (QUAD) Pathology, School of Medicine, University of St Andrews, North Haugh, St Andrews, KY16 9TF

3. Research fields and specialties:

Biological Sciences

4. Host institution: National Defense Medical College

5. Host researcher: Prof. Hideki Ueno

6. Description of your current research

Colorectal Cancer (CRC) is one of the most common cancers worldwide. Risk assessment and treatment choices for stage II CRC patients are in need of improvement. Various histopathological factors have been shown to be candidates for the identification of aggressive stage II CRC disease. Such is the desmoplastic reaction (DR) defined by the presence of fibrosis at the tumour's invasive margin. Although this feature seems very promising there remains the issue of standardised and reproducible reporting. My previous research demonstrated the ability of automated image analysis to quantify other candidate prognostic histopathological features including tumour buds and tumour-infiltrating lymphocytes (TILs) in a standardised and reproducible manner. Meanwhile, deep learning methods have shown promising results in identifying patterns in histopathological images, of which is the case with DR. This project aimed to combine the expertise of Prof Ueno, in CRC histopathology, with our cutting – edge digital pathology and image analysis methodology, in order to extract detailed and complex information from the patient's heterogeneous and heterotypic tumour microenvironment.

7. Research implementation and results under the program

Title of your research plan:

Personalising Colorectal Cancer Stage II Prognosis with the use of Automated Image Analysis.

Description of the research activities:

This project firstly aimed to validate the DR scoring method on an independent international cohort. During my time in the National Defense Medical College, I have firstly learned how to recognise and classify this feature on haematoxylin and eosin (H&E) stained slides. We have then assessed 165 digitised H&E stained slides from a Scottish cohort of patients and our results compared favourably with those previously shown by the group of Prof Ueno and therefore have successfully internationally validated their findings.

Furthermore, I got trained to identify manually other features with prognostic significance including tumour budding, poorly differentiated clusters and immune infiltration. Following my training, we have assessed these features on a cohort of 283 stage II CRC Japanese patients and 186 stage II CRC Edinburgh-wide patients. We had significant results from this assessment and we aim to submit a manuscript with these findings within the next few months.

One of the major aims of this project was to produce a standardised and reproducible method for assessing DR. The machine learning process for identification of the three histological categories of DR has begun, and this work is in progress. We anticipate good results in the near future, with potential of publication in a high-impact peer-reviewed journal.

Finally, previous work by the QUAD Pathology group in the University of St Andrews will be validated on the Japanese cohort upon my arrival back to the United Kingdom. This will include the quantification of various prognostic features including tumour budding and TILs, with an automated image analysis methodology and applied machine learning for feature selection.

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

My time in Japan has been a once in a lifetime experience. One thing that really impressed me is how polite, kind and respectful Japanese people are. Moreover, I admired their work ethic and the extensive efforts in accommodating my project in such a short space of time. All in all, my experience in Japan has been amazing. I have learned a lot from this programme and most importantly, I had a wonderful time.

JSPS Summer Program 2018
Research Report

1. Name: Jonathan PRAGER （ID No. SP18116 ）

2. Current affiliation: University of Bristol, School of Veterinary Sciences

3. Research fields and specialties:

Medical, Dental and Pharmaceutical Sciences

4. Host institution: Nihon University

5. Host researcher: Dr Daisuke ITO

6. Description of your current research

My current research aims to investigate new multi-modal and combination therapies for chronic paralysis after spinal cord injury (SCI). It is estimated that 2.5 million people worldwide are living with the consequences of SCI, and there is no curative therapy available for patients with chronic paralysis.

Cell transplantation into the injured spinal cord has shown promise experimentally. In particular, transplant of a cell type taken from the lining of the nose - olfactory ensheathing cells (OECs) – has been shown to improve walking in experimental animals and pet dogs. Phase 1 human clinical trials of OEC transplant has demonstrated safety, but inconsistent results on clinics suggest improvements and additional therapies are needed.

Injection of an enzyme – chondroitinase ABC (chABC) – has also improved walking after SCI in experimental animals and pet dogs. However, chABC is inactivated at body temperature within 72 hours, necessitating repeated spinal injections and limiting its clinical use.

We have developed genetically modified OECs that are able to continuously produce and excrete chABC, providing a potential new delivery method of chABC and a simpler way of delivering combined OEC and chABC therapy. Preliminary experiments have shown that transplant of these genetically modified OECs improves fore-paw reaching in rats (a model of voluntary hand function in humans) more than OECs alone.

One of the main limitations of cell transplantation strategies is low cell survival after transplant. As part of my research I am therefore also exploring ways of improving OEC survival using transplant within hydrogel biomaterials.

7. Research implementation and results under the program

Title of your research plan:

Combination therapy for spinal cord injury: olfactory ensheathing cell transplantation and chondroitinase ABC

Description of the research activities:

Our aim was to test whether OECs expressing chABC could improve walking after SCI in rats, and compare this to OECs alone. Determining whether there is a benefit to these modified cells on recovery of walking in rats is a necessary step before future trials could be performed in pet dogs or people.

We have therefore performed a blinded, randomized trial of these potential cell transplant therapies in a chronic contusion injury model in rats. We transplanted 1 group of rats with OECs expressing chABC and 1 group with OECs alone at 3 weeks after SCI and used behavioural tests of walking to measure outcomes.

We have successfully performed all transplants and are continuing to monitor outcomes. In the spirit of collaboration, Dr Ito's laboratory in Japan have kindly offered to continue this testing beyond the length of my stay in Japan to get more long-term outcome data which will be hugely valuable. As the trial is blinded we will not have results until after the final behavioural test.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I have hugely enjoyed my time in Japan and have been incredibly welcomed by the lab here, with people going out of their way to help me and facilitate my research. I have been fortunate to travel within Japan - to Morioka for a conference with members of the lab, and to see some of the amazing architectural and cultural attractions of Tokyo, Kyoto, Nara, and the Japanese Alps - as well as go to several festivals and try plenty of delicious Japanese food! It has been fascinating, and a real privilege, to spend time learning about the culture of Japan. The research I have been able to perform here will be hugely valuable for my PhD, and I hope will be of benefit to the lab here. I am certain we will collaborate in the future, and hope to be able to return. We are already planning for one of the PhD students here to visit the lab in Bristol.

9. Advisor's remarks (if any): Mr. Jonathan have accomplished most part of his study what we had set up before this JSPS program. He worked hard in the lab until late in evening (hope he enjoyed Japanese working time) and found spare time to learn Japanese cultures in lots of places. I am sure this collaboration made great progresses in the field and leading to next collaboration.

JSPS Summer Program 2018
Research Report

1. Name: Stephanie Rankin-Turner (ID No. SP18117)

2. Current affiliation: Loughborough University

3. Research fields and specialties:
Chemistry

4. Host institution: University of Yamanashi

5. Host researcher: Professor Satoshi Ninomiya & Professor Kenzo Hiraoka

6. Description of your current research

In the context of a legal investigation, the presence of human biological samples, such as blood, at the scene of a crime can provide essential information regarding the involvement of particular individuals and the sequence of events. Therefore, it is crucial that biofluids are detected and identified in a timely and cost-effective manner. Unfortunately current body fluid identification procedures can be time-consuming, non-specific and destructive. Furthermore, researchers have been attempting to develop a technique of establishing the age of a body fluid for years, however a reliable method has not yet been established. My PhD research is focused upon the development of non-destructive techniques capable of performing in-situ identification and age estimation of human body fluids for forensic purposes through the development of novel sampling techniques and ambient ionization mass spectrometry (MS). Current research has focused on the development of a direct analysis technique using a custom-designed handheld thermal desorption sampling device coupled with atmospheric pressure chemical ionization (APCI) mass spectrometry. This technique has proven capable of differentiating between human body fluids based on volatile organic compound profiles and estimating the time since deposition of a sample due to chemical changes in the body fluid over time. However as volatile compounds are particularly susceptible to environmental effects, alternative methods of analysis could improve this technique.

7. Research implementation and results under the program

Title of your research plan:

The In-Situ Analysis of Human Bodily Fluids using Dielectric Barrier Discharge Ionisation Mass Spectrometry

Description of the research activities:

During my time at the University of Yamanashi, I was able to implement a range of techniques coupled with high resolution accurate mass MS for the direct analysis of body fluids, including sheath-flow probe electrospray ionization (sfPESI), AC corona discharge ionization, Leidenfrost-assisted desorption, and dielectric barrier discharge ionization (DBDI). Human body fluids (blood, saliva and urine) were subjected to direct analysis, initially to ascertain the effectiveness of the different desorption and ionization methods. In some cases, such as with DBDI and AC corona discharge ionization, the application of heat was required to thermally desorb analytes of interest to obtain chemical profiles from the samples. In the case of sfPESI, rapid and direct analysis of biological fluids without the need for any kind of treatment was possible. This technique was capable of analyzing both fresh and samples stored over one month, enabling chemical changes in aged samples to be studied and compounds of interest identified. This has provided a real insight into the chemical changes occurring in biological fluids with time, essential for developing methods of time since deposition estimation, and has demonstrated the suitability of these methods to body fluid analysis in forensic or clinical settings.

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

My time spent in Japan as part of the JSPS summer program has been invaluable. I have gained a great deal of knowledge and experience, and I am extremely grateful to Professor Hiraoka and Professor Ninomiya for dedicating so much time to my research. Outside of the lab, I was fortunate enough to visit many beautiful places around Japan, climb Mt. Fuji, and make some incredible friends along the way. This summer has been a highlight of my career so far, and I look forward to returning to Japan to continue research in the future.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Shaun Scaramuzza (ID No. SP18119)

2. Current affiliation: University of Birmingham

3. Research fields and specialties: Biological Sciences

4. Host institution: Division of Molecular Cell Engineering, National Institute of Genetics

5. Host researcher: Prof. Masato Kanemaki

6. Description of your current research

My current research focuses on understanding the events surrounding the termination of DNA replication. Cell division is the basis for the propagation of life and requires the accurate duplication of genetic information. Thus, DNA replication must be precisely regulated as errors likely lead to changes to cellular behavior, potentially resulting in the development of a number of genetic diseases, growth defects, or cancers. In 2014, the Chromosomal Replication Laboratory at the University of Birmingham first reported the primary elements of the termination stage of DNA replication: the replisome disassembly mechanism. The replicative helicase (CMG complex) is polyubiquitylated by the ubiquitin ligase Cullin2-LRR1, subsequently recognized by the protein remodeler p97, resulting in the removal of the CMG complex from chromatin. Further investigation, combined with iPOND mass spectrometry data revealed several ubiquitin ligases and deubiquitylating enzymes to be potentially involved in this process. My current work utilizes a number of model systems, including *Xenopus Laevis* egg extract and immortalized human cell lines to explore any involvement of these enzymes in DNA replication, with particular focus on the termination stage. In addition, I am also interested in understanding any changes to the mechanism of action of the studied enzymes under varying inducible replication stresses or forms of DNA damage.

7. Research implementation and results under the program

Title of your research plan: **Auxin-Inducible Degradation Tags for the Study of DNA Replication Termination**

Description of the research activities:

The Auxin-Inducible Degradation System developed by Prof. Kanemaki's group is an extremely useful tool for the study of fundamental proteins in live cell environments. Briefly, a donor plasmid, containing the AID tag and resistance marker as well as a homology arm for the protein of interest, was transfected with a CRISPR/Cas-9 plasmid into immortalized human cell lines expressing the OsTir1 ubiquitin ligase. Following transfection, the Cas-9 enzyme cleaves the DNA before homology-directed repair insert the AID tag along with the resistance marker into the gene of interest. This technique allows the rapid degradation of the protein target upon exposure to Auxin. The overarching aim of the research conducted within the JSPS Summer Programme 2018 was to gain experience in the AID system. Three different cell lines were generated for two proteins of interest, containing mini-AID tags in a HCT116 cell background, mini-AID-mCLOVER tag in a HCT116 cell background, or mini-AID tags in a RPE1 cell background. Successful insertion of the relative cassettes was confirmed through genomic PCR analysis. Cell Cycle analysis identified the degradation phenotype for each clone generated. Furthermore, analysis of synchronized cell cultures, arrested in G1 prior to protein degradation and release, revealed interactions between chromatin and the CMG complex upon the degradation of the target proteins.

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

In addition to experiencing research in Japan. The JSPS 2018 Summer Programme has enabled me to visit several cultural spots and cities across Japan including Hiroshima, Tokyo, Kyoto, Osaka, Numazu, and Nara. Prof. Kanemaki and his research group ensured I felt extremely comfortable throughout my time in Japan. In particular, a trip organized by a member of the laboratory to climb Mt. Fuji, and watching firework shows on the beach in Atami are particularly memorable!

9. Advisor's remarks (if any):

It was a great pleasure to host Shaun for the last two months. We could share all techniques to make mutant cell lines using genome editing and auxin-inducible degron system. Actually, he successfully generated mutant cells during his stay, which will be important resources for his future study at University of Birmingham. Not only in sciences, we shared a good time to climb Mt. Fuji and to do other activities as well. I am totally happy with Shaun and look forward to continuing our collaboration after the JSPS programme.

JSPS Summer Program 2018
Research Report

1. Name: Zeke Steer （ID No. SP18120）

2. Current affiliation: University of Bristol and University of the West of England, UK

3. Research fields and specialties: Engineering Sciences

4. Host institution: Osaka University

5. Host researcher: Prof. Hideyuki Nakanishi

6. Description of your current research

Doll therapy is a relatively recent form of non-pharmacological intervention used in the treatment of distressed or challenging behaviours in dementia. In this form of therapy, the person with dementia is presented with or chooses an anthropomorphic doll to care for. Doll therapy has been shown to reduce distressed behaviours in people with dementia (Baumann, 1990; James et al., 2006; Ellingford et al., 2007; Braden & Gaspar, 2014). The responsibility of caring for the doll is thought to introduce a sense of structure and purpose into daily life, and the doll provides an outlet for feelings of love and tenderness (Alander et al., 2013). However, the dolls used at the present time lack interactive features and are sometimes mistaken for deceased children, increasing distress (Bisiani & Angus, 2012). The psychological theories underpinning doll therapy, which include the attachment theories of Bowbly (1969), Ainsworth (1973) and Miesen (1993) and the transitional object theory of Winnicott (1953), also suggest that an animated doll could be more effective at engendering feelings of attachment and providing comfort. Studies conducted with robotic pets have demonstrated that interactivity can improve engagement with the therapeutic object and increase feelings of attachment towards it (Libin & Cohen-Mansfield, 2004; Tamura et al., 2004; Wada et al., 2005). More lifelike dolls have also been shown to be more effective at reducing distressed behaviours in people with dementia, particularly when coupled with social stimuli (Cohen-Mansfield et al., 2010; Stephens et al., 2012).

The focus of my current research is to develop an interactive therapy doll capable of responding to detected distress of the kind which might manifest during an episode of distressed behaviour. The doll should attempt to calm, reassure and distract the person with dementia during such an episode, until a carer becomes available. My research in Bristol is developing the requisite sensor technologies and machine-learning based algorithms to enable the doll to recognize distress and predict distressed behaviours.

7. Research implementation and results under the program

Title of your research plan:

Developing a robot-assisted therapeutic doll to reduce distressed behaviours in dementia

Description of the research activities:

The focus of the activities in Japan was to develop the robotic components for an interactive therapy doll for people with dementia. These components included a pair of robotic hands which could be embedded in an empathy doll or plush toy, and the associated hardware and software necessary for controlling them. The design of the hands was to be adapted from Prof. Nakanishi's 2014 paper on remote handshaking.

Hand holding and hand massage are often used to provide comfort and reassurance to people with dementia. The robotic hands are capable of mimicking the palmar grasp reflex of new born babies by grasping a finger when touched. They also feature multi-colored light effects, emit soothing vibrations and are warm to the touch. The control unit plays back comforting sounds through an embedded speaker. The doll is wireless and can be controlled over Wi-Fi.

The objectives have mostly been achieved although some work remains to be completed in the UK. For example, the robotic hands need to be installed in the doll.

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

I've thoroughly enjoyed my time in Japan and I wish to express my sincere gratitude to JSPS, British Council and the Nakanishi lab at Osaka University!

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Sanita TAILOR （ID No. SP18121）

2. Current affiliation: Kyoto University, Institute of Chemical Research

3. Research fields and specialties:
Chemistry

4. Host institution: Kyoto University, Institute for Chemical Research

5. Host researcher: Prof. Masaharu NAKAMURA

6. Description of your current research

Current research both at my home university and in the Nakamura group involve the development of new first row metal-catalysed coupling reactions with the aim to improve upon chemical sustainability by replacing precious metal catalysts with more earth abundant, cheaper, and less toxic metals, such as iron and cobalt.

Ongoing research at the University of Bristol looks at cobalt-catalysed biaryl Suzuki cross-coupling reactions, whereby an arylboron reagent couples with an arylhalide. We are developing less harsh conditions which are more compatible with a wide range of functional groups to improve versatility and also examining the reaction mechanism by undertaking kinetic studies.

Another stem of research at my home institute focusses on gaining insight into the mechanism of the iron-catalysed aryl-alkyl Kumada cross-coupling reaction. In order to do this, we synthesized and characterised highly unstable organoiron complexes relevant to the coupling reaction, and compared reactivity of these in an attempt to deduce the active species.

The work I have been conducting in Japan greatly builds upon current iron-catalysed methodologies by developing enantioselective cross-coupling reactions to form highly useful chiral products, similar to those found in nature. This is a novel concept in the field of iron catalysis for cross-coupling reactions, and has been established by the Nakamura group. I have had the chance to research two types of cross-coupling reactions- Negishi-style coupling, which uses an aluminium reagent, and Suzuki coupling using a boron reagent.

7. Research implementation and results under the program

Title of your research plan:

Investigation into Novel Enantioselective Iron-Catalysed Cross-Coupling Reactions

Description of the research activities:

The first research topic involves the use of a zirconium-based catalyst to form a chiral aluminium reagent, from an alkene starting material. We then used this aluminium reagent in an iron-catalysed cross-coupling reaction with simple bromoalcohols, to give a chiral alcohol product. Allylbenzene proved to be an effective starting reagent, however we need to quantify the extent of enantioselectivity, and develop a wider substrate scope.

Secondly we investigated the novel Suzuki coupling between secondary propargyl bromides and alkenyl borates, and found quantitative yields were achieved using a non-chiral phosphine based ligand on the iron centre. To develop this into an enantioselective reaction, we screened several alternative chiral phosphine ligands and found two ligands that were effective that gave a promising yield of desired product. Further ligand design to improve upon this is required.

I had the opportunity to learn new purification (GPC) and analysis techniques (chiral HPLC, chiral GC), which I have not been exposed to at my home university.

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

It was greatly beneficial to be surrounded by such talented and hardworking chemists, and to learn numerous new techniques, as well as share ideas and expertise, especially during group meetings. Being close to Kyoto allowed me to experience the Gion-Matsuri festival and the Daimonji festivities.

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Hugh TANNER （ID No. SP18122 ）

2. Current affiliation: University of Bristol

3. Research fields and specialties:
Interdisciplinary and Frontier Sciences

4. Host institution: Osaka University

5. Host researcher: Professor Yasushi INOUE

6. Description of your current research

Correlative Light Electron Microscopy (CLEM) is an imaging technique that allows rare cellular events to be imaged in high temporal and spatial resolution. Although this technique is powerful its efficacy is limited by the quality of the probes available. My research revolves around designing better probes for this technique and applying them to aid in answering biologically relevant questions.

7. Research implementation and results under the program

Title of your research plan:

Development of Novel Correlative Light Electron Microscopy Probes – Fluorescence Nanoclusters

Description of the research activities:

The initial stages of my research consisted of learning how to synthesis fluorescent platinum nanoclusters. After I successfully synthesized these nanoclusters I had to characterize their fluorescent output. To do this I learned how to use excitation emission matrix (EEM). This technique measures the intensity of fluorescence while being excited by monochromatic light over a range of wavelengths. This technique confirmed that I had been successful in synthesizing nanoclusters with a fluorescent output.

Once this stage had been completed the nanoclusters need to be conjugated to a biomolecule which will localize them to a specific target in a cell, usually targeting a specific protein. I opted to conjugate the nanoclusters to transferrin and an antibody against sorting nexin 1. Both transferrin and sorting nexin 1 are primarily located on the cell surface membrane and endosomes. This information is useful as if the nanoclusters are not localized to these areas we can assume that the nanoclusters are

disturbing native protein function, or they are not labelling accurately.

Confocal microscopy was then used to determine if the nanoclusters were co-localizing correctly with the target protein. The EEM spectra were used to determine which excitation laser and filters to utilize on the confocal microscope. HeLa cells were incubated conjugated nanocluster and unconjugated nanoclusters were used as a positive control. Nanoclusters conjugated to sorting nexin 1 antibody did not display the expected localization within cells. Instead it seemed to be diffuse in the cytoplasm and relatively dense around the nuclear membrane. Transferrin conjugated nanoclusters did show native co-localization at the cell surface membrane. However a time course revealed that these transferrin conjugated molecules were not being endocytosed correctly and remained on the surface of the cell.

I also prepared samples to investigate with transmission electron microscopy, but due to time constraints I will complete these experiments after this report deadline with my remaining time in Japan and when I return to the UK.

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

I'd like to thank Inoue Sensei for allowing me to work in his laboratory and for being so welcoming and supportive. Inoue Sensei's lab group have also been very friendly, welcoming and helpful.

9. Advisor's remarks (if any):

Mr. Tanner enthusiastically carried out the research, synthesizing nanoclusters for the first time, evaluating optical properties and conjugating them to antibodies. If he wishes, I would like to support the continuation of this research even after he returns to the UK.

JSPS Summer Program 2018
Research Report

1. Name: Brett MCLEAN

（ID No. SP18123 ）

2. Current affiliation: Department of Computer Science, University College London

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Institute of Mathematics for Industry, Kyushu University

5. Host researcher: Professor Yoshihiro MIZOGUCHI

6. Description of your current research

In computer science, the field of formal methods aims to develop capabilities for formal, or even automated, reasoning about computer programs, in order to aid their specification, their synthesis, or verification of their correctness. In the past 15 years, the mathematical logic of partial functions has been investigated, for the possibility that it will prove useful for reasoning about programs. This work, including my own PhD work at University College London, has indicated that partial functions are logically ‘well behaved’. This is a positive sign; however we are still some way from practical real-world applicability.

7. Research implementation and results under the program

Title of your research plan:

Logic of functions for automated program verification

Description of the research activities:

Using the proof assistant software Coq, we have formalised known axiomatisations (sets of true statements from which all other pertinent truths can be deduced) for the valid statements about partial functions. We have taken some results proven in the literature and, using Coq, formalised machine-checkable proofs of these facts.

Coq is favoured because of its high level of expressibility, however it does not natively support the powerful automated proving capabilities of some other proof assistants. Therefore we have not yet tested the feasibility of automated theorem proving in this domain. This is future work.

Our code will be integrated into the Institute of Mathematics for Industry's existing project on formalization of reasoning about binary relations, of which partial functions are a specialised case.

A technical report on this work is in preparation.

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

The summer program is a fantastic program that I have thoroughly enjoyed.

I have visited Sasebo, Kagoshima, Kumamoto, Tokyo, Nagasaki, Hiroshima, and Okinawa.

I have tried many delicious foods and dishes for the first time, such as shabu shabu, kurobuta, and motsunabe.

In addition to the Japanese language lessons provided during orientation week, I have been able to attend a handful of lessons provided free by Kyushu University.

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Alexander David Gwillim (ID No. SP18124）

2. Current affiliation: University of Cambridge

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Institute of Solid State Physics, University of Tokyo

5. Host researcher: Prof Mikk Lippmaa

6. Description of your current research

In Cambridge, my current research focuses on doping an organic semiconductor. This means that I add a dopant chemical to a modern polymer to make it a more conductive molecule that can be used instead of silicon in electronics.

In Tokyo, I used my solid state physics knowledge to dope inorganic semiconductors. This means that I added a dopant chemical to a non-traditional oxide to make it a conductive molecule that can be used instead of silicon in solar cells, with the solar energy used to drive chemical reactions such as splitting water into oxygen and hydrogen gasses.

My Tokyo group measures the photo-generated charge, but currently the solar energy conversion is unpractically low. My group attempts to find which crystal defects are primarily responsible for the loss of carrier mobility and attempt better doping schemes and crystal growth regimes.

If successful, the next step would be reproducing laboratory results on an industrial scale, which has huge potential. One example would be non-polluting hydrogen gas, obtained from renewable energy, to be used as fuel in vehicles.

7. Research implementation and results under the program

Title of your research plan:

Solar energy harvesting with oxide semiconductors

Description of the research activities:

As the sapphire substrates are not cut absolutely perfectly, atomic level ridges can be seen under atomic force microscopy (AFM). When the substrates are received they are merely etched and so the ridges are pretty random depending on how the acid ate the surface. Laser annealing raises the temperature to 950^{o}C which forces the atoms to move into more ordered states - they stick to the step edge as it's easiest to hold the atom there.

Pulsed laser deposition then allowed me to grow rhodium-doped $SrTiO_3$ onto the annealed step surface. It was still possible to see the steps through the randomized deposition. It should be noted, however, that atomic force microscopy cannot see images smaller than the tip being used, and a convolution between the tip and the surface takes place. As such, small island features are all the same size because that's the tip shape.

I performed a Reflection High-Energy Electron Diffraction (RHEED) measurement on the sample, which shows the layer-by-layer oscillation crystal growth. The intensity goes down due to scattering from each new, partially built-up layer, whereas a fully built-up, perfect layer doesn't scatter and so intensity goes back up. This repeats several times but the amplitudes become smaller due to, for example, atoms not being hot enough to move into the holes, in which case the next atomic layer is grown (nucleated) before the first finished.

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

The stay in Japan was quite literally life-changing. I embraced an entirely new culture and truly loved it. From seeing the Japanese capital from the tourist-laden Tokyo Tower to spending my birthday sipping local whisky in a Beatles-themed Japanese-run British pub, I have adored my time here and it has made me grow further as a person. I am eternally grateful to both JSPS and my Japanese research group for the entire experience.

JSPS Summer Program 2018
Research Report

1. Name: Paul-Elliot Anglès d'Auriac （ID No. SP18201 ）

2. Current affiliation: Université Paris-Est Créteil, PhD student

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Nagoya University

5. Host researcher: Takayuki Kihara

6. Description of your current research

My current research deals with many aspects of Higher Recursion, a study of the very complex objects in the scope of computable reductions. One of these aspects is Algorithmic Randomness, the theory that answer the question of what properties have a typical random-generated infinite string of zeros and ones. I used a very powerful computational model, the Infinite Time Turing Machine which formalize the concept of computation during an ordinal time (an arbitrarily infinite time), to define new strong notions of randomness. I studied them and show that if they are close to the previously defined Π^1_1-randomness, they still have some very different properties.

The second aspect of Higher Recursion that takes an important part of my current research is Reverse Mathematics. This program seeks to classify theorems in terms of strength, which may be seen from two point of view: proof theory, and recursion theory. In the first, one tries to identify the minimal set of axioms that are sufficient for a proof of a theorem. The second study the complexity of the objects given by any instance of the theorem. The two are closely related, and my current research on this topic is focused on the recursion aspects of Hindman's Theorem, a theorem of combinatorics which state that every finite coloring has an infinite set such that any two finite sum from the elements of the set has the same color.

7. Research implementation and results under the program

Title of your research plan:

Toward an understanding of ATR in the context of Weihrauch reducibility: Σ^1_1-choice and homogeneous trees.

Description of the research activities:

During this two months program, we studied a particular class of theorems which are all equivalent under the scope of usual Reverse Mathematics, but different for Weihrauch reducibility, a finer reduction where one can use the stronger theorem only uniformly once to get a solution to the weaker theorem. In particular, we solved an open question asked in a paper by Brattka, Gheraldi, Holz, Nobrega, and Pauly. We had to study and separate the notion of trees with the notion choice: that is trees where every level is independent of the prefix to get there. We started by asking ourselves and solving many side questions on the Medvedev lattice of related notions appropriately introduced. Finally, we could solve the main question by using an unpublished result from Harrington.

We went on with considering different questions that I have in my PhD during the two last weeks, related to Infinite Time Turing Machine and Algorithmic Randomness.

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

In addition to hard work during week days, I could visit Kyoto, Gujo-Hachiman, Shirakawago, Kanazawa, Sado Island, Kiso Valley, and Tokyo. I also could visit Keita Yokoyama in JAIST to work with him, and Kazuyuki Tanaka in Tohoku University to make a seminar there. I had amazing time, cultural exchange and work in Japan, thanks to JSPS!

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Brandon Azeredo （ID No. SP18 202）

2. Current affiliation:

Paris Diderot University

3. Research fields and specialties:

Chemistry

4. Host institution: The University of the Shiga Prefecture

5. Host researcher: Pr. Balachandran JEYADEVAN

The energy and environment challenges are two of the main challenges of the 21st century. It is necessary to develop new efficient, environment friendly and cheaper technologies. Biomass is one the renewable resource available but not exploited enough. Some biomass-based molecules could be transformed into more useful ones but because of energetic concern, it should be done with lower energy consumption. In order to achieve that, my current research is focus on the synthesis of Co_xRu_{1-x} *nanoparticles by a soft chemistry method. Those nanoparticles act as catalysts which can transform selectively and specifically a molecule to another with high speed and yield. Because catalysts are not consumed, they can be recycled and reused multiple times.*

The formation of such objects can be the result of a complex mechanism. My task in Japan is having a better understanding of the nanoparticles mechanism of formation by gathering data with different techniques: UV-Visible Spectroscopy, Electronic Microscopy, X-Ray Diffraction...

7. Research implementation and results under the program

Title of your research plan:

Data gathering for a better understanding of the formation mechanism of Co_xRu_{1-x} nanoparticles

Description of the research activities:

In my laboratory in France, a protocol for Co_xRu_{1-x} nanoparticles has been developed but it always resulted in the formation of multiple phases (for example: $Co_{50}Ru_{50}$ and $Co_{95}Ru_5$). This was considered due to the difference in the reduction of Co and Ru ions in the system and co-reduction of these two metals are preferred for the formation of single-phased alloys.

On the other hand, the host laboratory has developed techniques to produce alloy nanoparticles by controlling the complexation of metallic ions with amine. The complexation modulated the reduction time of metals and facilitated the co-reduction. To achieve co-reduction they used a specially designed cell that enables in-situ UV-Visible analysis of the complexes formed during heating under different experimental conditions.

Thus, during my stay I performed in-situ UV-Visible measurements using the experimental system I used in France for the synthesis of $Co_{50}Ru_{50}$ by varying the metallic salts. In addition, I also conducted experiments in the presence and absence of complexing ligands in the form of surfactants. In addition, with the help of the host's collaborator in Tohoku University, we also performed some fine structural analysis using the X-ray absorption spectroscopy. The experiments carried out during my stay will be very useful for me to propose a novel scheme for the synthesis of single phased Co-Ru nanoparticle with different sizes and shapes.

Meetings were also organized during which any ideas could be proposed and discussed.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): *The JSPS Summer Program was a real chance to discover Japan. I could visit a lot of different places during free time: Kyoto, Okinawa, Sendai... All the staff welcomed me well in the laboratory. I shared pleasant moments with students and professors: welcome party, dinner, activities... For the next fellows, I advise them learning a bit of the Japanese culture before coming (language, daily life behavior...). In addition to be well appreciated, it helps a lot during the whole stay.*

9. Advisor's remarks (if any):

Brandon was very sociable with the staff members as well as the students. He got himself familiarized with the local experimental and analytical systems very quickly and began working towards his goal. I believe that he has gathered enough experimental data for him to proceed with his research in France. I wish him all success.

JSPS Summer Program 2018
Research Report

1. Name: BACHELET Pierre-Emmanuel （ID No. SP18203 ）

2. Current affiliation: ENS de Lyon, Lyon's Institute of East Asian Studies, Lyon, France

3. Research fields and specialties:

Humanities

4. Host institution: Institute for Advanced Studies on Asia, Tokyo University

5. Host researcher: Masashi Haneda

6. Description of your current research

Phd student at the ENS de Lyon, currently studying the foreign relationships of early modern Japan with Dang Ngoai (Tonkin), Dang Trong (Cochinchina) and Champa. Since my master I have been focusing on this major part of India-China maritime road during the first or proto-globalization.

My research aims at demonstrating the crucial role played by Viêt harbours within Japanese trading and diplomatic networks, as well as the role played by Japanese traders and migrants within their host societies, as partners of local authorities and foreign traders. I will also determine what these Japanese communities became after the so-called "closing" of Japan. These overseas Japanese certainly did not immediately disappear and the relations between Southeast Asia and Japan remained tight.

I am not only studying the relations between several states but tries to understand how they evolved in a specific global context, using the methods of global and connected history and connecting them with the current debates on the redefinition of Edo Japan’s foreign relations.

I am also building a database of all the traders, officials, feudal lords, missionaries etc. who played a role in early modern Japan-Southeast Asia relationships.

7. Research implementation and results under the program

Title of your research plan:

Early modern Japan's relations with Southeast Asia (late 16th-early 18th century)

Description of the research activities:

I have been able to find several documents which will help me expand my corpus of sources and support some of my hypotheses.

One of the most interesting Japanese traders settled in early modern Vietnam I have been working on, Kadoya Shichirobei Eikichi, left several letters sent to his brothers based at Matsusaka and Sakai. Unfortunately, until this research travel, I was not able to find any sources from Japanese authorities mentioning the activities of overseas-based Japanese traders. However, at the Historiographical Institute I have consulted the diaries from the Chinese interpreters in Nagasaki, and they briefly mention two of these Vietnam-based traders, including Kadoya Shichirobei. This confirms that even though Japanese government did not allow the Japanese to leave or return to Japan, it completely acknowledged and accepted that families in Japan and their relatives outside Japan kept communicating with each other.

One of the main purposes of this research travel was to gather early modern Japanese maps. Even though I was not able to access directly maps conserved in museums, I saw them in the permanent collections. I visited the Jingu Chokokan at Ise where a map belonging to the aforementioned Kadoya Shichirobei as well as one of the earliest Japanese globes by Shibukawa Shunkai, are conserved.

However, I was even more successful at Kyoto University, where a Japanese PhD candidate studying there lent me a book with huge reproductions of dozens of different maps, including those I was not able to see at museums. I am very grateful for his help because my corpus of maps is now important enough to allow me to write my thesis.

At the Nagasaki Museum of History and Culture, I also find the reproduction of a map which validated one of my hypotheses about Japanese marine charts. I was convinced that these maps were not just copies of nautical charts made by Portuguese but incorporated original Japanese knowledge, and this map indeed used names of places that never appear in Portuguese maps. It confirms that Japanese mapmakers copied Portuguese maps but were also able to include information provided by Japanese traders. I also found some unpublished documents including two letters by a Vietnamese lord, but until now I did not have enough time to read and translate it. Unfortunately there were some documents the museum's library could not give me access to.

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 2018
Research Report

1. Name: Morgane BONADÈ	（ID No. SP18204）
2. Current affiliation: National Natural History Museum (MNHN) of Paris, France	
3. Research fields and specialties:	
Biological Sciences	
4. Host institution: Nagahama Institute of Bio-Science and Technology	
5. Host researcher: Associate Prof. Atsushi Ogura	

6. Description of your current research

My PhD focuses on the dopaminergic nervous system of the cuttlefish *Sepia officinalis* (Cephalopoda) and the influence of light on its setting-up during embryogenesis. I've identified several dopamine receptors in the cuttlefish. I'm currently characterizing these receptors both phylogenetically and functionally. I'm also looking at their qualitative and quantitative spatio-temporal (in various tissues and developmental stages) expression in *Sepia* embryos. This is done by using various methods such as *in-situ* hybridization, PCR, or qRT-PCR. Finally I want to compare the expression of dopamine receptors but also light sensitive receptors in embryos that have been submitted to different photoperiods.

My participation in the JSPS Summer Program allows me to start the work on light sensitive receptors in collaboration with the major team working on the evolution and development of cephalopods in Japan. Furthermore it will add a comparative aspect to my thesis as I will study these receptors both in *Sepia officinalis* and in another cephalopod specie, the pigmy squid *Idiosepius paradoxus*. This program is most likely the beginning of a long term collaboration between Ogura sensei's team and mine.

7. Research implementation and results under the program

	Title of your research plan: Comparative study of light perception in two cephalopod species: *Sepia officinalis* and *Idiosepius paradoxus*

Description of the research activities:

The project we developed with Ogura sensei focused on the photosensitive receptors enabling light perception in the eyes of coleoid cephalopods. We wanted to study their expression during embryogenesis in order to have a better insight on the evolution and the function of these proteins in relation to the acquisition of visual abilities during development.

First part of the project was mostly bio-informatics. I scanned the transcriptomes and genomes of two coleoids cephalopod species (*Sepia officinalis* and *Idiosepius paradoxus*) and identified several putative receptors. I also run both phylogenetic and positive selection analysis to better characterized these receptors and to understand their evolutionary history.

Then I looked at the qualitative expression of *Idiosepius* and *Sepia* light sensitive receptors through RT-PCR in various embryonic stages.

Finally I prepare RNA extracts from different organs and different embryonic stages in order to do some RNA-sequencing to compare quantitatively the expression patterns of *Idiosepius* and *Sepia* receptors in collaboration with the Genomic Diversity Laboratory (Department of Bioscience, Nagahama Institute of Bioscience and Technology).

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

This program was a great opportunity for me to study abroad and met others scientists working in this very small scientific community focusing on developmental studies in Cephalopods. It was also a great opportunity to learn new methods and I want to thanks Takemura-san and Minei-san for their help with practical questions. Furthermore it was very nice to live in a country so beautiful, to discover a different culture and to meet all the JSPS Summer Program fellows.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Anne BOUVET （ID No. SP18205）

2. Current affiliation: CNRS - FRANCE

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Ritsumeikan University - Department of Mechanical Engineering

5. Host researcher: Prof. Isao TOKUDA

6. Description of your current research

The research aims to contribute to the physical understanding of human voice production due to auto-oscillation of the vocal folds. The auto-oscillation of the vocal folds is the result of a fluid-structure interaction between the airflow coming from the lungs, the structure of the vocal folds and the acoustical coupling with the vocal tract. The underlying physics is studied combining modeling (flow, structure and acoustics) and experiments on mechanical replicas with varying complexity. This way the phenomena can be characterized in a controlled and reproducible way and the model outcome can be validated against experimental data. In the PhD two main contributions are made. The first objective is to investigate the influence of a liquid layer on the vocal folds. The second objective is the development of a new non-invasive measurement method of the time-varying glottal area during continuous speech: external photoglottograph.

7. Research implementation and results under the program

The effect of vocal folds asymmetry on voice pathology

The Department of Mechanical Engineering at the Ritsumeikan University, led by Professor I. Tokuda, is specialized in the physical modeling of the human voice. Using a physiologically oriented method to reproduce in more details not only the geometry of human vocal folds but also its multi-layered structure. In this study, the research of effect of a geometrical asymmetry of the vocal folds on phonation is operated. Based on data provided by the University Hospital of Tokyo the laboratory produce realistic replicas based on highly detailed vocal folds geometry (obtained by

MRI). Artificial vocal folds are molded using successive layers each having different elastic properties in order to reproduce the internal structure of the human vocal folds. In this case three different replicas are used (Figure 1), from the simplest (two layers) to the more complex one (four layers).

a. Vocal fold physiology *b. M5 replica (2 layers)* *c. MRI replica (3 layers)* *d. EPI replica (4 layers)*

Figure 1 : 3 different vocal folds replicas studied

Then an experimental set up (Figure 2) is built in order to measure the influence of the angle asymmetry between the vocal folds, reproducing thus normal to pathological configurations. Oscillation pressure threshold, oscillation frequency, acoustic output and high speed video are recorded.

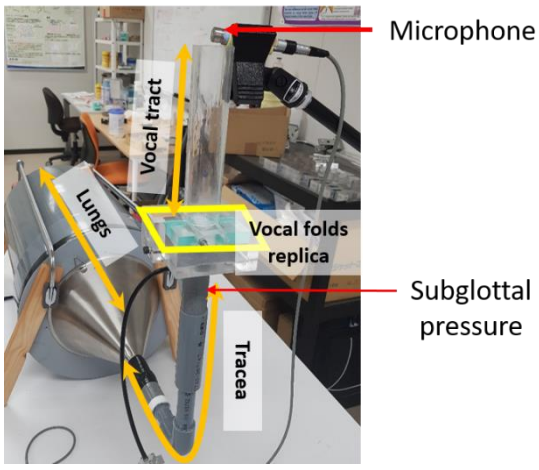


Figure 2 : Experimental set up allow measurement reproducing angle pathology

Results show a clear influence of the asymmetry between vocal folds on each replica. The first observation is the decrease in frequency with the increase of the angle asymmetry. Then, concerning the glottal pressure, results show that the symmetrical configuration isn't the best in term of effort for the lungs and an asymmetry around 2 degrees requires less pressure to lead the vibration. Above 2° degree of asymmetry, a leak induce by the angle different became bigger and it needs higher pressure to obtain the vibration. Finally, all these experimental results will be compare to the output of a theoretical model developed in France.

JSPS Summer Program 2018
Research Report

1. Name: Agnès Burgers （ID No. SP18206）

2. Current affiliation: University of Montpellier, France

3. Research fields and specialties:
Engineering Sciences

4. Host institution:

Laboratory of wood processing, Graduate School of Agriculture, Kyoto University

5. Host researcher: Professor Yoshihisa Fujii

6. Description of your current research

My current research is in the field of expertise and conservation of wooden building heritage. My studies and professional experiences have been oriented around wood construction. For my thesis I worked on non-destructive methods of wood characterization. Based on my previous experiences, I am now launching a more ambitious research plan on historical built heritage. One of the main research objectives is to develop methods and tools for the diagnosis of structures. This work starts with creating state-of-the-art non-destructive diagnostic methods. This project also aims to study the properties of employed wood including their evolution over time. Finally, a knowledge of the historical building practices as well as the renovation technique used is necessary to complete our understanding of wooden timber structure conservation issues.

7. Research implementation and results under the program

Title of your research plan:

Study and comparison of diagnostic methods of heritage wood structures and non destructive characterization tools

Description of the research activities:

During this program I realized several different activities.

I started to handle experimental methods used in the host laboratory for the diagnosis of wood structures, such as X-ray tomography or microscopic anatomical observations.

I visited several restoration sites of historical monuments. This allowed me to observe the methods of diagnosis used as well as the skill of the craftsmen in the traditional building techniques.

I did bibliographic research on traditional Japanese architecture, wood used in construction and diagnostic methods. I started to build database of wood characterization methods.

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

This summer program was a good opportunity for me to meet and exchange with researchers in the same field. It allowed me to enrich my knowledge in the diagnosis of wooden structures. I hope to continue to collaborate with the Japanese researchers I met.

I was also an opportunity for me to discover Japanese culture. I enjoyed architecture, Japanese cuisine and other aspects such as traditional festivals or the Noh Theater. I also started to learn the Japanese language.

9. Advisor’s remarks (if any):

Continue to support this program because it is a good way to discover research in Japan.

JSPS Summer Program 2018
Research Report

1. Name: CHEMIN Arsène
（ID No. SP18207）

2. Curent affiliation : Ecole Normale Supérieure de LYON / Institut Lumière Matière

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Tokyo University

5. Host researcher: Prof. Fumitaka MAFUNE

6. Description of your current research

My current research at the Institut Lumière Matière in Lyon (FRANCE) is about the nucleation of nanoparticles created by laser ablation in liquid. A pulsed laser is focused on a target such as metal or oxide. Because of the high density power at the laser's spot, target's material is ablated, and a plasma made-up of ions, atoms and diatomic molecules is formed. During the cooling of the plasma, the atoms will combine together forming clusters (ensemble of few atoms) growing until forming the nanoparticles. This method allows for clean, easy and versatile production of nanoparticles that are a subject undergoing intense study. Indeed, nanometric scale opens a door on quantum effects and reveals new and surprising properties of matter. This is a great opportunity for new developments. Nanoparticles can be used for chemical catalysis, energy storage, medical treatment, research etc.

My purpose is to study the physical processes occurring during the formation of the nanoparticles in order to better understand their formation and, hopefully, better control their production. Indeed, many different shape, size and composition of the nanoparticles have been observed depending on the target material, the laser parameters and the environment of ablation. However, the relations between the production conditions and the obtained nanoparticles are still questioned. Thus I study the plasma created by the laser and its evolution while cooling in order to understand the important parameters driving the formation of the nanoparticles.

7. Research implementation and results under the program

Title of your research plan:

Atomistic Mechanisms for the Nucleation of Aluminium Oxide nanoparticles

Description of the research activities:

During my work in Japan, I was able to use the experimental set-up developed by Prof. Mafuné's team. I used laser ablation of aluminum rod in helium/oxygen gas coupled with a heating tube and a mass spectrometer. Heating the cluster formed enabled me to determine the typical time of some reactions observed on the clusters. This is of first importance in order to know if the nucleation processes occur at thermodynamic equilibrium or not. Which is a fundamental information to understanding of the phenomena and for being able to develop any theoretical model. I was also able to observe theoretical results on the composition and size of the clusters depending on the ration between aluminum and oxygen in the plasma. Finally, I was able to observe some preliminary results on the size of the clusters depending on the surround pressure as predicted by the theory.

Despite the short time of my travel, this collaboration was very fruitful and should lead to publication.

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

My trip in Japan was an unforgettable experience. I discovered a complex and interesting society with a rich history and craftsmanship. JSPS summer program frame is of great support to approach this new culture as comfortable as possible. I only wish I had more time to developed further my study and travel more through the country. This short time in Japan definitely calls for another trip.

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Camilia DEMIDEM （ID No. SP18208）

2. Current affiliation:
Astroparticule & Cosmology Laboratory, Paris-Diderot University, FRANCE
Paris Institute of Astrophysics, Pierre and Marie Curie University, FRANCE

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Astrophysical Big Bang Laboratory (ABBL), RIKEN

5. Host researcher: Dr. Shigehiro NAGATAKI

6. Description of your current research

Particle acceleration is ubiquitous in the universe as evidenced by the non-thermal features in the spectra of high-energy astrophysical sources; or by the regular detection of cosmic rays, these particles that constantly bombard the Earth with speeds, far beyond what can be achieved in man-made particle accelerators; with kinetic energies actually comparable to macroscopic objects for the most energetic ones (the highest energy detected is a few 10^{20} eV, equivalent to the kinetic energy of a pitched baseball !). Despite continuous theoretical and numerical progress, the mechanisms behind this particle acceleration remain elusive, all the more so in the less studied relativistic regime (i.e. involving characteristic speeds close to the speed of light).

My current research is on astrophysical shocks and turbulence, which are today widely recognized as promising accelerating regions, mainly by means of numerical simulations and, with a particular focus on the relativistic regime, relevant for objects such as gamma-ray bursts, pulsar wind nebulae etc. In these environments, like in most part of the visible Universe, matter is ionized and in plasma-state, with charged particles coupled through self-induced and background electromagnetic fields. Modeling particle acceleration in these astrophysical plasmas is a real challenge as it is a highly non-linear (”everything is interdependent”) and multi-scale problem. Current numerical abilities cannot provide first principles simulations that would reproduce the physics from the micro-scales, at which the kinetic processes involving the turbulence and the particles take place, all the way up to the macro/astronomical scales, relevant to the dynamics of the astrophysical object and today, codes tend to adopt either a kinetic (e.g. PIC codes) or a fluid (e.g. MHD codes) approach. We are working on hybrid simulations taking benefit of both approaches to study particle acceleration in astrophysical plasmas; currently, we are in particular interested in acceleration occurring in a magnetized turbulence.

7. Research implementation and results under the program

Title of your research plan:

Particle Acceleration in Astrophysical Plasmas

Description of the research activities:

I worked on Monte-Carlo test-particles simulations to study particle acceleration by relativistic turbulence (such simulations involve drawing randomly many different possible configurations to determine the statistical properties of the acceleration process). The results seem to be in relatively good agreement with theoretical predictions. I also worked on relativistic MHD simulations of driven turbulence to compute self-consistently its temporal evolution, in contrast to the MC simulations. The next step will be to introduce the particles in there.

I attended weekly the numerous lab meetings but also discussed about my previous and current research outside of ABBL. In particular, I gave a seminar talk at ICRR (Tokyo U.) and had some very interesting discussion with Prof. K. Asano, who worked in the past, with a former member of ABBL, on similar issues. I also gave a seminar at YITP (Kyoto U.) and met with Prof. K. Ioka and his group. The workshop I attended there was also the opportunity to meet Dr. Herman Lee, with whom I could discuss the possibility of applying the code I am using to supernova remnants.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I am very thankful to the JSPS and nominating authorities for allowing me to take part to such a nice program; and to Nagataki-san and RIKEN's people, for the good working condition and accommodation they provided me with, as well as the opportunities of meeting with many researchers and learning a lot on various topics of physics, beyond my specific PhD subject. From a cultural perspective, I really enjoyed my home stay experience; my host family was lovely, I tried on kimono and yukata and it was great to have the chance to interact with Japanese children. I also travelled during weekends and enjoyed landscapes, delicious food, beautiful shrines etc. I even joined a near 1-million-people crowd to admire the fireworks of the Sumida River Festival!

9. Advisor's remarks (if any):

During Camilia Demidem's stay at RIKEN, she did a great job on Monte-Carlo calculations of test particles in random-magnetic fields. This is for advanced study of 2^{nd}-order Fermi acceleration in fluid with random magnetic fields that have mildly relativistic Alfven speeds. I believe that she can accomplish her current research well, and we can do nice collaborations on relativistic phenomena such as gamma-ray bursts.

JSPS Summer Program 2018
Research Report

1. Name: Jeremy DONON （ID No. SP18209）

2. Current affiliation: Laboratoire Interactions, Dynamiques et Lasers (UMR CEA-CNRS 9222), Université Paris-Saclay

3. Research fields and specialties:

Chemistry

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Prof. Masaaki FUJII

6. Description of your current research

My present research project as a PhD student deals with the “Characterization of Ion Pairs by Conformer-Selective Spectroscopy". Ion pairs are indeed ubiquitous in Nature, from sea water and aerosols, to living organisms. Being the very first step of crystallization of ionic species and influencing the properties of ion concentrated solutions or ionic liquids, they also play a key role in countless applications. Although they are met in many areas of Physics, Chemistry and Biology, their characterization is complicated by the coexistence of several types of pairs and their elusive nature in solution. Research in this field, so far, mainly consists in experiments carried out in solution and molecular dynamics simulations. Isolated neutral ion pairs (where anion and cation bear opposite charges ; $z+ = z-$) remain poorly documented, despite their fundamental interest, due to the difficulty to bring these objects to the gas phase. This issue, however, has been recently overcome by laser desorption of salt, and this leap forwards enables my group to investigate these objects, and address, from a new perspective, several scientific issues extending well beyond the frontiers of Physical Chemistry. In this context, the scientific program of my thesis aims at investigating, at the microscopic scale, neutral ion pairs, isolated and microsolvated in the gas phase, by using an approach combining conformer-selective IR and UV spectroscopy, molecular dynamics simulations and quantum chemistry calculations. Three directions are explored:

- Spectroscopic characterization of each type of pairs, and application to the dissociative role of the solvent.
- Description of the first steps of crystallization of ionic compounds.
- Analysis of the influence of counter-ions on the structure of charged biomolecules.

7. Research implementation and results under the program

Title of your research plan:

Ions Also Hug Each Other

Description of the research activities:

My objective was to make microsolvation experiments on acetate anion (negative charge) to understand how the stepwise addition of water molecules does affect the spectral signature of the carboxylate group. To reach this challenge, experiments should be carried out with the experimental setup of my host lab, especially an Electrospray Ion Source (ESI). All parameters were modified to provide and study negative ions. Several tests on negative systems were carried out. Unfortunately, detectors available were not able to provide a signal allowing to perform experiments. Experimental research is not always easy, but maybe that's why I like it! So, we had to change our plan and find interesting system with a positive charge. Such ion pairs are considered to be the most relevant species in the context of the interfacial chemistry, for example in sea spray aerosols where divalent calcium and magnesium cations are postulated to be layered below carboxylate surfactants at the air-water interface. Hydration experiments on carboxylate anions paired with double charged cation are carried out on calcium acetate ion pair. We were able to record the spectra of calcium acetate until eight water molecules added. Theoretical calculations have also been made to support experimental results. Thanks to these experiences, we show the hydration of the calcium acetate ion pair allows its relaxation. In addition, the direct environment of both carboxylate oxygen influences its spectral signature. The first results are promising and encourage further investigations. It could be very interesting for us to purchase this study on other system such as barium acetate and magnesium acetate to understand the influence of the cation in the ion pair and its hydration.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): It was the first time I visited Japan, and I discovered a wonderful country. The culture is amazing, combining old traditions from past centuries and today’s incredible technological progress. People are so nice and the food is exquisite! I also learned a lot about scientific research in Japan. My host lab was full of nice and smart students and researchers who gave me valuable advice. I enjoyed conducting my research in Japan.

JSPS Summer Program 2018
Research Report

1. Name: Etienne Bernard Edouard DUPONT （ID No. SP18210）

2. Current affiliation: CNRS and Université Paris Saclay, Orsay, France

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Advanced Science Research Center (ASRC), Japan Atomic Energy Agency, Tokai, Ibaraki

5. Host researcher: Riccardo ORLANDI

6. Description of your current research

Atomic nuclei are made of protons and neutrons, which are normally uniformly distributed in the tiny volume of the nucleus. In some special cases, however, protons and neutrons organize themselves in cluster structures, as if the nucleus was a molecule made of smaller nuclei. A most famous example is the “Hoyle state” in the carbon-12 isotope, which is made up by 3 coupled α particles (each α particle is made by 2 protons and 2 neutrons). If the Hoyle state did not exist, the fusion of 3 α particles could not occur in the Sun, and there would be no life on Earth. Among the large variety of cluster states, I focus on states which are made by one α plus a much heavier nucleus or “core”.

Such cluster states were recently discovered for the first time in a heavy nucleus by Alain Astier from CSNSM (Orsay, France). These states, found in the isotope ^{212}Po (polonium), consist of one α coupled to a ^{208}Pb (lead) core. They were populated in transfer reactions in which a low-energy oxygen beam irradiated a ^{208}Pb target. The γ rays emitted by these excited states reveal surprising electromagnetic properties, which are due to a completely new mechanism: the vibration of the “α-core” distance around its equilibrium position.

At the JAEA Tandem laboratory I performed an experiment which will permit to understand how these special states are formed. The results of my analysis should lead to several publications, and foster future searches of such states in other nuclei.

7. Research implementation and results under the program

Title of your research plan:

Study of the population of the α-core cluster states in ^{212}Po via α-transfer

Description of the research activities:

My work focuses on understanding the mechanism of the reaction leading to the formation of very unusual excited states in the ^{212}Po isotope. During this summer program, I carried out a dedicated experiment to provide the data for this study.

This program offered me a unique opportunity to perform the experiment that I had been preparing for over a year. I first presented my research and experiment goal to the local group. I then ran simulations and performed calculations to decide several experimental parameters. Supported by the local team, I also built the experimental setup. This taught me a lot on the technical aspects of our research, such as designing and 3D printing a small detector support, setting up electronics modules, testing and fixing silicon detectors. The experiment, strongly supported by the local group, ran continuously for one week. During these nights and days at the laboratory, I could discuss with colleagues the preliminary results so as to obtain from the experiment the maximum output. We collected data with four different beam energies and I was able to identify the cluster states in ^{212}Po. After the experiment I began the preliminary analysis. I discussed the new data with a nuclear theorist at Tsukuba University. This was very useful to deepen my understanding of the nuclear reaction.

During my stay, I also had the opportunity to join an experiment of the local group using an extremely rare radioactive target: Einstenium-254.

From every point of view, the JSPS summer program has been truly successful.

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

In addition to the scientific development, in Tokai I discovered another style of doing research in a united and very involved group. My two months in Japan have been a very positive experience and I enjoyed studying Japanese, joining public festivals and religious services. Thanks to the orientation session, I got to know other JSPS fellows together with whom I enjoyed discovering Japanese cultural treasures. I am sincerely grateful for the support of the Japan Society for the Promotion of Science, which allowed me to improve substantially the content of my thesis work and gave me the desire to come back to Japan.

9. Advisor’s remarks (if any):

Etienne has been an excellent student to work with and I am glad that his experiment was so successful. In addition to his sharp intellectual abilities, he is enthusiastic, kind, and independent, and adapted surprisingly quickly both to our research group and to his new life in Japan. I really hope that the future will offer us other chances of working together.

JSPS Summer Program 2018
Research Report

1. Name: Victor FRAIGNEAU （ID No. SP18211）

2. Current affiliation: Laboratoire Gerphau, EA 7486, ENSA Paris-la-Villette, Université Paris 8, France

3. Research fields and specialties:
Humanities

4. Host institution: Department of Architecture, Kuma laboratory, Graduate School of Engineering, The University of Tokyo

5. Host researcher: Prof. Kengo Kuma

6. Description of your current research

Experiencing an architecture implies much more than the only visual and auditive senses, which the overrepresentation tear us apart a real perception of our environments. The perception of an architectural atmosphere implies, as much as the eye or the ears, the nose through the sense of smell. Several areas of research, related in a way to architecture, investigate the sense of smell, for its naturally rich poetry and its suggestiveness. These reflexions converge on the relevance of a questioning of the potential of smells in the experience of a place. It may, therefore, be legitimate to ask ourselves what extent the inclusion of smell can change in our relationship to architecture and to the world, both for living them, and build them.

Designed or not, smells are already present in architecture, and their perception depends especially on outside environmental factors, the choice of materials and the way they are assembled. Smells express cultural, historical, geographical values. It is then up to architects, for some programs and in selected contexts, to seize these qualities to develop them at the time of the architectural project, in a conscious attitude from conception to realization.

The study of the olfactory sense in architecture raises questions that deserve to be studied with the aim of contributing to the definition of the experience, the practical and theoretical treatment of ambiances and perceptions related to it. The time of the experiment is of utmost importance in the reflection on smells in architecture because it is the original path that will lead to a legitimate study, not just theoretical. Some sensations depend on the nature of the perceived odor, which can only be understood by experience.

Those reflections lead the research to ask in which way the consideration of olfactory perception and its design can change our relationship to architecture and our world, both for living and building them.

7. Research implementation and results under the program

Title of your research plan:

Experience and design of the olfactory sensoriality in architecture, landscape and urbanism

Description of the research activities:

The research is focused on how much smells are taken into consideration in the experience and design of the built environment in Japan. Different scales were investigated: the landscape of a vast territory, the scale of an urban area, the use of smells in the design process of architects, and an experimentation at a scale of an artistic installation.

The study explored how much smells are controlled, and how much they are symptoms of political decisions or cultural practices in the management of the environment. One of the results is that smells are rarely a key issue on these kinds of the design process, but they are indeed part of it, in a multi-sensory approach. Smells in Japan are signs of a relationship linking human activities to the environment, outreaching the occidental distinction between nature and culture.

We identify three main categories of odorant sources : those directly linked to human production (e.g. food, goods, rituals, etc.), those produced by human constructions (industries, buildings, i.e., indirectly produced), and those diffused by non-human beings and entities (vegetals, natural elements, animals, natural chemical reactions, etc.). We can see that these three categories are almost always intertwined and define complex relations between humans and the environments they live in, and the way of living and being in Japan is still acknowledging this bind.

From the experience of contemporary buildings and from the few interviews that have been conducted, we can say that taking into account the sense of smell as an inspiration for design in the built environment is still very weakly tested. We can, however, observe a shift in the practice and experience of architecture: Japanese architects now open much more their works to nature, taking inspiration from the pre-modern way of building and living. These considerations are linked to profound thoughts on the relationships we build with nature, and a will to offer a genuine multi-sensory experience, closely related to the particular attention given to materiality and atmosphere.

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 2018
Research Report

1. Name: Lori Gonnet （ID No. SP18212）

2. Current affiliation: IMT Mines Albi-Carmaux, France

3. Research fields and specialties:
Chemistry

4. Host institution: Kyoto University

5. Host researcher: Prof. Tohru SATO

6. Description of your current research

The thesis project aims at developing green processes by medicinal mechanochemistry. It contains two parts:

- The study of the mechanisms in particular that of the Diels-Alder reaction by mechano-chemistry in comparison with the reaction in solvent medium
- Syntheses of pharmaceutical molecules using ball-mill, in particular condensed triazoles.

For the first part, Diels-Alder reaction is performed using a vibratory ball-mill under different temperatures. These mechanochemical reactions are compared with the same reaction in solvent medium and kinetic calculations are made to study the mechanism.

For the second part, hydrazones and triazoles are synthesized by mechanochemistry. Hydrazones and triazoles are bioactive products with numerous therapeutic properties, like antitubercular, antitumoral, vasodilatator and antibacterial for hydrazones and antitubercular, antileukaemia, anti inflammatory and antibiotic for triazoles. Hydrazones and triazoles derivatives are prepared using a planetary ball mill and the reaction conditions are optimazed starting from a model involving easily available reactants.

7. Research implementation and results under the program

Title of your research plan:

Contribution to the theoretical approach of the Mechanochemical Diels-Alder reaction

Description of the research activities:

Diels-Alder reaction was performed using mechanochemistry and in solvent medium. Mechanochemistry is reaction in solid phase induced by the input of mechanical energy, such as by grinding in ball mills. Using mechanochemistry, the Diels-Alder reaction is quicker and selective. Whereas, in solvent, the reaction isn't quantitative and two products are synthesized.

In order to better understand theses differences and to know more about the mechanism, theoretical aspect of Diels-Alder reaction were studied.

Computational chemistry enables to calculate the structures and properties of molecules. At Kyoto University, several calculations were performed, for example, to know energy diagram with and without solvent. These calculations can explain the differences between Diels-Alder reaction using mechanochemistry and in solvent medium.

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

It was a wonderful stay. I would like to thank Prof. Sato and all students for welcoming me on their laboratory, for helping me during my research and for making me discover the Japanese culture. Thanks to JSPS summer program, I had the chance to visit Kyoto, Tokyo, Nara, Osaka and Okinawa. I could discover and beautiful landscape and temples.

9. Advisor's remarks (if any):

We have found a general condition for mechanochemical reactions. After her return back to France, we will continue our collaboration to verify the condition for the mechanochemical Diels-Alder reaction.

JSPS Summer Program 2018
Research Report

1. Name: JOUSSELIN-OBA Tanguy （ID No. SP18213 ）

2. Current affiliation: Institut Lavoisier de Versailles – University de Versailles St Quentin-en-Yvelines

3. Research fields and specialties:

Chemistry, Organic Material Chemistry,

4. Host institution:

OPERA (Center for Organic Photonics and Electronics Research) Kyushu University

5. Host researcher: Pr. ADACHI Chihaya, Assistant Pr. MAMADA Masashi

6. Description of your current research:

The development of new optoelectronic technologies with higher efficiency and less energy consumption is one of the great challenges in the field of organic electronics.

In this optic, at the *Institut Lavoisier de Versailles* we design and synthesize novel organic semi-conductors that could be regarded as potential candidates for the use in OLEDs (Organic Light Emitting Devices) and OFETs (Organic Field Effect Transistors).

7. Research implementation and results under the program

Title of your research plan:

Novel Organic Semi-Conductors for Optoelectronic Applications

Description of the research activities:

In order to shed in light the characteristics and properties of the newly developped organic semi-conductors and to seek for potential applications, we studied and proceed to the photophysical and electronical characterization of nine potential candidates for OLEDs applications and also their direct precursors. Interresting TICT (Twisted intramolecular charge transfer) fluorescence has been shed in light and PLQY (Photoluminescence Quantum Yield going up to 90% for some of the compounds have been observed.

Also nine original organic semi-conductors that are potential candidates for OFET applications have been studied. Their optical and electronical characterization has been achieved and OFET devices has been engineered for five of them with hole mobility gowing up to 1.8 $Cm^2/(V.S)$.

These works will be at least subject for three scientific publications in the upcoming

year.

During my stay I had the chance to learn a lot of optical and electronic characterization techniques, furthermore, I learned how to make OFETs of several architectures. That has enable me to get familiar with the use of glovebox and cleanroom procedure for the engineering of wet processes electronic devices.

The results obtained during my stay will also permit to design new molecules and derivatives of the studied compounds in order to enhance optical and electronic properties for a next study.

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

I had the chance during my stay to visit Fukuoka, connect with the locals and enjoy a lot of local food too in restaurants and izakaya, without forgetting visinting many shrines in and around Fukuoka. I also visited Okonoshima and its beautiful and flowery National park.

I also had the chance to visit the lovely island of Okinawa and enjoy the nice tropical beaches.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: LEVY DIT VEHEL, Victor （ID No. SP18214 ）

2. Current affiliation: Université Lyon 1, Institut Lumière Matière

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: Tokyo University, Earthquake Research Institute

5. Host researcher: Prof. HATANO TAKAHIRO

6. Description of your current research

Our team in France focuses on systems exhibiting "self organised criticality" (SOC). Such systems are spontaneously avoiding equilibrium. This type of behavior is associated with avalanche mechanisms, for instance found in earthquake dynamics. The system we currently study is inspired from tectonic faults. A granular monolayer is arranged in a cylindrical shape, allowing for periodic boundary conditions. The monolayer is continuously sheared, at a very low rate (~1 rotation per 18h) at it's bottom. A constant pressure is applied with lifting weights at the top, and the volume can vary freely since the top plate is not vertically fixed. Earthquake-like event can be defined as a sharp drop in the resistive torque of the granular stack to the shear. Such events follow statistics closely related to real life quakes, such as the Gutenberg Richter Law [1,2]. Other measures include the acoustic emissions from the granular layer, the dilation of the stack and positions of all grains thanks to an array of cameras. The dilation signal has shown some hints of predictability [2]. Our aim is to use this model experiment to create substitute data in a controllable way, to further our understanding of quakes and SOC systems.

[1] "Avalanches invariantes d’échelle dans un milieu granulaire modèle", *Lherminier, PhD Thesis (2016)*

[2] "Continuously sheared granular matter reproduces in detail seismicity laws", *Lherminier et al., pending publication*

[3] "Evolution of the distance between plates in an experimental granular fault. Implications for earthquake forecast.", *Levy dit Vehel et al, RNL Publication 2018*

7. Research implementation and results under the program

Title of your research plan:

INVESTIGATING DILATION POTENTIAL AS A PRECURSORY SIGNAL

Description of the research activities:

Two kind of signals were investigated during my stay in the Hatano Labo. Dilation of the granular medium, as well as individuals grain motions.

The average dilation rate before large energy release event has been shown to significantly increase, in relation with the magnitude of the energy release. Larger energy release correlates with higher dilations rates. This results not only holds for average signals, but also single events, opening possibilities of predictions. Search for a theoritical model is ongoing.

Analysis of the grain positions also shown how intermittence evolves with distance from the shearing band. Far from the shearing band, the normal motion of the particles becomes more step-like, more intermittent than particles closer to the sheared zone. This allows for a better characterization of how crystalline the granular is. In addition, a sub-diffusive drift was found in the direction along the shearing. Wether this is an artifact (due to small recording time length) will be found out with more specific experiments back in France.

The new insights gained during the program will prove useful to guide future research on this system when Prof. Hatano will visit our team in France in a few months.

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

The people at the ERI are very warm and hold many social events (one or two per week) where anyone is welcome. This allowed me to meet and exchange with many people both from Japan, but also other foreigners. It was a great learning experience, and I'm very much looking forward coming back.

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Martin Nicolas （ID No. SP18215 ）

2. Current affiliation: GIPSA-lab, CNRS

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution:

Imura Lab., Department of Systems and Control Engineering, Graduate School of Engineering, Tokyo Institute of Technology

5. Host researcher:

Prof. Jun-Ichi Imura

6. Description of your current research

Human relations, urban road networks, computer networks, chemical reactions, food web, Internet, electric power distribution, … all these systems can be represented as networks. Indeed, a network represents a set of interacting entities. Thus network theory aims to study networks and processes over networks such as dynamics over network, network topology, control of networks... When the networks are too large it becomes computationally impossible to apply some algorithms or analysis. Network reduction methods provide then a simpler version of an original large-scale network and with similar properties.

My current research is focused on the design of such a method. In particular, we aim to design a reduction method such that the network outgoing as a particular structure called *scale-free*. A scale-free network is a network in which there is some nodes with a large number of connexions while most of the nodes have few connexions.

This particular structure endows interesting properties such as small radius and diameter, robustness to failure, easiness to disconnect, hyperbolic embedding... In a certain way, it is also more easy to design a control strategy for scale-free networks. Thus, to take advantage of these properties we aim to design a reduction method whose outgoing network is scale-free.

A previous work during my thesis allowed us to design such a method, called MergeToScale-Free, while preserving some properties of the initial network (eigenvector centrality, mass conservation property and total mass). This method has been applied to network with about 20000 nodes and 40000 edges. In particular, it has been tested on the road traffic network of Grenoble. Road traffic management and estimation being the main concern of the team in which I am working.

An application, called MergeToCure, takes advantage of the scale-freeness of the network outgoing of MergeToScale-free to design a strategy of cure assignation in network epidemiology.

7. Research implementation and results under the program

Title of your research plan:

Network model reduction with connectivity constraints.

Description of the research activities:

A lot of network reduction methods imply to find a partition of the network. A smaller network arises then from this partition. For some applications it is interesting that every nodes in a same part of the partition are connected (i.e. the nodes form a single component). In road traffic network, for example, it means that we want the division of the city to corresponds to geographical zones.
In Imura lab. where I am hosted, they also have designed a network reduction method. This method allows to find a smaller network having a dynamical behavior *close* to the initial network. However their method does not have the connectivity constraint described above.
I first modified their method to add the connectivity constraint. In this new version, the estimation of the reduced network is obviously worse. Indeed in the original version, we look for the best partition within all possible partitions, in the new version we look for the best partition within all “connected” partitions. To estimate the loss due to this constraint, I searched to estimate the number of “connected” partitions compared to the number of all possible partitions.
This problem can be reformulated as follows : “Given a network, how many ways to cut the network such that each zone is connected ?” A very good approximation of this value has been found and large simulation confirmed this result.

Some other minor works have been investigated.

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

The visit in Imura laboratory and more generally my stay in Japan has been a very rewarding experience. I discovered a all new culture and a wonderful country. More than the joy to discover new places and experiences, my stay here made me question some of my habits in France, and I am sure it will allow me to improve my way of working and living.

9. Advisor’s remarks (if any):

Martin Nicolas has worked on the model reduction of large-scale networks composed of dynamical systems in our laboratory. He has formulated a new problem taking account of a traffic network and derived a new algorithm. This result will be very useful for traffic distributed control design, which will be one of the next research topics. I think he also had very meaningful and enjoyable time in Tokyo.

JSPS Summer Program 2018
Research Report

1. Name: Valentin Pigeon （ID No. SP18216 ）

2. Current affiliation: PhD Student

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: Research Institute for Applied Mechanics, Kyushu University

5. Host researcher: Prof Shigeru Inagaki

6. Description of your current research

This work is focused on the plasma-wall interaction occurring in space engines called Hall thrusters. These engines use electric energy to convert a gas into plasma, which is accelerated toward the output of the device, eventually leading thrust. The plasma interacts with the ceramic wall, which is limiting the lifetime of the engine, modifies the plasma properties and decreases the efficiency.

This interaction is studied from an experimental point of view, both experimentally and theoretically. More precisely, the transition region between the plasma and the ceramic wall, which is called the sheath, is investigated. The main experimental tool is the Laser Induced Fluorescence (LIF) diagnostic, that allows the measurement of the Ion Velocity Distribution Function (IVDF), which is the function quantifying the statistic repartition of the ion velocities in the plasma. This function allows the calculation of relevant ion parameters like flow velocity and temperature. The variations of these parameters in the sheath characterize the plasma-wall interaction. The IVDF is also simulated thanks to a numerical code.

The sheath is studied for various materials that are relevant for Hall thrusters, and in different plasma conditions, in order to better understand the different phenomena able to modify the sheath and then the plasma-wall interaction.

7. Research implementation and results under the program

Title of your research plan: Ceramic sheath comparison in a magnetized plasma

Description of the research activities:

LIF measurements were performed in the HYPER-II device, which creates a plasma thanks to the combination of microwaves and solenoid magnetic field. Firstly, LIF was performed without samples, and allowed to measure the IVDF for the first time in this device. These measurements took place in two different locations and highlighted the interaction between ions and the neutral gas.

Several material sample (ceramics, metals, glass) were placed in the device and the IVDF was measured near the surface for different microwave powers. This allowed the calculation of fluid velocity and temperature and to compare them, highlighting differences between the samples.

Also, a routine has been developed for the LIF data treatment of the PANTA device, which is another plasma source used in the laboratory.

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

This 2 months experience in the RIAM lab was very fruitful, both in professional and personal terms. I learned a lot more about LIF, especially on the procedure used in RIAM which is different from my laboratory's one and acquired results that are relevant for my thesis. Also, this stay was a wonderful opportunity to discover Japan (Fukuoka, Kyoto, Tokyo, Nikko…) and Japanese people. I am now seriously considering coming back to Japan for professional purposes.

9. Advisor's remarks (if any):

The IVDF was measured in the HYPER-II device for the first time. When he performed the experiment, many unexpected troubles were happened (sudden change of laser oscillation condition, very low signal and so on). He and his collaborators solved the problems quickly and led the experiment to success finally.

JSPS Summer Program 2018
Research Report

1. Name: Léa PINON (ID No. SP18217)

2. Current affiliation: Institut Pierre Gilles de Gennes, Ecole Normale Supérieure, Sorbonne Université.

3. Research fields and specialties:

Chemistry Biological Sciences

4. Host institution: Tara Center, University of Tsukuba.

5. Host researcher: Pr. N. NOMURA, Ass. Pr. A.S. UTADA.

6. Description of your current research :

My Ph.D. project is based on studying immunological synapse between Antigen Presenting Cells (APC) and B cells. Functionnalized oil-in-water droplets are used as a model of APC to ease the analysis of B cells mechanisms. Droplets are functionalized with antigens specifically recognized by B cells receptors and both droplets fabrication and droplets-cells contact are carried out using microfluidic devices. Antigen recruitment and B-cell recognition analysis is parallelized using individual microfluidic traps that can be observed by fluorescence microscopy.

In Japan, I am focused on another biological material: hydrocarbonocclastic bacteria. These bacteria use hydrocarbon as nutrient source, they so create a biofilm at the oil interface to degrade it. We use microfluidic technics for studying bacterial behavior at the oil interface. Two main projects are so highlighted. Bacteria encapsulation into oil droplets is first studied to control the bacterial concentration at the interface and to observe the oil phase degradation. The second project is based on a new microfluidic method for analyzing the hydrophobicity of these bacteria.

7. Research implementation and results under the program

Title of your research plan: Emulsion droplets as a new tool to study cell behaviors and mechanisms at the interface

Description of the research activities: I mostly used microfluidic technics (microfabrication, photolithography and assembling) to generate and trap double and simple emulsion droplets in contact with bacteria.

With these microfluidic chips, I first encapsulated E.Coli Nissle bacteria into double oil emulsion and tried to improve their stability. We aim to understand the consequences related to oil phase changes. The final goal is combining both double emulsion stability and bacteria encapsulation to image their behavior at the oil interface.

I then imaged fluorescent bacteria at the oil interface with high speed camera and laser dissection microscope. I tried to compare usual MATH test with a new method based on microfluidic technics. We aim to characterize bacterial attachment on oil phase in chip and highlight additional information about bacterial hydrophobicity compared to usual technics.

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 2018
Research Report

1. Name: Rafaël PINOT （ID No. SP18218 ）

2. Current affiliation: Paris Dauphine University PSL / CEA LIST Institute

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Hisashi KASHIMA

6. Description of your current research

Protecting the privacy of individuals while producing statistical analysis is an old topic whose foundations have mostly been laid in the 1980's, and has made an astonishing comeback due to the privacy concerns raised by the recent progress in Computer sciences. A very famous example of massive security breach occurred when Narayanan and al. demonstrated a robust de-anonymization procedure of the dataset released for the "Netflix Price contest". They showed that the analysis of cross-correlations between the anonymized database and external open source datasets allowed an attacker to obtain concealed information about individuals. It means that, given some statistics about a dataset, an adversarial Machine learning algorithm can obtain with high probability personal characteristics from the individuals in the dataset.

In the last decade, a widely adopted condition to preserve individual privacy, called differential privacy, has emerged. First introduced by Cynthia Dwork and al. differential privacy is a robust and rigorously defined notion that provides formal but adaptive conception of privacy preserving data-analysis. Since this seminal work, several models respecting the differential privacy conditions have been proposed, but most of them do not consider structured types of data such as graphs. Therefore, how to consider differential privacy on structured data types remains an open question.

During my Master Thesis, I focused on an adaptation of differential privacy on structured datasets, especially on graph type datasets. The issue of finding new ways to define and treat privacy on structured datasets will also be one of the central issues to tackle during my Ph. D.

7. Research implementation and results under the program

Title of your research plan:

Towards Statistical Security on Structured Databases

Description of the research activities:

My academic training gives me a strong background in statistics and probability theory, allowing me to have a good understanding of the privacy conditions I am working on. Visiting Pr. Kashima's group gave me the opportunity of combining my knowledge in theoretical statistics and differential privacy with the expertise of this laboratory concerning graph structured datasets and algorithms.

Our initial goal was to investigate the links between compression and differential privacy in the context of structured datasets. This topic have quickly been investigated, by considering some work conducted by Nicolas MARTIN et al. In 2015 on large scale network reduction. Using this work as a preprocessing to a privacy preserving method could considerably improve the accuracy, and reduce the computation time of such a method.

Furthermore, the joint bibliographic work conducted with prof. Hisashi KASHIMA during the first few weeks of my stay led us toward an elegant new approach.

The rational of this new interpretation is that it is possible to give a generalized form of the definition of differential privacy by using metric spaces. This new model can capture the special cases of structured datasets such as graphs. Using this generalized form of the definition could pave the way to demonstrating that keeping privacy on individuals in a database is equivalent to other well known, and well studied problems in both statistics and machine learning.

However still quite rudimentary, this work could potentially lead in a near future to a joint publication in a major machine learning conference.

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

This stay in Japan has really been an amazing personal and professional experience for me. Among all, I have been able to meet Japanese people and experiment the Japanese culture (Home-stay in Japanese family, Diner with co-workers, …), but also to meet world leading scientist of my domain (Hisashi KASHIMA, Masashi SUGIYAMA, Jun SAKUMA, …). Moreover, I loved living in Kyoto, which is a beautiful and lively city, full of cultural and social opportunities. I thus would like to thanks prof. Hisashi KASHIMA and his team for this great stay. Finally, I also would like to give a special thanks to the NAKAKUBO family for their hospitality, generosity, and kindness.

9. Advisor's remarks (if any):

As an expert of mathematical foundation of privacy, Rafael brought us a new perspective of graph-structured data analysis, which led to a new research topic in the intersection of privacy and structured data. Actually, I feel the stay is too short to finish the current promising research, but we will continue the collaboration in the future.

JSPS Summer Program 2018
Research Report

1. Name: Emilie Ruiz (ID No. SP18219)

2. Current affiliation: IREGE, University Savoie Mont Blanc

3. Research fields and specialties:

Social Sciences

4. Host institution: Hosei University

5. Host researcher: Prof. Hidehiko NISHIKAWA

6. Description of your current research

During my PhD I studied crowdsourcing (CS) for innovation. It is the outsourcing of creative tasks or complex problems to the crowd, a large group of individuals. While CS for innovation has generated interest, both theoretically and empirically, the increasing adoption of this new practice by organizations raises many unanswered questions. This thesis aims to study the adoption of CS for innovation by identifying the factors that influence this process. To do so, it builds on an analytical framework that combines resource-based approaches (Resource-Based View, Knowledge-Based View, open innovation) with theories of innovation adoption, which consider adoption as a process and not as a mere decision.

To describe and understand the influence of factors on the adoption process, this research utilizes a qualitative approach based on the study of six companies. It gives rise to three articles that lead to three major contributions. First, we identify the influence of four categories of factors (strategic, cultural, organizational and epistemic) on the adoption of CS for innovation. Strategic factors seem to have a lesser influence whereas cultural factors influence mainly the decision-making stage, organizational factors the stage of implementation and epistemic factors the stage of maturity. Moreover, it appears that these last three types of factors are interdependent. Secondly, this research explores the notion of "crowd" by suggesting that CS for innovation, and particularly CS of creative activities, relies on communities and not on a disembodied crowd of anonymous and undefined individuals. Finally, it seems that when an organization adopts a proprietary platform of CS for innovation, this new practice can be assimilated to an organizational innovation. These contributions offer a more holistic view of the adoption of CS for innovation and provide managerial recommendations to organizations wishing to adopt this approach.

My current research deals with crowdsourcing for innovation adoption. Beyond the main findings of my PhD thesis, it opens avenues for future research. I especially pointed out the role of communities to support the adoption of creative activities crowdsourcing. I

suggest that the notion of "crowd", at the core of the crowdsourcing concept, could rely on communities and not on a disembodied crowd of anonymous and undefined individuals, as it is currently suggested in the literature (Howe, 2006; Schenk and Guittard, 2011; Pénin and Burger-Helmchen, 2012). The research plan conducted in Japan is in line with this research avenue.

7. Research implementation and results under the program

Title of your research plan:

From crowd- to communitysourcing

Description of the research activities:

During my research trip at Hosei University, I had the opportunity to work both on the literature and to collect data for achieving my research plan.

- Literature: I deeply investigate the literature about communities. This helped me clarify the gap of my research plan.
- Empirical evidences: most of the work that has been done is dealing with data collection. During my stay in Japan, in line with the literature that I explored, I build an interview guide in order to firstly collect qualitative data. I interviewed a dozens of actors during my stay. I especially interview people from Lego Users Communities. These exploratory interviews helped me to fine-grained build my article. I now identified two level of analysis:
  1) Inter-organizational level: between the firm and the community, with the question of balancing flexibility and control to the community.
  2) Intra-organizational level: between the members of the community, with a "coopetition" view (members of a same community are both collaborators and competitors).

My objective is now to collect the same data within French Lego Users Communities to compare both sets. Finally, I want to use this data, in addition to the ones I collected in 2016, to finish my article.

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

During my stay in Japan, I had the opportunity to travel in the Kansai area to collect data. I went to Kyoto, Kobe, Nara and Osaka. I also had the opportunity to meet friends at Shimonoseki during two days, away from Tokyo. I had a yukata party at the University and during my homestay.

I had a wonderful time in Japan!

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Camille URVOY （ID No. SP18220）

2. Current affiliation: Sciences Po, Economics Department

3. Research fields and specialties:

Social Sciences

4. Host institution: Nihon University

5. Host researcher: INABA Yoji

6. Description of your current research

My research is in the field of public economics which is concerned with the study of the interactions between the state and the economy, encompassing firms and households.

In a first co-authored article, I have been researching the mechanisms underlying the incidence of firm taxation onto wages. Indeed, in the literature, there is no consensus on the incidence of such taxes. In this article, we take advantage of a far reaching corporate income tax credit whose amount is equal to a fixed proportion of wages paid to workers earning less than 2.5 times the minimum wage. This sharp cutoff implies variation both at the individual level (according to whether workers are paid more or less than this amount), and at the firm level (depending on whether the firm hires many workers paid above this threshold). We are therefore able to estimate the wage incidence of this reform at these two levels. Our results show that there is no individual-level incidence while the firm-level incidence is substantial and in line with the corporate income tax literature. It means that the discrepancies evidenced in the literature are not necessarily due to the different nature of the reform studies, but probably to the identification method. These findings can be rationalized by the existence of collective bargaining, implying that firm-level mechanisms are crucial to understand the distributive impact of a fiscal reform.

In a second article, I seek to understand the relationship that exists between the state and non-governmental organizations. Indeed, despite their non-governmental nature, NGOs in France benefit from substantial amounts of transfers each year from the central government. This raises the question of the motives of the state when granting money to these non-governmental actors. A recent article by Bertrand et al. (2018) has shown that company-sponsored philanthropic organizations are more likely to give money to charities located in districts of congressmen who have been nominated in comities relevant for the

firms. This indicates that transfers to NGOs are valued by local representatives, possibly for electoral motives. In parallel, the local public finance literature has documented that grants to low-tiers of governments depend on electoral alignment. In this article, I seek to test whether a similar phenomenon occurs for grants to NGOs and, if it is the case, which kind of NGOs' funding seems the most affected by electoral cycles.

7. Research implementation and results under the program

Title of your research plan:

Financial relationships between the state and non-governmental organizations

Description of the research activities:

During my stay in Japan, I have benefited from the advices of Professor Inaba, who has helped me define my research question, and who has encouraged me to think more thoroughly about the concepts used in my dissertation. I have also been able to meet Professor Tsujinaka, who has graciously given me access to his survey data on non-governmental organizations. Pr. Nishide has helped me with bibliographical references so I can understand better the main policies governing NGOs. Pr. Tatefuku has also been teaching me about the legal framework and main characteristics of NPOs in Japan. I have also met other members of the faculties who have indicated me interesting data sources that may be useful for my future research.

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

I would like to thank Professor Inaba for welcoming me in his institution, for always taking the time to introduce me to Japanese scholars and allowing me to make the most of my stay in Japan. I would also like to deeply thank Doctor Park who has been very kind and has always taken the time to make sure I understood what had been said in Japanese and, more generally, who always made sure I had everything I needed. I am also grateful to Mrs. Miyashita for her kindness and for taking the time to handle administrative affairs, as well as Mr. Togawa and the other students of the university. I would also like to thank all the scholars I have been able to meet, with a special thought for Pr. Tsujinaka who has kindly given me access to his data. On a more personal note, I am grateful to my host family, the Sato family, with whom I spent wonderful moments and made great memories. Finally, I would like to thank all the organizers as well as other participants who have contributed to the quality of my time spend in Japan.

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Rene Albert （ID No. SP18301）

2. Current affiliation: Max-Planck-Institut für Kohlenforschung

3. Research fields and specialties: Engineering Sciences

4. Host institution: Kyushu Institute

5. Host researcher: Prof. Haiwen Li

6. Description of your current research

One mayor issue of the usage of metal hydrides as heat storage material is the low heat transfer capability.

My scientific work is the investigation of the effective thermal conductivity of metal hydrides. Therefore, we are developing special autoclaves for the use of the Transient Plane Source method which can resist temperatures of up to 500 °C and hydrogen gas pressure of 100 bar. A major part of my practical work is the conduction of thermal conductivity measurements under operation conditions of magnesium hydride. As first a measurement procedure has to be developed because the metal hydride undergoes a chemical reaction at these elevated temperatures.

The main part of the work is the measurements of the effective thermal conductivity and the evaluation of the results in order to understand which parameter have the most influence on the heat transfer in such a system. Especially the change of the thermal conductivity during hydrogenation or dehydrogenation and the change with the number of cycles and the altering of the material are of big interest. The reason for that is that in theoretical approaches as calculations and simulation mostly small ideal systems are discussed and not these which suffer from inhomogeneity’s and degradation processes.

These measured values will help to define the geometry of up-scaled heat storage tanks and the design of heat exchanger.

7. Research implementation and results under the program

Title of your research plan: High Pressure Torsion of Aluminum, Copper and Titanium

Description of the research activities: Main purpose of my research at Kyushu university is to prepare ultrafine-grained materials with the high-pressure torsion method and investigate their mechanical, structural and thermo-physical properties.

The high-pressure torsion method allows us to introduce a large number of lattice defects into the material by high mechanical straining which changes phase stability and physical and mechanical properties. With measurements of the thermal conductivity of the materials in Germany, I am going to find a correlation between the microstructure, material phases, mechanical properties and their capability to transfer heat.

The materials used in this project are aluminum, titanium and copper. They are used as pure metals (10 mm disc with 0.8 mm thickness) and in combination as a ternary hybrid material (one third of disc for each metal). The high-pressure torsion method set-up consists two anvils in which a disc-shaped sample is embedded. During the process, the sample is compressed between these two anvils by a pre-set pressure. The lower anvil is then rotated against the other anvil under high pressure. After fabricating the samples, they are polished for further investigation by different methods.

The investigation of the sample is conducted by using an X-ray diffractometer to determine the crystal structure and phase changes. Mechanical properties are measured by applying the Vickers microhardness testing. In the Vickers method, a well-defined pyramidal diamond indenter implements a geometrical impression in the material which is used to calculate the hardness of the material. With this method, the relation of hardness and shear strain can be determined.

The thermal conductivity will be measured by applying the laser-flash method and the transient plane source method in Germany.

Results show, that there is a strong dependency of the hardness on the applied number of revolutions (i.e. shear strain) and the applied pressure. For all selected materials, the hardness increases with increasing the shear strain and reached the steady states at large strains. Applying high pressures such as 6 GPa to titanium during high pressure torsion leads ~~a~~ to the formation of ω phase instead of α phase, which results in a higher hardness. Preparing a hybrid material of the three above mentioned metals by high-pressure torsion results in a material of high hardness as 520 Hv, exceeding the hardness of ω-titanium. To achieve a homogeneous material distribution in the hybrid sample, a high number of HPT revolutions are needed (in this experiment 100).

Measurements of the thermal conductivity will help to get a better understanding of these advanced ultrafine-grained materials, as there are no publications on the effect of severe shear straining on thermal conductivity. Moreover, with the success of preparing hybrid materials with a high defect density, more complex systems can be prepared in future, such as high entropy alloys for hydrogen storage application.

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

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Toni A. BAEUMLER （ID No. SP18302）

2. Current affiliation: University of Oxford, UK

3. Research fields and specialties:

Biological Sciences

4. Host institution: Department of Chemistry & Biotechnology, The University of Tokyo

5. Host researcher: Assistant Professor Ryosuke UEKI & Professor Shinsuke SANDO

6. Description of your current research

For the last few years, I have been interested in engineering a repertoire of artificial receptors that allow the manipulation of how cells respond to the same stimuli – transitioning from a native towards a non-native, user-defined cellular response.

Signal integration and transduction by cell-surface receptors is a complex, multi-layered process resulting in the tight regulation of downstream mediators, which in turn elicit predefined cellular responses. The modular architecture of transmembrane receptors provides a unique opportunity for installing *de novo* sensor/effector circuits in cells. Such engineered designer cells are capable of sensing specific disease markers and in turn drive customised therapeutic programmes, aiding the development of next-generation, cell-based therapies.

To overcome some of the limitations of current artificial receptor designs, I engineered a new class of chimeric receptors that deploy the universal nuclease deficient Cas9 (dCas9) protein –derived from the prokaryotic defence mechanism CRISPR– as intracellular signal transduction module. In combination with the evolutionarily optimised ligand-sensing extracellular domains of native receptors, dCas9-based synthetic receptors (dCas9-synR) can integrate a broad variety of input signals (e.g., peptides, proteins, lipids, sugars) and importantly, activate any cellular pathway by simply reprogramming the dCas9-associated single guide RNA (sgRNA).

7. Research implementation and results under the program

Title of your research plan:

Oligonucleotide-based reprogramming of the ligand specificity of a dCas9-based synthetic Met receptor.

Description of the research activities:

To further advance the scope of dCas9-synRs, I intended to create a universal synthetic dCas9-based receptor tyrosine kinase that can respond to any of the 20 growth factor families.

Recently, Professor Sando's group pioneered the development of non-protein ligands for the hepatocyte growth factor (HGF) receptor (also known as Met receptor). Such oligonucleotide-based HGF mimetics (aptamers) facilitate Met dimerization and trigger endogenous Met activation and signalling. Furthermore, they designed bispecific DNA aptamers that allow the reprogramming of the ligand specificity of Met receptors to virtually any desired growth factor.

Firstly, I investigated whether I can adopt the synthetic dCas9-based receptor architecture for the Met receptor (dCas9-synMet). By using molecular biology techniques, I created an initial set of new expression plasmids that encode for various configurations of a dCas9-based synthetic Met receptor. Subsequently, I assessed their expression profiles in an immortalised human cell line.

Secondly, to investigate the transcriptional activation potential of such dCas9-synMet, I adapted a high throughput assay. dCas9-synMet expressing cells responded to recombinant HGF and monovalent aptamers. To maximise the activation potential, however, I started an iterative process consisting of the design of new configurations and the determination of their extracellular expression profiles and transcriptional activation potentials.

In future efforts, the most optimal configuration will be selected and tested in combination with various bispecific DNA aptamers. If successful, this approach would allow us to redefine the input for dCas9-synMet to any desired input solely based on the administered bispecific DNA aptamer.

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

First and foremost, I would like to express my sincere gratitude to Assistant Professor Ueki and Professor Sando for accepting me as a visiting research fellow. I was welcomed with open arms by all lab members and I had a terrific time with them, inside and outside of lab. Special thanks to the staff and committees of the German Academic Exchange Service (DAAD) and the Japan Society for the Promotion of Science (JSPS) for having initiated this magnificent programme. I am deeply grateful for this wonderful experience.

JSPS Summer Program 2018
Research Report

1. Name: Max BERGMANN （ID No. SP18303）

2. Current affiliation: International Graduate Centre for the Study of Culture (GCSC), Justus Liebig University Giessen

3. Research fields and specialties:

Humanities

4. Host institution: Nagoya University

5. Host researcher: Prof Hideaki FUJIKI

6. Description of your current research

My dissertation project analyzes a new kind of filmic narration, increasingly marked by associative linkages and in this way able to reflect on a multitude of questions regarding technological change, new media and societal transformation. The most significant attribute of the central films of the project is their fragmented narration: they leave narrative gaps, do not introduce characters in conventional ways and consist almost entirely of loosely connected sequences. Nevertheless, the films develop a narrative logic of their own, influenced by digital network structures and new technologies. In doing so, the narrative focus is shifted and in a posthuman turn, the network itself seems to become the central protagonist. By analyzing the films' narrative strategy, aesthetics and cinematic devices, the project will address how the medium film is positioning itself in an increasingly networked world.

7. Research implementation and results under the program

Title of your research plan: *All About Lily Chou-Chou* and the Networks of Star- and Fandom

Description of the research activities:

In my research at Nagoya University, I was able to write my proposed sub-chapter about the film *All About Lily Chou-Chou* (*Riri Shushu no subete*, Shunji Iwai; J 2001). The valuable feedback my colleagues provided after my presentation in the Joint Graduate Seminar of the department or during our conversations has greatly improved the depth and scope of the chapter. For example, I was able to specifically research the production landscape of Japanese cinema around 2000, which has become an important part of the chapter and has allowed to me analyze certain aspects of the film that would not have been possible otherwise. Therefore, the sub-chapter first situates the film in both Shunji Iwai's filmography and Japanese film landscape around the millennium, a time of 'rebirth' for Japanese cinema, burgeoning digital filmmaking, and the J-horror boom.

I then go on to examine the film and its aesthetics in three crucial ways for my study: 1) the interfaces the film employs, merges and establishes in an effort to represent the digital life of its protagonists, 2) the way online and offline worlds are created and shown as contesting and colliding forces within the film, mirroring real life confrontations that came along with the advent of digitality in filmmaking and beyond, 3) the way star- and fandom features as an intricate entry point into the film's narrative world, including networks of fans and stars as mediated through technology.

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

The JSPS summer program was an amazing way to experience Japan and I am extremely grateful for the hospitality with which I was greeted. Besides enjoying my research and other activities with my colleagues around Nagoya, I was able to take several trips during my time, e.g. to Kyoto, Tokyo, Kobe, or the Ise Shrine, and had a truly wonderful time getting to know the country, culture and cuisine of Japan.

9. Advisor's remarks (if any):

It was a very nice experience for me to work with Max at Nagoya University. He gave a presentation in our joint-seminar and received some feedback from my colleagues and graduate students. He has also been active to communicate with me, my colleagues, and students at Nagoya University. Moreover, he took research trips in Kobe, Kyoto, and Tokyo. I hope staying here at Nagoya, even if it is short, has been fruitful for his research.

JSPS Summer Program 2018
Research Report

1. Name: Johanna BOBER （ID No. SP18304）

2. Current affiliation: University of Hamburg, GERMANY

3. Research fields and specialties: Biological Sciences

4. Host institution: Seto Marine Biological Laboratory, Shirahama (Kyoto University)

5. Host researcher: Michitaka SHIMOMURA (and Dr. Gento SHINOHARA,
Department Zoology, National Museum of Nature and Science, Tokyo)

6. Description of your current research

In context of my master thesis at the University of Hamburg, I am currently focusing on morphological and genetical investigations of deep-sea crustaceans, specifically of the isopod family Ischnomesidae (Crustacea, Isopoda, Janiroidea) based on samples from the Kuril-Kamchatka Trench and the Sea of Okhotsk. This study is designated to emphasize biogeographical aspects under consideration of ecological factors.

Previous samples were obtained from the deep-sea using a camera-epibenthic sledge in the Kuril-Kamchatka Trench and the adjacent abyssal Northwest Pacific Basin during the KuramBio II expedition in 2016 and the SokhoBio expedition in 2015. So far more than 200 ischnomesids have been analysed genetically for mitochondrial gene CO1 and nuclear genes 18S and 28S.

7. Research implementation and results under the program

During my research stay I had planned to inspect the crustacean collections for ischnomesids in and around institutions of Tsukuba and at the Shirahama Seto Marine Biological Laboratory in Shirahama. Foremost my interest lied within obtaining more data and a general insight on material from other areas of the Northwest Pacific Ocean around Japan to complement the information of the material studied at the University of Hamburg.

In general about 250 specimens of Ischnomesidae could be inspected morphologically and, if not already done before, identified to putative species level during the research stay. The studied material contains specimen from areas such as Japan Trench, Kamchatka

Trench, Sea of Japan and its adjacent waters. The samples were taken between 1992 and 2008, therefore providing important information not only about biogeographical composition of the isopods, but also its evolution over time. Within the material new undescribed species are contained. Some of those morphospecies are also existent within the samples of Hamburg, but in some cases represented only by single specimen. Thus the investigated material in Japan serves as an essential complementation regarding the description of those new species. The material will be loaned to the University of Hamburg for further genetical investigation to facilitate a greater understanding of the population structure of the Ischnomesidae in the Northwest Pacific Ocean.

Title of your research plan:

Distribution and diversity of deep-sea isopods (Crustacea, Peracarida) in the Northwest Pacific Ocean

Description of the research activities:

The material of the Ischnomesidae was investigated on a morphological basis, identified to species level and compared to the constitution of the samples studied in Hamburg. Furthermore genetical investigations were conducted. Different methods of DNA extraction and PCR analyses for the mitochondrial gene CO1 and the nuclear genes 18S, 28S and Histon 3 have been done in the laboratory of Seto. Aside from that an insight on the work of other marine biologists for example on the ecology of hermit crabs could be gained by accompanying their sampling and experiments.

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

It was a wonderful experience and very helpful to work together with Japanese scientists and students and getting an introspective on their way of working and their scientific methods as well as receiving kind and helpful advices on how to improve the own methodical working in the laboratory. Also to get the chance to meet and work together with a scientist, who was on the same expedition with me 2 years ago as well as meeting so many friendly new people and getting an insight on their everyday life in Japan. Thanks to their support and kindness, I got to experience a typical Japanese summer with Hanabi, yukata wearing, spending time at the ocean, watching shooting stars and much more and got to discover the beautiful more rural side of Japan in Wakayama prefecture.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Sarah ESSER ID No. SP18305 ）

2. Current affiliation: University of Cologne

3. Research fields and specialties:

Humanities

4. Host institution: Waseda University

5. Host researcher: Prof. Katsumi WATANABE

6. Description of your current research

We are investigating factors that influence the transfer of implicitly learned motor sequences to new, structural similar situations. Implicit learning research is concerned with the acquisition of knowledge about sequential or statistical contingencies in the environment. Learning is said to be implicit when (a) there is no intention to learn and (b) there is no conscious awareness about the acquired knowledge, even though there are observable changes in behavior. Such implicit learning processes can be observed for motor and perceptual contingencies. It has been shown that implicit sequence knowledge can be transferred to new, structurally similar sequences (e.g. a mirrored version of a learned motor sequence). In our current study, we investigate whether such transfer of implicit motor sequence knowledge can be improved by additional action-effect knowledge. Action-effect representations contain knowledge about the sensory consequences which follow a certain motor command. Action-effects are an important invariant in motor control because the sensory consequences, respectively the goals of an action remain the same, while the parameters that control a movement (e.g. force, direction) vary to some degree, depending on environmental circumstances. Consequently, we assume that an implicitly learned motor sequence can be more easily transferred to a mirrored version of the same sequence, if this motor sequence is accompanied by a correlated action-effect sequence (i.e. each button press leads to a contingent color lighting up).

7. Research implementation and results under the program

Title of your research plan:

Transfer of Implicit Action-Effect Sequence Knowledge

Description of the research activities:

Design: Participants were randomly assigned to one of two implicit learning conditions: (1) *Action-Effect Condition* (80 participants): Participants were trained with a 21-element long motor sequence. On each correct button press, the button lit up in a specific contingent color. (2) *Color Sequence Condition* (80 participants): Here, the buttons displayed the same contingent colors before they were pressed. Once a button has been pressed correctly, it would turn grey. Therefore, in this condition participants were provided the same information, but here the colors were not an effect of an action. Instead, the colors provide additional imperative information.

In a subsequent transfer test, participants were trained with a horizontally mirrored version of the training sequence. Here, they were either tested with the concurrent action-effect sequence or the concurrent color sequence.

We expected the Action-Effect Condition to show better transfer performance (faster reaction times and fewer errors) than the Color Sequence Condition. This should be true for both transfer conditions.

Results: The study is still running and participant collection is not yet complete. So far, it seems that participants in the Action-Effect Condition acquire the training sequence faster, but show comparable transfer performance to the Color Sequence Condition. It is however remarkable that participants in the Action Effect Condition show substantially more explicit sequence knowledge of the transfer rule (i.e. they can report that the rule has been mirrored horizontally). Including these participants with explicit rule knowledge into the analysis leads to an advantage in transfer performance for the Action-Effect Condition.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): My experiences here in Japan have been thoroughly positive. The work environment was very pleasant; all colleagues were very friendly, open and supportive. My host was always approachable whenever I had a question. Japan in general was a very interesting experience and I hope to return for future work projects.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Helen HÖLZEL （ID No. SP18306 ）

2. Current affiliation: FAU Erlangen-Nürnberg

3. Research fields and specialties:
Chemistry

4. Host institution: The University of Tokyo

5. Host researcher: Prof. Eiichi Nakamura

6. Description of your current research

The current research I am involved in is focused on carbon-rich porphyrin systems for the construction of novel nitrogen-containing carbon allotropes. I am concerned with the synthetic preparation and photophysical investigation of donor-acceptor systems, which are interconnected with nano-graphenes. Hereby, we investigate the effect on the electronic communication between the two chromophores with respect to their geometrical alignment and structural orientation. Therefore, porphyrinoid architectures, large polycyclic aromatic hydrocarbons and combinations of both are studied.

Further I am interested in the supramolecular chemistry of porphyrins on metal and metal oxide surfaces. Herein, I collaborate tightly with surface science groups and provide my synthetic expertise in porphyrin synthesis for the investigation of custom-tailored porphyrins. I elaborated novel protocols that allow us to isolate regioisomeric porphyrins that are otherwise hardly separable. We study the effect of directing units, such as nitriles, on the self-assembly on the substrates as well as their chemical reactivity.

My last major topic is related to graphene-porphyrin (“graphyrin”) hybrid systems. These novel structures contain a porphyrin core embedded into a large carbon-based π-system. Their intrinsic pentagons, stemming from the porphyrin core, result in formation of a curved π-system, a nano-cone. The curvature can be further increased, leading to cylindrical nanotube caps or even porphyrin-embedded fullerene-like structures. While the wet-chemical synthesis of such architectures remains difficult, I focused on the preparation of pre-programmed graphyrin precursors that should reveal suitable for the cyclization on active metal substrates.

7. Research implementation and results under the program

Title of your research plan:

Investigations of the formation of graphene-porphyrin hybrid materials from pre-programmed tetrabenzoporphyrins by SMART-TEM

Description of the research activities:

My research in the group of Prof. Nakamura was based on above mentioned hybrid structures. I was studying the behavior of these molecules on a graphene surface, using high-resolution transmission electron microscopy (HR-TEM). In order to conduct these experiments, I gained a lot of practical and theoretical knowledge and expertise about electron microscopy. I was able to elaborate successfully a protocol for the cleaning of pristine graphene followed by sample preparation, allowing for the deposition of single molecules, while maintaining large areas of graphene monolayers. Several measurements of my molecules (containing also different metals), revealed the successful deposition of my molecules. Further, a novel type of single-metal atom transfer on the graphene surface under the electron beam irradiation was found, which might become potentially interesting for studying single atom motions by ultrafast electron microscopy. Additionally, I conducted X-ray photoelectron spectroscopy (XPS) and photo-yield spectroscopy (PYS) to support my data. Finally I learned how to process and to simulate the microscopy data, in order to analyze those.

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

Besides my scientific work I experienced several social group activities (nomikai) and explored local cuisine. Further I traveled to Okinawa and enjoyed the beautiful beaches, landscape and islands. Additionally I explored the surroundings of Tokyo city like Yokohama city, Kamakura and Enoshima. In Tokyo itself I went for sightseeing, ranging from a boat tour in Asakusa to Odaiba, Disney Sea and to Tokyo tower.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Mona KEMPKES （ID No. SP18307）

2. Current affiliation: Universität Kassel

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Yokohama National University

5. Host researcher: Prof. Feng-Lei Hong

6. Description of your current research

Currently I´m working on my master thesis in the laboratory astrophysics group of professor Thomas Giesen at the University of Kassel. This group works on the investigation and characterization of molecules that are of astrophysical relevance. The aim is to focus on the very first steps in the chemical evolution of matter by examining the relevant molecules, from small sized di-atomics and larger poly-atomics to nanosized dust particles in the laboratory, in theory and by observations.

One of my special interests is the formation of interstellar dust. Interstellar dust is an important component of the chemical evolution in the interstellar medium. It works as a catalyst for many chemical reactions and is thought to be essential for the formation of not only complex organic molecules, but also for the formation of the water molecule H_2O. Although dust plays an important role for the interstellar chemistry little is known about the formation of dust grains themselves. *How is interstellar dust produced?*

One approach to answer this question is to investigate the elements which build the backbone of interstellar dust grains. These building blocks of dust grains can be molecules like Si_2C, Si_2C_3, C_3, TiO or AlO and many more. To identify these molecules in space it is necessary to know their spectral “fingerprint”. This is part of our laboratory work.

Furthermore, many of them are not stable under terrestrial conditions. To solve this problem molecular sources based on laser ablation technique combined with supersonic jet expansion are used and allow for spectroscopic investigation. One of the most sophisticated techniques to investigate the produced molecules by means of high resolution spectroscopy is based on radiation sources that are frequency-stabilized by optical frequency combs. Currently we are building up a new spectrometer which is based on this technology. In the framework of my master thesis and for my further research career I wished to learn more about frequency stabilization of radiation sources.

7. Research implementation and results under the program

Title of your research plan:

Frequency stabilization and measurement using a compact diode laser

Description of the research activities:

My aim for the stay in Professor Hong's laboratory was the exchange of scientific knowledge and to learn as much as possible about frequency stabilization of radiation sources by working on the above-mentioned topic. In this two months I measured the hyperfine components of the R(36)32-0, R(38)32-0 and P(35)32-0 transition of molecular iodine with two frequency stabilized lasers. The prospective goal here is to study the rotational dependency of the electric quadrupole interaction of molecular iodine. I learned how to prepare and perform the measurements (locking the frequency of a semiconductor laser and measuring the laser using an optical frequency comb) and how to evaluate and interpret the data (calculate the Allan standard deviation, absolute frequency and frequency spans). Furthermore, we examined the influence of five different parameters (pressure in the iodine cell, power of pump beam, DC offset, the relative phase and the degree of overlap between pump and probe beam) on the laser's frequency, to check the reliability of the system and analyze the degree of frequency stability. The measurement results can -among others- be used by one of the groups students to prepare a research paper.

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

During my two months stay in Japan I got a very precious insight in the country of Japan and its cultural uniqueness's. I was overwhelmed with hospitality and support from the whole working group and we did many great cultural activities together (such as sightseeing in the surrounding area, climbing Mt. Fuji, watching a Baseball game and enjoying the Japanese cuisine). Furthermore, I could accompany Professor Hong to the National Institute of Standards and Technology (NIST) in Tsukuba where I had guided tours through laboratories that relate to frequency stabilization methods. Besides the enormous research benefits I will take unforgettable memories and a deep love for the Japanese country with me. Thank you very much!

9. Advisor's remarks (if any):

We are very happy to have Mona Kempkes visiting our group and working with us on laser frequency stabilization and measurement. She has worked hard and learned how to lock and measure the frequency of a laser. She has also experienced the analysis of molecular hyperfine interactions. She is very good in communication. So, we also learned a lot form her. This program turned out to be a very good one to benefit both sides of laboratories.

JSPS Summer Program 2018
Research Report

1. Name: David KISS （ID No. SP18 308 ）

2. Current affiliation:

Leibniz University Hannover

Institute of Labor Economics

Koenigsworther Platz 1

30167 Hannover

Germany

3. Research fields and specialties:

Social Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Daiji KAWAGUCHI

6. Description of your current research

As one can infer from my list of publications, the Economics of Education constitutes my main research field. For several years I was investigating empirically how the skills of classmates shape student achievement. Currently I am investigating the effects of high stakes learning environments on student outcomes, and evaluating the impact of mock exams on final exam performance.

7. Research implementation and results under the program

Title of your research plan:

Future of Work: The Economic and Societal Effects of Digitalization and Automation

Description of the research activities:

The main purpose of my research stay was the preparation of a grant proposal on the effects of digitalization and automation on the future of work. We identified three promising research projects. In the first project, we would like to investigate how firms adapt the skill mix of their employees over time in response to their IT-investments. Particularly we're interested to see when firms choose to train their workers and when they prefer to hire new ones. In the second project, we would like to investigate to which extent high school graduates alter their field of study choice if returns to IT skills are increasing. The third project focusses on the tasks carried out by workers. Advances in robotics and AI allow to substitute capital for human labor for an increasing number of tasks. We would therefore like to investigate how the set of tasks executed by workers is changing over time, conditional on the type of previously performed tasks and firm characteristics.

Overall, we hope to contribute to a better understanding on the effects of robotics and AI on the future of work by identifying skill groups and industries where policy interventions might be needed. The preparation of the grant proposal greatly benefited from comments provided by Prof. Kawaguchi (University of Tokyo), Prof. Ukita (Toyota Technological Institute, Nagoya,) and Prof. Suga (Kyushu University, Fukuoka)

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

During the weekends I was visiting several places (Nikko, Osaka and Kyoto). I also took one class in Japanese calligraphy.

9. Advisor's remarks (if any):

Research Report

1. Name: Jannes Klee （ID No. SP18309）

2. Current affiliation: Kiel University

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Shin MINESHIGE

6. Description of your current research

The goal of my research is to better understand the physical processes involved with the cosmological growth of supermassive black holes (with mass of million to billion solar masses), with a focus on influences during the early universe. At that time, the black hole environment was very different from that we know at the present day, in terms of chemical enrichment, cosmic rays or the cosmic microwave background. Another difference is that collisions of young galaxies were more likely to occur. A common scenario is that such galaxy mergers drive transport of large amounts of gas to the new center and provide the fuel for black hole growth. If the central black holes of the initial galaxies are finding each other, there forms a binary black hole system with a large gas reservoir in an accretion disk.

The driver that transports the gas closer towards the black holes is turbulence. In massive, self-gravitating disks this turbulence can be induced by their own gravity. Thereby, angular momentum is redistributed in an efficient way. Eventually, there are two possible outcomes for such disks. Either the turbulent mode sets in, when cooling is slow, or local fragmentation occurs, when cooling is fast. The latter is thereby a mechanism for star- and planet formation and alters the accretion theory fundamentally.

My research focuses on the above-mentioned influences on self-gravitating disks by running numerical simulations. Here, I use and contribute to the hydrodynamic package Fosite originally developed by Dr. Illenseer of Kiel University. I write efficient algorithms capable to run on large computer clusters. This includes, e.g., Fourier methods for solving Poisson’s equation or ODE-solvers for stiff and sparse systems to calculate primordial chemical networks. During my stay at Kyoto University I had a closer look at the influence of binary black holes at self-gravitating disks.

7. Research implementation and results under the program

Title of your research plan:

Fragmentation in self-gravitating accretion disks around binary black holes

Description of the research activities:

I performed two-dimensional hydrodynamic simulations of massive accretion disks around two black holes circling around each other to examine how self-gravitating instability develops within the disks. An isothermal proof of concept setup was enhanced by an easy cooling prescription. It showed off that the final results are very sensitive to the minimal temperature of the disks. Fragmentation is not as easily reached as in isothermal simulations even if cooling is fast and the disk may fragment around a single black hole. Moreover, we found that it is very likely that an effect called swing amplification plays a role in circumbinary self-gravitating accretion disks. The effect leads to a strong enhancement of the density of the arm-shaped structure by up to two orders of magnitude. A limitation of the setup was the unsuitability for comparisons to single point masses within the center and is part of upcoming investigations. Thanks to Prof. Mineshige, I had the possibility to present past results and the research project at Kyoto University, Tsukuba University and a black hole workshop in Tokyo. At Tsukuba University I had the opportunity to talk among others in front of Prof. Ohsuga, as my local host, and Prof. Umemura, both also experts within the field of accretion disks and numerical astrophysics.

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

I appreciate a lot that Prof. Mineshige gave me the possibility to get such valuable insights into the scientific system of Japan and the culture of the country. In respect of this, especially the possibility for the participation at the workshop was a great insight. Also, staying at Kyoto watching Gion Matsuri and the many traditional buildings were very impressive for me.

9. Advisor's remarks (if any):

The stay of Mr. Klee at Kyoto has provided fresh experience for the graduate students in our laboratory. We all enjoyed scientific discussion in formal and informal seminars, as well as non-scientific activities, in which he could appreciate Japanese culture.

JSPS Summer Program 2018
Research Report

1. Name: Maike KLEIN （ID No. SP18310）

2. Current affiliation: University of Stuttgart (Germany)

3. Research fields and specialties:

Humanities, Interdisciplinary and Frontier Sciences

4. Host institution: GV Lab, Tokyo University of Agriculture and Technology

5. Host researcher: Prof. Gentiane VENTURE

6. Description of your current research

In my PhD thesis entitled “Emotions in Artificial Systems”, I investigate the current emotion modeling practice as it is done in Affective Computing and Human-Machine-Interaction or Human-Robot-Interaction. I am mainly interested in the emotion theoretical framework of the emotion models and emotional abilities. What theories do they ground on? Are the outcomes emotions or emotional abilities, or are they something else? I argue that both an emotion theory for artificial systems and an emotion model have to meet philosophical and technical requirements. On this basis, I suggest that an enactive emotion theory could accomplish this.

7. Research implementation and results under the program

Title of your research plan:

Integrating Philosophical and Technical Requirements for Emotions in Artificial Systems

Description of the research activities:

I worked on the integration of philosophical and technical requirements for an emotion theory of artificial systems that will result into an enactive emotion model. At GV Lab, I worked on this by reading, writing, building, coding, and exchange:

_Reading: I read various literature at the intersection of AI, robotics, and philosophy.

_Writing: I started to write the intended research paper “Integrating Philosophical and Technical Requirements for Emotions in Artificial Systems”. It will be a collaboration between Liz Rincon-Ardila, Gentiane Venture, and me published in Misselhorn and Klein (Ed.): Emotional machines - Perspectives from affective computing and emotional human-machine interaction. Wiesbaden: Springer (2019).

_Building:I built an Arduino-based robot with an interface consisting of different sensors (touch, distance, vision, temperature) and outputs (display, piezo, servo motor). First, I figured out how I can implement different sensors and connect them with each other, observe their interactions, and how I can regulate them through coding. First, I coded with C / C++ on the Arduino IDE, later I imported the Arduino into MATLAB. When I had assembled all the parts and decided on the reciprocal actions between brain, body, and environment, I thought about a name and a design for the robot: It became a cat named Mako (a Japanese unisex name that is, among others, also the name of a city in Hungary, and a genus of sharks).

_Coding: While building the robot, I enhanced my coding skills: C / C++ (Arduino IDE), MATLAB / Simulink, Python. For my emotion model, I took Colombetti’s enactive emotion theory as a starting point from that I will program it via Simulink.

_Exchange: Weekly Lab meeting (presentations and research updates of Lab members), class on Deep Learning and Neural Networks, guest seminar with two talks on robot applications, and continuous exchange with Gentiane Venture and Liz Rincon-Ardila.

8. I had a wonderful stay at GV Lab, both professionally and culturally. My colleagues introduced me to popular culture (like Anime, Manga, Izakaya, VR, escape room). My guest family introduced me to traditional culture (like Koto, Sushi, Ramen, Origami). Besides, I visited different places in Japan. The introduction week at Sokendai organized by JSPS was a very good start into this great overall experience.

9. Advisor’s remarks (if any): Maike did a great job in the lab introducing philosophy in a group of engineering researchers and students. She also contributed actively to the lab activities and it was an amazing opportunity to have her with us.

JSPS Summer Program 2018
Research Report

1. Name: Christian Metzger （ID No. SP18311 ）

2. Current affiliation: Julius-Maximilians-Universität Würzburg, Germany

Fakultät für Physik und Astronomie, Experimentelle Physik VII

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Institute for Molecular Science (Okazaki)

5. Host researcher: Prof. Dr. Satoshi Kera

6. Description of your current research

During my ongoing experimental work I have performed various studies using photoelectron spectroscopy (PES), angle-resolved PES (ARPES), and scanning tunneling microscopy on adsorbed functional organic molecules. My main target is on the understanding of the electronic and geometric structure of molecular layers evaporated on noble metals including hybridization effects at the interface. In particular, I am involved in investigating the intensity distribution of photoelectrons emitted from such samples. This distribution is known to contain information on the electron distribution within the sample which is immediately connected to its properties. The insights gathered with such studies can therefore be used to tailor and optimize devices for specific applications as well as examine novel effects at the edges of our current comprehension.

In order to understand these ARPES experiments I carry out theoretical simulations of the photoemission matrix element defining the excitation process on different levels of complexity. These are based on initial states calculated with density functional theory and final states with either the free-electron approximation or the more intricate independent atomic center approximation. The computation is done in a program of my own making, which I continuously enhance by including further settings and effects. The project for the JSPS Summer Program 2018 was focussed on this second part of my activities, improving the decription of the photoemission process, expanding its applicability with the inclusion of an augmented model of the potential at the surface and within the sample, and streamlining its implementation to accelerate the calculation speed.

7. Research implementation and results under the program

Title of your research plan:

Orbital Imaging of Non-Planar Molecules Beyond the Free Electron Finalstate Approximation

Description of the research activities:

After settling in I started working on the proper treatment of the surface potential barrier. Since I had already prepared a roadmap for tackling this issue before coming to Japan, it could be incorporated smoothly in the code. I also finalized the inclusion of an optional second type of experimental geometry in the simulation, which is still prevalent in many non-synchrotron laboratories around the globe.

During a visit to the groups of Prof. Dr. Kaori Niki and Prof. Dr. Peter Krüger at Chiba University from 27. – 29.6. we discussed ways to improve the description of the potential inside the system that would be sufficiently accurate without a disproportionate slowdown in calculation speed due to the added layer of complexity. These measures have been partially implemented already and will be finalized after the conclusion of the Summer Program. They should help to explain details in our current projects and make the simulation of systems with strong electron scattering a new possibility.

The updated iteration of the code has also been applied in the evaluation of experimental photoemission data from ordered mono- and bilayers of perfluoropentacene on silver(111) previously gathered by Prof. Dr. Satoshi Kera's group. While theory and experiment are already in decent agreement we are confident we can further characterize the electronic hybridization and structural alignment of the molecules once the aforementioned enhancements have been carried out.

I will present part of these results at a workshop in Hakone during the first week of September.

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

Besides the work on the project, I am immensely grateful for the opportunity to visit lots of exciting places in central Japan which was especially interesting with other JSPS fellows and people from my host institute.

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Katrina MEYER (ID No. SP18312)

2. Current affiliation: Max Delbrück Center for Molecular Medicine in the Helmholtz Association (MDC)

3. Research fields and specialties:

Biological Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Yasushi ISHIHAMA

6. In my current research, I am interested in mutations in intrinsically disordered regions (IDRs) of proteins that can cause a wide spectrum of diseases. Since IDRs lack a fixed three-dimensional structure, the mechanism by which such mutations cause disease is often unknown. It is unlikely that they lead to misfolding of the mutated proteins, which means that these proteins probably retain a part of their functions. Changes in protein-protein interactions are a recurrent cause of disease and short linear motifs (SLiMs) embedded in IDRs are known to mediate PPIs. This is why, I have employed a proteomic screen to investigate the impact of mutations in IDRs on protein-protein interactions (PPIs). Protein-protein interactions mediated by IDRs are generally characterized by low binding affinities and are hence difficult to study. High-throughput protein interaction screening using a peptide array allows to assess even low affinity PPIs of more than hundred disease-associated variants in parallel. I have found that mutations in disordered cytosolic regions of three transmembrane proteins (GLUT1, ITPR1 and CACNA1H) lead to an increased binding of clathrin. In all three cases, the mutation creates a dileucine motif known to mediate clathrin-dependent trafficking. I pursued follow-up experiments on GLUT1 (SLC2A1), a glucose transporter involved in GLUT1 deficiency syndrome. These experiments revealed that the mutated protein mislocalizes to intracellular compartments in cell lines and in patient-derived induced pluripotent stem cells (iPSCs). In collaboration, I have found that mutated GLUT1 interacts with adaptor proteins (APs) *in vitro*. To follow this up, I have knocked-down AP2, which reverts the cellular mislocalization. Our proteomic screen provides a first systematic experimental analysis of how mutations in disordered regions affect PPIs. Our results show that the method can (i) capture known interactions, (ii) detect how mutations in SLiMs affect binding of cognate domains and (iii) provide novel mechanistic insights into pathogenesis.

7. Research implementation and results under the program

Title of your research plan:

A peptide-based interaction screen on disease mutations that affect phosphorylation sites

Description of the research activities:

Amino acids within IDRs often carry posttranslational modifications -- a possibility which we did not consider yet in my project. I was very interested to include modified peptides into a new peptide based interaction screen. This is especially interesting since mutations often affect modification sites. The lab of Yasushi Ishihama has great expertise in the field of phosphoproteomics. His lab is generally interested in elucidation of intracellular phosphorylation networks through development of proteomic tools to detect phosphorylation events. Here, our interests overlap very nicely. We combined my expertise in peptide based interaction screening with their expertise in phosphoproteomics. In the Ishihama lab, I had access to newest generation mass spectrometry machines. In preparation for my stay in Japan, I had prepared the theoretical part of designing and ordering the peptide screen. I was able to successfully carry out the experimental part of the project during my time in Kyoto and I highly appreciate the great amount of support I received by my supervisor, Koshi Imami. Since we had some issues with the mass spectrometer, my schedule was postponed slightly and data analysis is still preliminary. Nevertheless, results on a control peptide already confirm known changes in interaction and proof that our peptide-based interaction screen can also be used to study interaction changes due to changes in phosphorylation. More thorough analysis will hopefully help us to detect how disease causing mutations in modification sites change protein-protein interactions and hence help unravelling molecular disease mechanisms.

8. Comments, including any cultural experience during your stay in Japan: I can only recommend staying in Japan. The country and culture is really fascinating and I have felt at home from the first day on. Regarding the work experience, it still seems common practice to discuss science in Japanese, which can make scientific exchange a little challenging. In Yasushi Ishihama`s lab this was, however, more than made up for by a very warm and welcoming atmosphere.

9. Advisor’s remarks: Katrina has brought us a cutting-edge technology which allows us to assess the impact of phosphorylation on protein interactions in a high-throughput manner. I am very excited to keep our collaboration to discover a novel mechanism by which phosphorylation/mutation cause disease. Katrina has also brought up a topic about how we should discuss science with people from different countries. Although we use English partially in lab meeting, I will consider to have all lab meetings in English so that everyone can participate in scientific exchange during the meeting. I think this is very important to make labs in Japan more ethnically diverse.

Report
JSPS Summer Program 2018
Research Report

1. Name: Judith MUENCH （ID No. SP18313）

2. Current affiliation: Leibniz Institute of Plant Biochemistry Halle Germany

3. Research fields and specialties:

Biological Sciences, Biochemistry

4. Host institution: Toyama Prefectural University

5. Host researcher: Prof. Yasuhisa ASANO

6. Description of your current research

The focus of my present research is to generate new enzymes for non-natural reactions. Using enzymes as biocatalysts in chemical reactions is of particular interest due to its enormous potential of being ecologically beneficial alternatives to chemical synthesis. There are different ways to engineer an enzyme to improve its enzyme activiy. At Leibniz Institute of Plant Biochemistry in Halle, Germany, we use directed evolution, a process that mimics the natural evolution cycle in a laboratory setting. We are working with a enzyme with iron containing heme as co-factor. Using iron in biocatalytical reactions has many advantages as it is readily avaiable and able to catalyze a large variety of organic reactions in a sustainable fashion. There are many different heme containing enzymes, which catalyse a large amount of different reactions. The main focus of my research in Halle is improve the activity of carbonyl olefination reactions. I am looking forward to get to now new heme containing enzymes and their reactions.

7. Research implementation and results under the program

Title of your research plan:

Isolation and Characterization of stand-alone Aldoxime Dehydratase

Description of the research activities:

At Toyama Prefectural University, a new promising enzyme was found in the plant *Fallopia Sachalinensis* (giant knotweed), which contains a heme domain as well. This and another heme containing enzyme from *Prumus mume* (plum) were produced in *Escherichia coli* bacteria and the enzyme activity was tested. After cell cultivation the cells were harvested and processed to gain spheroplasts. This were used to perform the reaction. The reaction conditions were tested using phenyl-acetoaldoxime (PAOx) as substrate. The analysis of the product formation was performed using High Liquid Performanche Chromatography (HPLC). It was determined that a short cultivation time of two days instead of three days resulted in a higher product formation. Moreover, the co-expression of the chaperone pGro7 and the usage of detergents to increase the solubility like Triton or Cyclodextrin did not lead to a increase in product formation.

After analysing the cultivation and reaction conditions and the eleven different aromatic substrates were tested to further analyse the substrate scope. These contained heteroarmotaic compounds, compounds containing two aldoxime gropus as well as naphthalin derivates. In the analysis it was only possible to find novel peaks indicating activity with two other substrates, furan-2-carbaldehyde oxime and 2-phenyl propanal oxime (PPOx). The second enzyme derived from giant knotweed lead to novel peak for some more substrates, cinnamaldehyde oxime, 4-methoxylbenzaldehyde oxime, 1-(3-Pyridinyl) ethanone oxime and well as furan-2-carbaldehyde oxime and PPOx). The highest activity was found for the natural educt PAOx.

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

During my time in Japan I could join the Chinese-Japanese-Korean Symposium for Enzyme Engineering in Kyoto, an amazing experience and chance to get to know other researchers in my scientific field. Moreover, I hat the chance to visit Kyoto and many of its famous temples, shrines and palaces. With the research group I had the possibility to visit Fukui prefecture, we visited the dinosaur museum and were hosted in a traditional Ryokan.

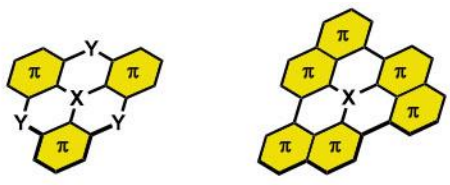
9. Advisor’s remarks (if any):

Research Report

1. Name: Johannes NEBAUER	（ID No. SP18314 ）
2. Current affiliation: University of Erlangen-Nürnberg	
3. Research fields and specialties: Chemistry	
4. Host institution: University of Nagoya	
5. Host researcher: Prof. Shigehiro Yamaguchi	

6. Description of your current research

Carbon-based organic materials have attracted much attention in recent years due to their promising features making them suitable for the implementation in flexible thin-film device technologies including organic photovoltaics, organic light-emitting diodes, and organic field-effect transistors. The incorporation of heteroatoms such as nitrogen and phosphorus into all-carbon structures has a considerable impact on both their physicochemical and optoelectronic properties. The synthesis and investigation of a series of molecules, which are all based on the same framework but contain different heteroatoms, allows for deeper understanding of structure–property relationships. These efforts will provide useful guidelines allowing to precisely tailor the properties of these molecules according to their desired application.



X = Heteroatoms (N, P)

7. Research implementation and results under the program

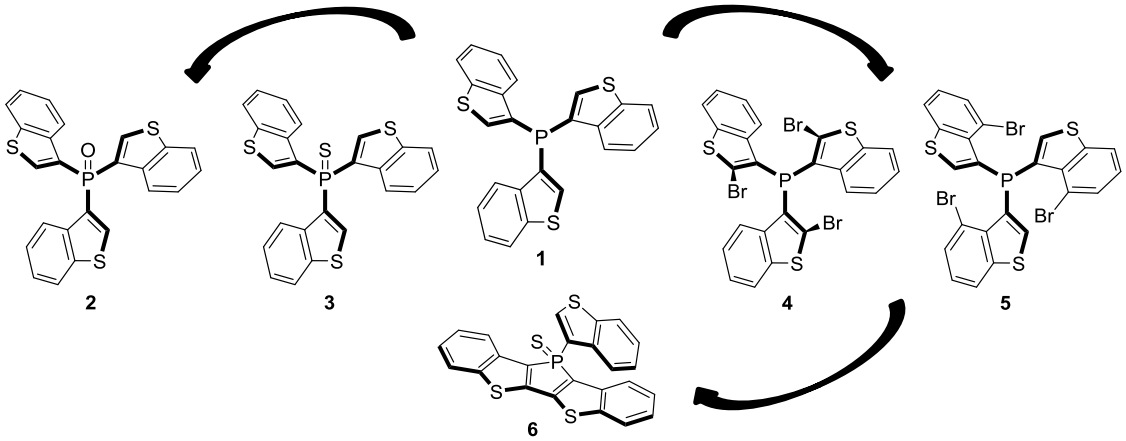
Title of your research plan:

Study of P- and S-doped polycyclic aromatic hydrocarbons (PAHs)

Description of the research activities:

A procedure to prepare the versatile precursor **1** in a good yield of 77% was developed successfully. The phosphorus center of **1** could be protected as oxide (**2**) and sulfide (**3**) adduct, respectively. Further modification of **1** was achieved by both selective 3-fold bromination on the 2-positions of the thiophene (**4**) and on the 4-positions of the benzene ring (**5**). The molecules obtained represent promising precursors for further cyclization reactions such as [Pd]-catalyzed annulation or intramolecular radical cyclization.

The photocyclization of **3** resulted in the formation of a 5-membered ring between two thiophenes which was confirmed by X-Ray crystallography (**6**).



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

My research stay in Japan and in the *Yamaguchi* group was an incredible experience. I learned a lot not only about chemistry but also about the Japanese culture. Apart from work, I had time to explore some cities such as Tokyo, Kyoto, Kobe, and Osaka. Thereby, I got addicted to Maze soba (dry Ramen).

JSPS Summer Program 2018
Research Report

1. Name: Karen Otte （ID No. SP18315 ）

2. Current affiliation: Charité Universitätsmedizin Berlin

3. Research fields and specialties:
Computer and Medical Sciences

4. Host institution: Chiba University

5. Host researcher: Prof. S Kuwabara

6. Description of your current research

Motor dysfunction is one of the most common and most relevant symptoms in patients with neurodegenerative disease like Parkinson's Disease (PD), Multiple Sclerosis (MS) and Neuromyelitis Optica (NMO), ranging from small instabilities during stance to the complete loss of the ability to walk. Motor impairment severely influences patients' quality of life, and therefore, continuous monitoring may provide relevant insights on disease progression and therapy effectiveness. The current assessment of motor symptoms is mostly subjective and highly dependent on the assessing health professional. Objective measurement systems tend to be expensive and time-consuming resulting in an absence of use in clinical routine.

In the last years, new technologies like 3D cameras enable human motion tracking without the attachments of markers or sensors on the patient's body. Based on these 3D cameras, we developed a set of motor tasks that trigger specific symptoms, which can then be objectively measured. Assessments include static and dynamic balance tasks, gait and fine motor function tasks of the upper limbs and hands. Currently, assessments and algorithms for symptom quantification are evaluated in a longitudinal study with MS and NMO patients at the Charité – Universitätsmedizin Berlin, Germany. Using this system, we were able to detect and quantify symptoms like altered sway behavior during stance and decreased walking speed, which were below a clinically detectable threshold. These findings, along with the detection and analysis of freezing of gait in patients with PD, were already published in peer reviewed journals and presented at relevant international neurological conferences. The technical accuracy and reliability of the system was evaluated and published as well.

7. Research implementation and results under the program

Title of your research plan:

Objective medical motion Analysis in Patients with neurodegenerative Disease

Description of the research activities:

The technology was applied at the Chiba University Hospital, where a trial study with young healthy adults was conducted. When compared against a selection of age-matched healthy German adults, the results showed no significant differences for most performed motor tasks. Still, significant differences between the groups existed when they were tasked to step in place, or stand up from a chair. These findings might be limited by the small number of healthy volunteers (Japanese: 24; German: 32) but are nevertheless interesting and will be explored in further studies including patients and more a more diverse set of healthy controls. Additionally, IRB was submitted and approved for further follow-up studies with patients with cerebral palsy, patients with Parkinson's Disease and Ataxia patients.

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

During my time in Japan, I experienced a lot of support by my colleagues for my work as well as in my spare time. I met a lot of wonderful people and learned much about the Japanese culture - from being taught to make gyoza to attending a small lecture about Japanese Hanabi. It was interesting to see and experience the life in a small town while still being able to reach Tokyo.

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Maximilian Schaal （ID No. SP18316）

2. Current affiliation: Friedrich Schiller University Jena

Institute of Solid State Physics

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Institute of Molecular Science, Okazaki

5. Host researcher: Prof. Dr. Satoshi KERA

6. Description of your current research:

My current research is focused on the growth and application of quasi 2D Materials as templates for the epitaxial growth of molecular films. 2D materials are crystals with an atomically thin layer thickness and high film quality. These materials are part of active research and their number is still rising. Their reduced dimensionality allows unique physical and chemical properties, which strongly differ from the properties of its bulk versions. That's why it is possible to control their optical and electronic properties by the number of layers. Furthermore, the high film quality enables the application of 2D materials as suitable substrate (or interlayers on metal substrates) for the ordered growth of organic molecules.

So far I restricted myself to two different 2D materials, namely hexagonal boron nitride (h-BN) and epitaxial graphene (EG) ,on different transition metal single crystals like nickel, platinum, iridium and rhodium. The different interaction between the 2D materials and the substrates causes largely different structures, which reach from very flat layers in case of the nickel substrate to highly corrugated layers in case of the rhodium substrate. This structural difference influence the electronic properties, which I study with ultraviolet and x-ray photoemission spectroscopy (UPS and XPS).

I use these 2D materials as templates for the ordered growth of organic molecules. Therefor I focus on changes of the electronic properties of the 2D material layer due to the molecular layer and the behavior of the molecular electronic states in comparison to organic films on bare metal single crystals.

7. Research implementation and results under the program

Title of your research plan:

Graphene growth on the Ni(110) surfaces using pentacene molecules as precursor

Description of the research activities:

Recently Dinca *et al.* showed the temperature activated conversion of pentacene to graphene domains on a Ni(111) surface. They assumed that the growth process is related to the dehydrogenation of pentacene. Such on-surface polymerizations are part of active research. [1]

Is it possible to use the same process to convert pentacene to graphene on a Ni(110) surface? This Question was the main topic of my research in the Group of Prof. Dr. Satoshi Kera. The aim of this investigation was to find a procedure to grow high quality graphene films as templates for the epitaxial growth of molecular films. Therefore I studied the thickness dependent electronic properties of pentacene on Ni(110). I also started to observe the temperature dependents of the electronic structure, but this investigation is still in progress and I will continue this research in the Group of Prof. Dr. Torsten Fritz in Germany.

Furthermore I got the opportunity to work with a new photoelectron analyzer at the beamline BL6U of the UVSOR Synchrotron Facility, which is able to simultaneous measure photoelectrons from a wide range of the reciprocal space.

In the beginning of September I will present my research results at a scientific summer camp in Hakone, which is organised by the groups of Prof. Dr. Satoshi Kera and Prof. Dr. Hiroyuki Yoshida from the Chiba University.

[1] Dinca *et al.*, Nanoscale **7**, 3263 (2015)

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

I enjoyed the home stay with my host family. Especially the cooking of Japanese food like gyouza and takoyaki and the conversation were invaluable.

The work in the group of Prof. Dr. Satoshi Kera was great. I was integrated very fast and enjoyed the extensive discussions with my colleagues. I learned new methods to investigate the electronic properties of surfaces.

In my free time I visited many famous cities and got the opportunity to see the Gion Matsuri in Kyoto and beautiful fireworks in Niigata and Okazaki. It was really amazing.

JSPS Summer Program 2018
Research Report

1. Name: Frank SODE （ID No. SP18317 ）

2. Current affiliation: Goethe University Frankfurt

3. Research fields and specialties:
Humanities

4. Host institution: Mie University

5. Host researcher: Ayaka SUGAWARA, (菅原 彩加), Ph.D., Assistant Professor

6. Description of your current research

My current research focuses on the meaning and interpretation of modal expressions in German, English and Japanese. Modal expressions are used to express notions of possibility and necessity related to what is known, (1-a), to what is demanded by certain laws, (1-b), to certain physical properties of a material, (1-c), etc.

(1) a. **Nach allem, was wir wissen, muss er die Tat selbst begangen haben.**
after all what we know must he the dead himself done have
'Given what we know, he must [=necessity] have committed the crime by himself.'

b. **Baden ist strengstens verboten.**
bathing is strictly forbidden
'Swimming is strictly prohibited [=not swimming is a necessity].'

c. **Die Vase ist sehr zerbrechlich.**
the vase is very breakable
'The vase breaks easily [=possibility].'

The modal expressions that I'm interested in include attitude verbs (**glauben** 'believe' and **wollen** 'wish'), speech act verbs (**sagen** 'say', **fragen** 'ask', **fordern** 'demand'), modal verbs (**sollen** 'should'), expressions of (dis)preference (**es ist gut/schlecht, dass** 'it is good/bad that') and German modal particles (**ja**, **doch**, **wohl**).

Another related topic of my research is the question of how the position and the mood of a verb can affect the illocutionary force of a sentence, i. e., the range of possible speech acts that can be expressed by the corresponding sentence, compare (2-a)-(2-c).

(2) a. **Es regnet.** (declarative sentence: assertion)
It rains
'It is raining.'

b. **Regnet es?** (interrogative sentence: question)
Rains it
'Is it raining?'

c. **Würde es doch regnen!** (optative sentence: wish)
would it PART rain
'I wish it would rain.'

7. Research implementation and results under the program

Title of your research plan:

NOTIONAL CATEGORIES OF EPISTEMIC MODALITY IN GERMAN AND JAPANESE

Description of the research activities:

In a recent experimental study of modal verbs in German, Matthewson & Truckenbrodt (2018) showed that the modal verbs **sollen** and **müssen** in their subjunctive forms (**sollte** and **müsste**) can be used to express weak epistemic necessity – in contrast to the epistemic use of the plain indicative form of the modal **muss**, (1). This is similar to the contrast that is described in the literature for the English modals **must** and **should** in their epistemic use, (2), see for example von Fintel & Iatridou (2006).

(1) [My friend is late. She calls me and says:]

Ich #muss/√sollte/√müsste bis 13.30 Uhr da sein.

I must/ SOLLTE / MÜSSTE by 13.30 o'clock there be

'I must/should be there at about 1:30.'

(2) [My friend is late. She calls me and says:]

I #must/√should be there at about 1:30.

In our joint research at Mie University, Ayaka Sugawara and I looked at the Japanese modal expressions **nitigainai** (に違いない) and **hazu** (はず) that are reported in the literature to have epistemic modal meanings that correspond to the epistemic uses of **must** and **should** in English, see Narrog (2009) and the literature cited there. Based on the careful experimental set-up in Matthewson & Truckenbrodt (2018) for German, we designed a similar experiment for Japanese to test the Japanese modal expressions **nitigainai** and **hazu** for their modal strength.

In the first round of the experiment we distributed 36 questionnaires. The participants were students from Mie University with no linguistic training. In a second round, we plan to distribute 27 slightly modified questionnaires based on the preliminary results of the first round. The preliminary results of the first round were presented at an international workshop on August 10, 2018 that was organized by Ayaka Sugawara at Mie University. Already at this stage, it is clear that the comparative experimental study with Japanese will provide new important insights in the cross-linguistic stability of certain notional categories in the domain of epistemic modality that are attested in German and English. The evidence from Japanese is particularly valuable since the Japanese modals **nitigainai** and **hazu** don't show the same poly-functionality that is found with the modal verbs in English and German: **nitigainai** and **hazu** are restricted to the expression of epistemic modality.

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

Highlights of the cultural experience of my stay in Japan were the home stay experience during the orientation week, the welcoming atmosphere at my host institution, Mie University (in particular, the support by my host Ayaka Sugawara), and several short trips to sites of cultural heritage in Kyoto, Nara and Ise. I am greatful for these insights into Japanese language and culture.

JSPS Summer Program 2018
Research Report

1. Name: Kira Urban
（ID No. SP18318）

2. Current affiliation: University of Goettingen

3. Research fields and specialties:
Environmental Sciences

4. Host institution: JAXA

5. Host researcher: Dr. Takeo TADONO

6. Description of your current research

Currently, I am working on deforestation and forest degradation (mainly caused by fire) mapping and forest structure type classification, amongst others as indicator for forest degradation, using SAR and optical remote sensing data in Jambi Province, Indonesia, with main focus on Harapan Rainforest. I focused on the influence of different wavelength, spatial resolution and polarizations as well as necessary preprocessing steps. Since the information differs from sensor to sensor the processing has to be adjusted.

To validate findings based on remotely sensed data, several stays in the field were conducted. Besides the sampling of ground truthing data, indicator variables for forest structure were recorded on 70 field plots on transects following defined UAV flight paths where multispectral images were taken within the study area.

For combining these sources of information for a high accuracy in classifications different methods will be applied, starting from simpler regressions up to deep learning algorithms.

7. Research implementation and results under the program

Title of your research plan:

Mapping deforestation and forest structure deterioration using SAR

Description of the research activities:

During my stay at JAXA, I was working with radar time series data for deforestation mapping. I compared different process levels of available products and different processing steps to enhance the accuracy of finding deforested area and calculating its dimensions.

Using this information changes in forest cover can be visually classified and their point in time can be determined.

In addition, re-measurements of the position of ALOS-1/-2 corner reflectors (CRs) managed by JAXA, necessary for geometric and radiometric calibration of Synthetic Aperture Radar (SAR) sensors, were made in Tomakomai Experimental Forest close to Sapporo, Hokkaido. Afterwards, during a meeting with Tatsuro Nakaji, Associate Prof. at Field Science Center for Northern Biosphere, Hokkaido University, the experiments in the forest on fluxes and canopy insects and the canopy gondola were visited.

Since processing has to be adjusted to the images and conditions in the specific area, time on discussions with experts, literature reviewing and hands-on trials were an important part of the activities, where further work can be based on.

Also part of the activities was the attendance of a meeting of the GEO Global Forest Observations Initiative (GFOI) in Tokyo, which gave interesting insides on current work in forest monitoring and necessary steps for the future.

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

My stay in Japan and with JAXA was very fruitful. Not only exploring a different working environment but also a different culture was very interesting. The weekends offered a good possibility to explore Japan with its beautiful nature and its combination of culture and technology in the cities.

9. Advisor’s remarks (if any):

It was good opportunity to work with Kira Urban for monitoring forests by satellite, especially Japanese ALOS-2 data, which is a current prioritize research topic in JAXA. I hope to keep collaborations in future.

- Takeo Tadono -

JSPS Summer Program 2018
Research Report

1. Name: Philipp Valente Gouveia Pais （ID No. SP18319）

2. Current affiliation:

Technical University of Munich

3. Research fields and specialties:

Engineering Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Prof. Kengo KUMA

6. Description of your current research

My project in Japan involves a continue of the attempt to make architectural atmospheres tangible and understandable. As noted in my bachelor thesis, I think that a change in the current problematic situation of the enclosure due to the room atmosphere can be fundamentally solved.

Japanese culture uses the term wabi-sabi, which is strongly identified with the theme of atmospheres. Wabi-sabi is a word that is more commonly considered for the jewel of traditional Japanese beauty outside of Japan. The term does not define the simple aesthetics of a particular object. If someone asks Japanese about the meaning of the word, he will get no answer. Since the emergence of this phenomenon, the rational understanding of wabi-sabi is deliberately prevented. It is seen as enigmatic and difficult to define, with the indescribable forming part of its fascination and peculiarity. Therefore, if one tries to create clarity and transparency here it would be accompanied by the decay of the essence of wabi-sabi. The roots of the term reach as far as Zen Buddhism, in which true beings can be understood neither by language nor by scripture, but by intuition. Agnosie determines the Zen Buddhimus, the concept of the wabi-sabi, and according to my understanding, the aspiration of the atmospheres.

I want to understand what lies behind this East Asian understanding. I want to gather experience of arts and philosophies and grasp the concept. Only in this way I intend to go beyond the well-known writings of Western authors such as Leonard Koren and Andrew Juniper and to give me an independent impression.

7. Research implementation and results under the program

Title of your research plan:

Wabi-sabi

Description of the research activities:

After intensive preparatory research, I used the time in Japan to look at different arts that are interwoven with the term. Furthermore is spend some weeks in the main monastery "Eigen-ji", to participate the way of life of the monks and to study the roots of wabi-sabi. I also focused on the traditional Japanese architecture of the Edo period, where I observe studies at the "Nihon Minka-en", the “Isui-en” and the "Manshu-in". It is a great honor for me that Kuma-Lab from the University of Tokyo was supporting me during my research in Japan. Kuma-sensei is known as an acknowledged architect who is strong connected to the traditional architecture of Japan.

As a goal of my research I publish a written work, which I will also submit to TU Munich, as well as the possibility to deepen the topic in the further course of my master's thesis.

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

I was able to attend a tea ceremony and to practice in daily zazen at the monastery at the university. In addition, I have visited many temples and shrines concerning my research and thus dealt with the spirituality of Japan more intensively.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Andreas Stephan WOERL （ID No. SP18320）

2. Current affiliation: Augsburg University

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Institute for Solid State Physics, The University of Tokyo

5. Host researcher: Prof. Satoru NAKATSUJI

6. Description of your current research

My current research focuses on quadrupolar Kondo lattice materials and related novel states of matter. To investigate those materials, I use a capacitive based technique to measure thermal expansion and magnetostriction at very low temperatures ($T < 4$ K) and high magnetic fields. Just as specific heat, thermal expansion and magnetostriction are powerful probes to detect various types of phase transitions, characterize the electronic state of a material and quantify anisotropy effects. Especially the Pr-based 1-2-20 metals offer key prerequisites to explore novel quadrupolar driven phases. The ground state of those materials is the non-Kramers Γ_3 doublet with quadrupolar and octupolar degrees of freedom. Due to the high coordination number of metallic atoms (Zn or Al) around the Pr-site (T_d-symmetry), a strong hybridization between localized f-electrons and itinerant conduction electrons is expected. In fact, various novel phenomena such as quadrupolar order, unconventional superconductivity and non-Fermi liquid behavior were found in this material class. During my PhD project I measured the ambient pressure thermal expansion and magnetostriction of $PrIr_2Zn_{20}$ and $PrRh_2Zn_{20}$. Purpose of those experiments was to further characterize the antiferroquadrupolar ordered state. Above the phase transition temperature, specific heat and electrical resistivity exhibit a non-Fermi liquid state which can be scaled based on a quadrupolar Kondo lattice effect. Our volume expansion results show that this state is accompanied by a tiny change in hybridization. This is very different to the magnetic Yb-based isostructural material. Establishing a universal phase diagram for the Pr-based 1-2-20 materials ($PrIr_2Zn_{20}$, $PrRh_2Zn_{20}$, PrV_2Al_{20}, $PrTi_2Al_{20}$) is crucial. Therefore, extensive characterization in magnetic field and under pressure is necessary.

7. Research implementation and results under the program

Title of your research plan:

Thermal Expansion and Magnetostriction of Pr-based 1-2-20 Materials

Description of the research activities:

During the JSPS Summer Program 2018 we have carried out the low temperature and high field measurements of the thermal expansion and magnetostriction under uniaxial stress for the quadrupolar Kondo lattice system PrV_2Al_{20}. Previous ambient pressure thermal expansion and magnetostriction measurements at the host laboratory revealed a peculiar hysteresis for $\Delta L \,||\, B \,||\, [111]$, whereby the related linear contribution in ΔL suggests the onset of an octupole order. To further investigate this possibility, we combined a dilution refrigerator and a uniaxial stress dilatometer that has been recently developed by a German collaborator. Our results show that uniaxial stress along the [111] direction stabilizes the possible octupolar ordered phase and the hysteresis extends to much higher temperatures as compared to the ambient pressure experiments. At low magnetic fields magnetostriction shows a huge response (similar to a ferromagnet) and a sign change. Since the ground state of PrV_2Al_{20} does not carry any dipole moment, this behavior is striking and needs to be further investigated in future experiments.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): Participating in the JSPS Summer Program 2018 was a very valuable experience for me. A cultural highlight was the homestay program. I was overwhelmed by the hospitality of my host family. The research environment at the Institute for Solid State Physics was excellent and I am very grateful to my host researcher Prof. NAKATSUJI and his staff for the very warm welcome and the continuous support during the program. Besides the research experience at the University of Tokyo I got the opportunity to visit Hiroshima University for a few days to discuss about the Pr-based 1-2-20 materials.

9. Advisor’s remarks (if any): I was amazed to see that the stay of Mr. Woerl finishes so successfully. His proposal was very challenging: he proposed to install a newly developed measurement system to a dilution refrigerator and explore a totally new state of matter of a new type of compound. He not only successfully installed the system, but improved the measurement precision by a factor of 10. His success is far more than what was expected. He is not only a hard-working but very friendly gentleman. We really enjoyed hosting him.

JSPS Summer Program 2018

Research Report

1. Name: Alexandra Beland （ID No. SP18401）

2. Current affiliation: University of Ottawa, Canada

3. Research fields and specialties:

Social Sciences

4. Host institution: Osaka University of Health and Sports Science

5. Host researcher: Dr Taku Hamada

6. Description of your current research

The research conducted in our lab at the University of Ottawa focuses on the question of brain metabolism, and more specifically how it changes in different situations such as nutritional and active state. We are interested in how the brain regulates its energetic needs and demands in responses to its physiological environment. Does the brain always use the same energy sources or does it vary? And if so, in what conditions and why. We hope to extrapolate this data to disease states such as diabetes and Alzheimer's where cerebral metabolism is often significantly altered even prior to symptom onset.

7. Research implementation and results under the program

Title of your research plan:

Molecular observation of the synergistic contributions of diet and exercise to the metabolic changes induced by these neuroprotective therapeutic approaches

Description of the research activities:

We used a rat model to investigate the combined effects of both exercise and diet on changes in metabolic ability, both in the brain and the body. Changes in metabolic ability were examined by looking at changes in the expression of critical proteins involved in various and complimentary metabolic processes. Secondly, we examined how a sedentary and high fat diet may impact the metabolically beneficial changes brought upon by exercise and diet.

Results are not yet available as the data collection is still on going.

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 2018
Research Report

1. Name: Matiyas Bezabeh (ID No. SP18402)

2. Current affiliation: The University of British Columbia-Okanagan

3. Research fields and specialties: Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Izuru Takewaki

6. Description of your current research

The architectural and structural forms of the recent generation of tall buildings show a trend towards complex geometry, reduced weight, stiffness, and damping properties, leading to an increased excitation by the wind. Currently, tall buildings are designed only considering the linear-elastic behavior of structural systems, which could result in uneconomical and conservative design of tall buildings. This implies that the current design process of tall buildings is not sensible when considering the economics of owners, and to a greater extent, the society. In my Ph.D. research, two unified PBWE (Performance-based wind engineering) frameworks for tall buildings are being developed by adapting and revisiting the Alan G. Davenport Wind Loading Chain. The level of complexity, applicability in the real world, and the development process differentiate the two frameworks. The unified PBWE frameworks will introduce the controlled inelasticity limit state for structural systems with re-centering capability. These frameworks aim to utilize self-centering systems to reduce or eliminate the post-yield damage accumulations. The efficiency of self-centering systems in controlling or eliminating the damage accumulation will be investigated and validated through non-linear aeroelastic tests of tall buildings using superelastic Shape Memory Alloy (SMA) springs as stiffness controllers. To the best of my knowledge, these tests will be the first-of-their-kind in the world and will assess the wind performance of tall buildings beyond their first yielding point.

7. Research implementation and results under the program

Title of your research plan:

Multi-hazard performance-based design approach for high-rise buildings equipped with self-centering systems

Description of the research activities:

During the summer JSPS fellowship period, as part of the multi-hazard performance-based design framework, the critical earthquake response of self-centering structures subjected to near-fault ground motion has been investigated. In the research, near-fault fling-step ground motions were substituted by double impulse input to formulate closed-form expressions for the prediction of the critical response of self-centering systems. The capability of the developed analytical expressions to accurately predict the critical response was checked by using time history analysis under one-cycle sinusoidal input. Two journal papers titled *"A closed-form solution for the critical response of self-centering systems under fling-step near-field ground motions (Part 1: Theoretical development and validation)"* and *"A closed-form solution for the critical response of self-centering systems under fling-step near-field ground motions (Part 2: Application to design innovative timber shear walls)"* are being prepared and will be submitted to Frontiers in Built Environment journal. Moreover, a future collaboration is underway between the host supervisor and fellow to extend this study to the wind response of self-centering systems by using multi impulse input as a substitute for a long duration wind load. The wind loads for this research will be obtained from Wind Tunnel tests at WindEEE-Dome at Western University. Finally, it is worth mentioning that results from this summer research fellowship program will be presented at the 2018 World Conference on Timber Engineering in South Korea, where the fellow will receive the "*Young Scientist Award*" for outstanding research work on the wind response of high-rise wood buildings.

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

I would like to express my special appreciation and thanks to my host supervisor, Professor Izuru Takewaki, for his support, technical guidance, mentoring and introducing me with the critical excitation problems. Moreover, the support of Professor Fujita and Ms. Kadonaga is appreciated with thanks. In general, I had a very enlightening cultural experience in Japan. I really enjoyed the streets of Kyoto and Osaka, the summer festivals, visiting temples, and learning the Japanese language.

9. Advisor's remarks (if any):

Mr. Matiyas Bezabeh is the most outstanding young researcher among whom I have ever met. His selection to the "*Young Scientist Award*" stated above (only 4 among about 800) demonstrates his academic excellence. He has a broad and deep perspective for future work. I would like to conduct a joint work with him in the near future.

JSPS Summer Program 2018
Research Report

1. Name: Andrew Brown （ID No. SP18403 ）

2. Current affiliation: York University

3. Research fields and specialties:

Humanities Social Sciences

4. Host institution: Okinawa Institute of Science and Technology

5. Host researcher: Dr. Gail Tripp

6. Description of your current research

ADHD is today generally qualified in the scientific community as a neurodevelopmental disorder. However, beliefs in its ontological status are by no means coherent or conclusive. In my research, I argue for an alternative understanding of ADHD that is based in "empirical philosophy," a methodology that is enacted by the disorder itself as it 'moves' from place to place, person to person, culture to culture, and behaviour to behaviour. To follow the disorder in this topological manner requires both an ethnographic positionality across multiple sites, and a philosophical vision that is driven by the disorder itself, in an attempt to reveal its ontological status in the world. In particular, I am interested in the strategies and forces which cut across various discourses, disciplines, and industries of ADHD, along multiple dimensions, such as the pathological—normal—hypernormative dimension, the individual difference—natural kind dimension, the biological—social dimension, and others. Included in this project is answering the question of how cultural techniques externalize and distribute the cognitive capacities of ADHD individuals, and to what extent these techniques provide explanatory alternatives to the systems of representation in psychology vis-à-vis the natural sciences. Through rigorous empirical study, including qualitative content analysis, participant observation, open-ended interviews, and cognitive ethnography on an international scale, I argue that an empirical philosophy of ADHD provides a concrete foundation for a 'new' philosophy of materialism that necessitates and reassures cognitive alternatives, marking a resistance to the endless churning of individuals through biopolitical structures automated by Post-Fordist economic investment and speculation.

7. Research implementation and results under the program

Title of your research plan:

Attention-Deficit Hyperactivity Disorder (ADHD) in Okinawa: Biomedicine Situated in Local Contexts

Description of the research activities:

Visiting the Human Developmental Neurobiology Unit at the Okinawa Institute of Science and Technology (OIST), I conducted over 20 interviews with psychologists and specialists of ADHD, asking them questions about cultural barriers and particularities in importing western biomedical models of ADHD into Japan, the work they do, how a psychology research unit functions, and about their varying perspectives on ADHD. I also interviewed some professors who were visiting from other universities. In addition, I voluntarily gave a talk to approximately 80 Japanese parents of children with ADHD in Naha, Okinawa. Dr. Shizuka Shimabukuro translated the talk for the audience. Much of my research included observing the daily workings of a psychology unit, taking fieldnotes, reading articles associated with their research, designing personalized interview questions for each individual, and learning about the cultural and political context of Okinawa, including the context of the host university, OIST.

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

My experience over the past eight weeks has highlighted some of the unique challenges that psychologists face in trying to "import" western biomedical models to Japan. While psychologists who research ADHD sometimes claim that culture has no influence over neurodevelopmental disorders, I investigated the ways in which the implementation of research programs, parent training, and assessments in Okinawa are necessarily entangled in local contexts. When investigating the more minute details of a psychologist’s work, abstract dichotomies between ‘culture’ and ‘nature’ appear overly simplistic and unhelpful, despite these dichotomies often showing up in academic debates. I found that tensions do arise between the expectations of universality in psychological research, and the local complexities of nearby communities.

JSPS Summer Program 2018
Research Report

1. Name: Breanne Ashleigh CAMERON （ID No. SP18404）

2. Current affiliation: Dalhousie University

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

4. Host institution: Okayama University

5. Host researcher: Dr. Gentaro IRIBE

6. Description of your current research

The heart is an electrically-driven mechanical pump, vital for life. A major cause of death world-wide is disturbances of the heart's electrical activity (arrhythmias) due to reduced blood supply (ischemia).

At Dalhousie University, we have been investigating the role of stretch in the development of arrhythmias during ischemia in isolated rabbit hearts. We have shown that stretch is essential for these arrhythmias, and that their number declines with drugs that control calcium levels inside the cell, suggesting that stretch-induced arrhythmias may be related to changes in calcium dynamics.

My objective is to test the hypothesis that stretch-induced arrhythmias during ischemia are driven by calcium, due to a change in cellular calcium activity. At Okayama University, I performed experiments using single heart cells isolated from mice. We investigated the effects of controlled stretch, using a pair of microscopic fibres that stick to the surface of cells, on cellular calcium dynamics under ischemic conditions using a specialized fluorescent dye sensitive to changes in cellular calcium.

Additionally, previous experiments have shown that stretch causes an increase in the production of reactive oxygen species (ROS), which may increase the sensitivity of calcium channels. An increase in ROS could therefore alter cellular calcium handling. My second objective was to determine if ischemia exacerbates this stretch-induced increase in ROS production using fluorescent dye to detect intracellular ROS levels.

7. Research implementation and results under the program

Title of your research plan:

Effects of Ischemia on Stretch-Induced Changes in Cellular Calcium Spark Rate and ROS Production.

Description of the research activities:

Experiments were performed using cells isolated from mouse hearts. The cells were loaded with specialized fluorescent dyes to detect calcium release and reactive oxygen species (ROS) and exposed to either ischemic or control (salt) solution. The cells were stretched while simultaneously monitoring the changes in calcium and ROS dynamics under control or ischemic conditions.

The results from our calcium experiments indicate that ischemia caused a significant increase in the baseline rate of calcium release (sparks), as well as an increase in the stretch-induced increase in calcium release rate. Additionally, we have shown that the baseline spark rate during ischemia occurs in a bimodal fashion, similar to the incidence of arrhythmias during ischemia. The results from the ROS experiments indicate that ischemia resulted in an increase in the stretch-induced increase in ROS production.

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

This experience has been one of the most rewarding opportunities I have received. I was able to perform exciting research under the guidance of experts in my field, and in my free time, I was able to explore the beautiful sites of Japan. The locals I met (including my homestay family during the SOKENDAI orientation) are some of the most welcoming, wonderful people I have ever met, and seeing the sunrise from the top of Mt. Fuji was an experience I could never forget. I am beyond grateful for this opportunity, and I look forward to the day when I can return and continue exploring this beautiful country!

JSPS Summer Program 2018
Research Report

1. Name: Andrew Deelstra （ID No. SP18405 ）

2. Current affiliation: University of Victoria; British Columbia, Canada

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Ana Maria Cruz

6. Description of your current research

My current research involves the use of resilience and recovery modeling for disaster planning and preparation. By understanding the dynamics of failure and recovery during and after a disaster, facilities may be able to implement better protection measures to prevent catastrophic loss in the future.

7. Research implementation and results under the program

Title of your research plan:

Incorporating Natech Hazards in Resilience and Recovery Modeling

Description of the research activities:

Natech disasters are those that involve a triggering NAural hazard (such as a flood or earthquake) along with a resultant TECHnological disaster (such as a chemical release or disruption of lifelines). Resilience and recovery modeling processes have yet to include this specific type of disaster. My research at Kyoto University was focused on finding effective ways of integrating these two areas of inquiry. A new methodology for the setup of Natech disasters in the modeling platform was developed using a base scenario of an earthquake and tank farm. Future implementation should allow for simple expansion to incorporate more complex hazards and facilities.

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

Having the opportunity to live in and explore Japan was great! I'd encourage future fellows to get out and travel as soon as possible – 10 weeks goes by fast and there is so much to see here! From the summit of Mt. Fuji, to festivals in Kyoto, to the stunning Himeji Castle and the beaches of Shirahama, Japan is a beautiful country!

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Marie-France DORION （ID No. SP18406）

2. Current affiliation: Université de Montréal

3. Research fields and specialties:
Biological Sciences

4. Host institution: Hirosaki University

5. Host researcher: Dr. Ken ITOH

6. Description of your current research

Age-related macular degeneration (AMD) is one of the leading cause of loss of vision in the elderly population. Oxidative stress and aberrant inflammation are thought to play a major role in the development of this disease. Mononuclear phagocytes and the retinal pigmented epithelium (RPE), a specialized layer of cells that maintain retinal homeostasis, both contribute to the inflammation. In its advanced stage, the RPE degenerates, which leads to loss of photoreceptors in the macula. The nuclear factor E2-related factor 2 (NRF2) pathway is a primary system employed by the RPE to fight oxidative stress. In fact, NRF2 is a transcription factor that controls the expression of hundreds of genes involved in cytoprotection, mitochondrial function and inflammation, among others. Its disruption in mice induces an age-dependent degenerative pathology of the RPE.

Our group is working on the development of selective CD36 ligands for their therapeutic use in AMD. CD36 is a scavenger receptor that plays an important role in inflammation and lipid homeostasis. We have previously shown that stimulation of CD36 by a selective ligand preserves photoreceptor function in a mouse model of AMD. Although it has been established that NRF2 can regulate CD36 expression, the effect of CD36 stimulation by a ligand on NRF2 activity has yet to be investigated.

Our aim is to investigate the effect of MPE001, a selective CD36 ligand, on macrophages and RPE-elicited inflammation and its protective effect on RPE, and to verify if these effects are dependent on NRF2 activation.

7. Research implementation and results under the program

Title of your research plan:

CD36 as a therapeutic target in age-related macular degeneration.

Description of the research activities:

Before my arrival, I had investigated the anti-inflammatory effect of MPE001 in macrophages. MPE001 was found to induce an immunometabolic reprogramming of macrophages. However, NRF2 was unlikely to be activated by MPE001.

Upon my arrival in Japan, I started investigating the cytoprotective effect of MPE001 on the RPE. Briefly, oxidative stress was induced in a cell line of the RPE by treating them with sodium iodate. MPE001's effect on sodium iodate-induced mitochondrial and total reactive oxygen species was measured. Then, MPE001's effect on cell viability was verified. The involvement of NRF2 in these effects was also investigated.

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

My stay in Japan was a rewarding experience. I was able to exchange knowledge with my labmates, and got to know how they work and the different instruments that they use.

Dr. Itoh and my labmates ensured that my stay in Japan would be a comfortable one. They took me to *Nebuta* festivals and to *yomiya*. I also visited temples and hot springs, and went to see a work of art made of rice fields. Everywhere I went, I enjoyed the culinary and cultural experience.

9. Advisor's remarks (if any):

Miss Marie-France worked very hard in my lab and I surmised she enjoyed the experiments based on her very attractive hypothesis. Her research and her entire stay is very stimulating and enjoynable to our lab, and I and the lab members enjoyed exchanging both scientific and cultural thoughts with her.

JSPS Summer Program 2018
Research Report

1. Name: Ghazal EBRAHIMI （ID No. SP18407）

2. Current affiliation: University of British Columbia

3. Research fields and specialties:

Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Dr. Kazumasa OZAWA and Dr. Yu MAEMURA

6. Description of your current research

The construction industry is identified as one of the most risky, challenging, and dynamic industries. Risk can affect quality, productivity, and performance of construction projects. Therefore, Risk management is an important part of the decision-making processes in this sector of the economy. The tendency to employ risk-sharing mechanisms embodied in project delivery methods has increased over the last few years in construction industry of several countries including Japan and Canada. In Japan, a project delivery method called “Early Contractor Involvement” (ECI) has gained ground recently, which has many principles in common with a novel method called “Integrated Project Delivery” (IPD) that has become a center of attention in construction industry of Canada. Considering that the two countries are experiencing similar trends in adoption of risk sharing mechanisms for delivering construction projects, this research was designed to better understand: (1) how risk is perceived by different stakeholder groups in construction projects of Japan and Canada, and (2) what are the preferences of different groups in relation to risk allocation and management schemes. The findings of this research facilitate knowledge transfer between the two countries and propose effective approaches to risk management in construction projects.

7. Research implementation and results under the program

Title of your research plan:

Risk Management Perceptions in the Construction Industry of Japan and Canada

Description of the research activities:

During my stay at the University of Tokyo, I conducted a comprehensive literature review to identify: (1) the critical risk factors that exist in construction projects, and (2) various approaches used for risk categorization in this sector of the economy. Based on the findings from the literature review, I identified 62 risk factors classified in 11 groups, that were catalogued in two broader categories: *external* and *internal*.

The result of this work was used to develop a questionnaire seeking construction industry professionals' perceptions with regard to the importance level of various risk factors. This questionnaire was discussed and pilot tested by a number of industry professionals from various stakeholder groups in Japan. The refined questionnaire will be distributed among larger group of potential participants in Japan and Canada through online survey platforms. The results will be used to identify the most important risk factors in construction industry of the two countries (using *Delphi* process). The resulting risk factors will be used to develop a second questionnaire seeking IPD and ECI participants' allocation preferences regarding each risk factor. Together with Dr. Maemura and a research assistant from my host lab, I also conducted a series of interviews with ECI participants from different stakeholder groups that we met in various cities during my stay in Japan. The results of these interviews that were focused on ECI implementation will be compared with the findings of my PhD research on IPD to conduct a comparative analysis between the use of ECI in Japan and IPD in Canada.

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

In addition to conducting my own research during my stay at the University of Tokyo, I also had the opportunity to attend weekly seminars held at the "Construction Management and Infrastructure Systems Laboratory" that I found very interesting. Moreover, I attended several sessions of two courses offered by the Faculty of Engineering, which were very informative and allowed me to meet several researchers and professors with valuable insights and experience to share. I believe there is a great opportunity to continue the research we started this summer. I would like to continue my collaboration with my host supervisors in Japan and facilitate knowledge transfer between the construction industry of Canada and Japan. Participating in the JSPS fellowship program was a very rewarding and fruitful experience for me. I also had a wonderful time during my home stay where I was treated with great hospitality and felt like having a family in Japan.

9. Advisor's remarks (if any):

The Management Group at the Dept. of Civil Engineering UTokyo has benefited greatly from Ghazal's brief but productive time with us. We have identified definitive areas for further collaborative research going forward, with plans to work towards producing further research results (through questionnaires, conference presentations, and publications) that have been generated from the lessons we have learned from one another. The Laboratory would like to convey our sincerest gratitude to the JSPS and MITACS for providing us with this opportunity.

JSPS Summer Program 2018
Research Report

1. Name: Joshua GUILFOYLE （ID No. SP18408）

2. Current affiliation: York University

3. Research fields and specialties: Social Sciences

4. Host institution: Kobe University

5. Host researcher: Yohsuke Ohtsubo

6. Description of your current research

What promotes or prevents transgressors from apologizing? My research seeks to answer this question. Apologies are a unique process used by transgressors to repair harm and reconcile relationships after committing an interpersonal transgression. They often require many different steps such as admitting wrongdoing, accepting responsibility, expressing regret, remorse, and guilt, saying “sorry”, and seeking forgiveness. Although apologies provide tremendous benefits there are also costs involved. Admitting wrongdoing and accepting responsibility are difficult and transgressors often need to make sacrifices or offer compensation to signal they can be trusted again.

In Canada, my research has found that transgressors’ motivation to apologize or not is affected by how much power they wield. Relative to those with low power, high power transgressors behave less apologetically and report less willingness to apologize. In Japan, I will test the relationship between transgressors’ power and their motivation to apologize in a Japanese cultural context as culture is likely to affect transgressors’ motivation to apologize. Research from Eastern cultures such as Japan find that transgressors offer apologies more readily than those from the West. Further, culture seems like it would impact the relationship between transgressors’ power and motivation to apologize because these two cultures have different values associated with both power and apologizing. Western culture places value on power as freedom from external constraints and ability to satisfy one’s self-interested goals, whereas Eastern cultures places value on power with restraint and responsibility and emphasizes serving social-responsibility goals. Additionally, for Western cultures, emphasis in apologizing is placed on giving up one’s independence and autonomy, whereas in Eastern cultures emphasis it is placed on saving face and maintain harmonious relationships. Given the different cultural values, I predicted that culture would moderate the relationship between transgressors’ power and their motivation to apologize.

7. Research implementation and results under the program

Title of your research plan:

The moderating role of culture on offenders' power and motivation to apologize

Description of the research activities:

I have completed a social psychological study with my host supervisor. We recruited a community sample of Japanese participants and randomly assigned them to high and low power conditions. In the high-power condition, participants were asked to think about a person they know (or knew) that they had power over. In the low-power condition, participants were asked to think about a person they know (or knew) that had power over them. In both conditions, participants were then asked to write about the power dynamic between them and the other person. This technique is a simple and effective way to temporarily activate a psychological sense of powerfulness or powerlessness. Participants then imagined committing an interpersonal transgression against this person and we then measured their motivation to apologize or not. We found that those with high power were more motivated to apologize than those with low power, and that the effect was explained by perspective-taking of the victim. In other words, those with high-power were more likely to take their victims perspective and in turn were more motivated to offer an apology than those with low-power. This is counter to my research findings in Canada, suggesting the relationship between transgressors' power and motivation to apologize is moderated by culture. Upon returning to Canada, I will replicate this study with a Canadian sample of participants to compare the results cross-culturally. My host supervisor and I are also currently designing a second study with more experimental control to see if this effect will be replicated in Japan.

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

Completing the JSPS program was one of the most profound professional and personal experiences of my life! I've had the opportunity to learn how social psychological research is conducted in Japan and cross-culturally. I've made lasting connections with Japanese researchers and had the opportunity to explore this beautiful country, eat its amazing food, and meet and engage its wonderful citizens. Thank you!

9. Advisor's remarks (if any):

It has been a pleasure working with Mr. Guilfoyle on this summer program. We plan to keep collaborating on this project after he goes back to Canada to confirm the very interesting cultural difference that we found in this summer.

JSPS Summer Program 2018
Research Report

1. Name: Zhong Hua （ID No. SP18409）

2. Current affiliation: Faculty of Land and Food Systems,
The University of British Columbia

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 **Other** (Food Science)

4. Host institution: Keio University

5. Host researcher: Prof. Daniel Citterio

6. Description of your current research

My current research involves developing microfluidic paper-based analytical devices (μPADs) to detect chemical hazards in foods. To ensure food safety, monitoring potential hazards in food throughout the entire supply chain is necessary. Fast-screening tools and devices are highly demanded to detect various types of chemical hazards in different food matrices. However, the cost of conventional lateral flow immunoassay and enzyme-linked immunosorbent assay (ELISA) is still not satisfying to food industry where rapid, low-lost and simple devices are required due to the nature of agri-food business. My research work covers the design of fully cellulose-based devices, the application of novel nucleotide-based recognizing agent in lateral-flow format, and the exploration of on-paper sample clean-up. All of these efforts aim to transform μPADs into practical tools being able to test real food samples for revealing potential chemical hazards within the very complicated food matrix.

7. Research implementation and results under the program

Title of your research plan:

Development of Microfluidic Paper-Based Analytical Devices for Detection of Pesticides in Foods

Description of the research activities:

The compatibility of acetonitrile/water extracting system with the wax-printing technique had been tested. Three types of filter paper, five different dyes, various design, and three lamination methods had been tested. Further, the selected conditions were used for on-paper separation of representative food model, spinach, with two extracting conditions to study the analyte (malathion) transportation on cellulose. Enzyme inhibiting colorimetric method was test for the compatibility with acetonitrile/water system to quantify the pesticide transportation.

Besides, as the most important objective, I had learnt from Dr. Citterio and his students throughout the introduction of their precious experience in inkjet printing technique and demonstration of the operation and troubleshooting of primary printing systems.

Seminars were held for visiting researchers and the students in the lab to introduce current research works to each other, and potential future collaboration was discussed. Seminars were also held by the faculty where visiting professors introduced their great works in analytical chemistry.

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 2018
Research Report

1. Name: Daniel King （ID No. SP18410)

2. Current affiliation: Carleton University

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Prof. Jiro Hirokawa

6. Description of your current research

My research involves the design and implementation of mm-wave antennas, metasurfaces, and metasurface antennas for use in 5G communication networks. 5G is the upcoming telecommunication standard. Extrapolating from current market trends in mobile technology, 5G wireless networks will need to support a 1,000-fold increase in data capacity to handle over 100 billion devices featuring peak rates of 10 Gb/s. Metasurface antennas are 2D antenna structures whose physical apertures are engineered at a sub-wavelength scale to generate arbitrary EM radiation for smart beam-forming applications. While these antennas have been demonstrated at microwave frequencies, limited work has been reported at mm-waves. This is due to fabrication constraints and increased power dissipation at high frequencies using conventional structures.

Specifically, during my research mm-wave metasurface antennas will be explored based on slot-array radiators, which are used for high-frequencies due to their superior performance compared to other printed devices. The antennas will be designed with non-uniform slot distributions with varying geometries for arbitrary EM radiation from these apertures. These antennas are ideal for high-speed wireless systems, offering smart beam-forming solutions for 5G short-range communication systems.

7. Research implementation and results under the program

Title of your research plan:

mm-Wave Metasurface Antennas for 5G Wireless Networks

Description of the research activities:

A 60 GHz antenna system for beam-switching applications was designed, fabricated, and measured. The antenna system was based on three 1D linear slot array antennas. The antennas consisted of cells with asymmetric slot pairs. The slots exist in pairs to cancel reflections of the input signal, while the asymmetry ensures maximum radiation perpendicular to the antenna surface. The cell periodicity causes the beam to radiate at a specific angle depending on the frequency.

Once the models were simulated in a commercial electromagnetic software and the simulation satisfied specifications, the antenna layouts were prepared based on a substrate integrated waveguide (SIW) design. In addition, a cavity resonator was also fabricated to characterize the fabrication material for a potential second round of fabrication.

The antennas were then measured. S parameters (which are a measure reflection and transmission) were measured with a vector network analyzer (VNA), and the far-field radiation pattern was measured in an anechoic chamber to confirm the beam switching.

In addition to the antenna system, previously designed and fabricated metasurfaces were measured to determine their effects on far field antenna radiation patterns. Elliptical array metasurfaces at 60 GHz were measured, and the data was processed through algorithms to extrapolate the near field to far field, and to estimate the near field on different planes or cuts.

JSPS Summer Program 2018
Research Report

1. Name: Alexandra Maris (ID No. SP18412)

2. Current affiliation: University of Toronto

3. Research fields and specialties:

Humanities Social Sciences

4. Host institution: Waseda University

5. Host researcher: Professor Lee Thompson

6. Description of your current research

My current research examines sports tourism, specifically looking at martial art destination training camps with a focus on judo and karate tourism in Japan. My work interrogates privilege at the nexus of sport, tourism and issues surrounding race, class and gender. I explore how discourse and rhetoric at destination training camps is used such as invoking notions of 'authenticity' to sell camp services to foreigners. Moreover, I am also interested in the specificities and intersections of social relations between martial art training camp consumers and the local communities who service western tourists. My study seeks to understand why these camps are a global phenomenon and the impacts these camps have on the clients, trainers and local workers who service the destination training camps. I interrogate how privilege allows global access to physical cultural sites and how dominant groups seek out and consume 'authentic' experiences through engagement in non-dominant cultures and practices. The implications for this study are connected to developing ethical sporting tourist practices that do not exploit the Other or their cultural environments.

7. Research implementation and results under the program

Title of your research plan:

(Original Title) Martial Art Destination Training Camps as Colonial, Racial, Classed and Gendered Sporting Projects: A Comparative Study

(Edited Title) Martial Art Destination Training Camps in Japan: Parallels in Judo and Karate Tourism

Description of the research activities:

During my research I have explored and found that there is a trend of martial art training camps abroad, I specifically focused on judo and karate tourism in Japan in Tokyo and Naha (Okinawa). There has been a new phenomenon developing in the sports tourism realm, that of martial art camps being established in 'places of origin' of certain martial arts like Muay Thai in Thailand, Judo in Japan and Brazilian Jiu Jitsu in Brazil. Through discourse analysis and autoethnographic methodology I have examined why there is an interest in these camps, how the camp is advertised and sold, the implications of partaking in the camp based on my personal experiences and focusing on theories surrounding the body, intersectionality, space and affective economies. This study is a reflexive project examining my positionality within judo and karate tourism space, with having the goal to better understand the workings of the development of martial art tourism outside Western countries.

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

During my stay in Japan I presented at a conference in Hiroshima as well as learned about the history of that area. My research also took me to Naha, Okinawa where I learned about karate tourism and the history of the island.

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

JSPS Summer Program 2018

Research Report

1. Name: Josée Maurais (ID No. SP18413)

2. Current affiliation: Université de Sherbrooke

3. Research fields and specialties: Chemistry

4. Host institution: Hokkaido University

5. Host researcher: Prof. Gen Sazaki

6. Description of your current research

Ice surface chemistry plays a significant role in determining the chemical composition over snow in the polar boundary layer, as well as in the presence of ice aerosols under tropospheric/stratospheric conditions. Although, studying chemical reactions at the air/ice interfaces remains a technical and scientific challenge requiring the continuous development of experimental methods specifically tailored to allow the deployment of techniques adapted to the properties of such a soft and dynamic molecular material under environmentally relevant conditions. Therefore, this collaborative effort aims at elucidating heterogeneous atmospheric chemistry phenomena on ice surfaces that builds on recognised expertise on advanced microscopy studies of ice surfaces and the quasi-liquid layer from the Sazaki laboratory (University of Hokkaido-UofH) and spectroscopic studies of ice surface chemistry from the Ayotte laboratory (Université de Sherbrooke-UdeS). As we seek to comprehend the molecular basis for heterogeneous catalysis by ice surfaces, these detailed mechanistic investigations improve our description of elementary steps involved in stratospheric ozone depletion events. More precisely, our joined studies attempt to determine whether HNO_3 dissociate upon adsorption onto ice surface under tropospheric/stratospheric conditions and whether the adsorption and dissolution of HNO_3 in quasi-liquid objects near ice's melting point results in the formation of stable aqueous nitric acid solution droplet at the surface of ice and to establish their chemical composition. From these elementary benchmarking studies, the projected work will soon thereafter evolve towards more complex issues such as the adsorption, dissolution and hydrolysis/photolysis of nitrogen dioxide/nitrates, processes that strongly impact the oxidative properties of the boundary layer over polar snowpack.

7. Research implementation and results under the program

Title of your research plan:

Spectroscopic and microscopic study of heterogeneous atmospheric chemistry phenomena on ice surfaces

Description of the research activities:

My research activities for the first two-three weeks consisted in being trained by Sazaki's team on the Laser Confocal Microscopy coupled with the Differential Interference Contrast Microscopy (LCM-DIM) while observing ice crystals. Thereafter, the exposition of ice to low concentration nitric acid (HNO3) gas was undertaken (week 4-10) to investigate by LCM-DIM any chemically induced perturbation in the physicochemical properties, the quasi-liquid layers (QLL) and in the crystal growth of ice. The preliminary results show novel phenomena occurring on the ice surface and in the bulk of the ice crystals through the diffusion of nitric acid in ice. Namely, different crystal phases were possibly observed below -10 °C in both super-saturated and under-saturated conditions, the threshold temperature for the QLL was modified in addition to the altered shape, morphology and behavior of the QLL, compared to what is normally observed on pure ice crystals. Further experiments are underway to elaborate and improve the description and understanding of the described phenomena.

These preliminary results point out the disruptive effects of pollutants gas in atmospheric chemistry considering the crucial role of ice and of the QLL in various chemical processes. To obtain more detailed information about the adsorption mechanism of HNO_3 on the ice and the composition of the different liquid/crystalline phases, the integration of FTIR spectrometer (Jasco) and differential interference contrast microscopy with a new experimental design for the sample cell was undertaken (weeks 9-10) allowing exploratory work to be initiated and showing promising results.

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

This was an incredible research experience – the unique academic resources available, as well as experiencing a new and fascinating culture, made the JSPS summer program an enriching and invaluable addition to my master's program. I particularly enjoyed my culinary experience in Japan and the kindness and hospitality of the Japanese people, but especially of my host professor, the assistant professors and Ph.D. student.

9. Advisor's remarks (if any):

During Ms. Maurais' visit to our laboratory, I was really surprised by her very high-level understanding of fundamental science and her enthusiastic attitude about researches. Since our collaborative study has just started, I am really looking forward to further developing this project in the near future. Finally, I am very grateful for this opportunity given by the JSPS summer program.

JSPS Summer Program 2018
Research Report

1. Name: Kissan MISTRY （ID No. SP18414 ）

2. Current affiliation: University of Waterloo

3. Research fields and specialties:
Engineering Science

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

5. Host researcher: Genki YOSHIKAWA

6. Description of your current research

Nanoscale gas sensors have a many potential applications such as toxic gas sensing, air quality monitoring, early disease detection and point of care diagnostics. Recently a novel gas sensing design based on a nano-mechanical membrane has been developed, known as the membrane-type surface stress sensor (MSS). The membrane is coated with a gas sensing material known as the receptor layer, which promotes the adsorption of the target gaseous analytes. The adsorption of the gas on the receptor imparts a physical stress onto the membrane which is subsequently measured by a stress sensitive material known as a piezoresistor placed at the fixed ends of the membrane. The measured stress indicates detection of the target gas. Thus far the receptor layer has been a polymer based material that has been able to sense water vapors, alcohols and various aromatics. The proposed project is to replace the polymer layer with newly developed gels of two-dimensional (2D) materials such as graphene oxide (GO), molybdenum disulfide (MoS_2), tungsten trioxide (WO_3) and hexagonal boron nitride (BN). These 2D materials have high surface area for increased gas adsorption, high strength, and long term stability which makes them excellent candidates for the receptor layer. Furthermore, the use of 2D materials expand the gas sensing capabilities of the MSS device by being able to detect pollutants and hazardous gases such as nitrogen oxide, nitrogen dioxide, carbon monoxide, carbon dioxide, hydrogen sulfide, methane and ammonia, to name a few. Successful detection of these harmful gases with the 2D material functionalized MSS can lead to the realization of a stand alone enhanced gas sensor device as a preventive safety measure for industrial or consumer use.

7. Research implementation and results under the program

Title of your research plan:

Two-dimensional material functionalized nanomechanical membrane-type stress sensors

Description of the research activities:

The nanomechanical membrane was coated solutions of reduced graphene oxide, Boron Nitride doped graphene oxide, Molybdenum disulfide, Tungsten disulfide and boron nitride. Microlitres of the materials were coated onto the membrane surface by an inkjet spotting method. The coated membrane structures were then placed in a gas chamber system where vapors of water, ethanol, hexanol, acetone, chloroform, analine and toluene were introduced to the sensor and their electrical response measured.

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

The research group welcomed me with open arms and made me feel like one of the group members. I thoroughly enjoyed working with everyone there. They invited me to their home's for dinner and night outs at izakayas. My host supervisor invited me for a tea ceremony at his home. We spent a lot of time together and I will thoroughly miss them all.

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Mina R. NAROUZ （ID No. SP18415）

2. Current affiliation: Queen's University

3. Research fields and specialties:
Chemistry

4. Host institution: University of Tokyo

5. Host researcher: Professor Tatsuya Tsukuda

6. Description of your current research

In the past few years, the Crudden group has made significant contributions in the application of N-heterocyclic carbenes (NHCs) as novel carbon-based ligands in surface modification of metal surfaces. We have found that NHCs can form ultrastable self-assembled monolayers (SAMs) on metal surfaces. NHC-based monolayers survive harsh conditions such as 1% hydrogen peroxide, electrochemical cycling, boiling organic solvents, boiling water, and pH extremes (acid and base). Considering these outstanding stabilities of the resulting NHC-based SAMs on surfaces, my current research is focused on applying NHCs to metallic materials with structures other than sheets, namely gold nanoclusters. Gold nanoclusters are a particular type of nanoparticles, often smaller than 2 nm in size, that are atomically precise with unique electronic and optical properties. Nanoclusters have recently become a very hot scientific topic due to their unique properties and precise structures that can impact the field of materials science in general. NHC-modified gold nanoclusters with more than three gold atoms, have not been reported to date.

7. Research implementation and results under the program

Title of your research plan:

Synthesis of N-Heterocyclic Carbene-Modified Gold Nanoclusters and their Use in the Aerobic C-H Oxidation of Cyclohexane

Description of the research activities:

By the proper design of NHC ligands, we managed to achieve promising results regarding the synthesis of NHC-protected gold nanoclusters. One of those clusters was highly luminescent making it a potential candidate in bioimaging and nanomedicine applications. Having the chance to do this research in the Tsukuda lab significantly accelerated this project due to their world-level expertise in the nanocluster field and the availability of state-of-the-art facilities at the University of Tokyo. Collaboration between the Crudden and the Tsukuda labs will pursue to complete and potentially publish those findings, among others.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): My stay in Japan represents an unique personal experience. I really enjoyed learning from and working with very talented researchers in the Tsukuda group. We share some special memories of the good findings moments, for some unknown reasons, that occurred coincidentally in the times of typhoons. At the beginning of the program, I liked the very well-organized orientation week in which I was exposed more deeply to the Japanese cultural, tried to learn Japanese language and got to know other fantastic JSPS Fellows. Staying with a host Japanese family was another so memorable event. Living in the big city Tokyo was very special. Climbing the top of Mount Fuji was a lovely adventure. Spending few days with friends in Hakone was amazing. For the limited space, I only highlighted those events but a lot more were detailed in my daily journal.

9. Advisor's remarks (if any):

Mina has accomplished a great deal during his stay in Tokyo. He has managed to significantly move our project ahead which is fare beyond my initial expectation. His work during that time is currently being written up for publication. He also made a good influence to my group members through the discussion during the group meetings. At the same time, he found time for some important cultural experiences as well. He has also made long lasting contacts with the Tsukuda group and also with others in the JSPS program.

JSPS Summer Program 2018

Research Report

1. Name: Anne Nguyen (ID No. SP18416)

2. Current affiliation: University of British Columbia

3. Research fields and specialties:

Pharmaceutical Sciences

4. Host institution: Tokushima University

5. Host researcher: Prof. Tatsuhiro ISHIDA, Prof. Hidenori ANDO

6. Description of your current research

My current research is focused on improving the aqueous solubility of hydrophobic drugs with chemical conjugation to hydrophilic polymers. Gambogic acid (GA) is the drug of interest and is known to have anti-inflammatory effects. Unfortunately, the clinical application of gambogic acid is limited due to its very poor aqueous solubility. Current treatment plans involve co-administration with surfactants, which elicit toxicity when dosed frequently and at higher concentrations.

The objective of my current research is to develop a type of polymeric nanoparticle for gambogic acid by covalently linking GA to a water-soluble polymer. The resulting conjugate is anticipated to self-assemble into nanoparticles in aqueous media. These nanoparticles are expected be selectively internalized by macrophages and gambogic acid will be released inside the cells to suppress the inflammatory pathways, leading to reduced inflammatory responses.

7. Research implementation and results under the program

Title of your research plan:

Drug Delivery Technology to Increase the Water Solubility of Gambogic Acid and its Interaction with Activated Macrophages

Description of the research activities:

Three different GA polymer-drug conjugates were synthesized at the University of British Columbia. Initial experiments involved purification and determining optimal conditions under which these conjugates would form stable and uniform nanoparticles. Characterization parameters such as size distribution, stability, and drug concentration were measured for each test nanoparticle. Once formulation conditions were finalized and

the characterization of nanoparticles were compared, one conjugate was chosen to test in *in vitro* and *in vivo* experiments.

The purpose of these experiments is to compare the efficacy of the chosen GA-nanoparticle with free drug GA in suppressing inflammatory responses. Models need to be developed as a means to compare the ability of GA and GA-nanoparticles to suppress inflammation. This can be done by experiments in mice and in activated macrophage cell lines.

An *in-vitro* model of activated macrophages was developed to measure the effect that GA-nanoparticles has on the secretion of inflammatory cytokines and gene expression. In this process, I learned several new techniques that are extremely valuable not only for this project but also for the remainder of my graduate studies including flow cytometry, enzyme-linked immunosorbent assay and RT-PCR. Given the short period of time to learn all these new techniques and to establish appropriate models, results obtained are preliminary and no conclusions have been made thus far regarding the efficacy of GA-nanoparticles to suppress inflammation. However, I was able to obtain invaluable experience with several different experiments and techniques that I can continue back in Canada.

An *in-vivo* rheumatoid arthritis mouse model was initiated and will be used to test the anti-inflammatory effects of GA-nanoparticles. These *in-vivo* experiments will be continued by Dr. Hidenori Ando after my departure. By using the parameters that we have outlined together, I will be able to analyze the *in-vivo* results in Canada.

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

It has been an incredible experience here in Japan. Dr. Ishida's laboratory has been so welcoming and kind, it was a great working environment. I learned so many different techniques and have made a lot of progress on my research project. I hope that I can return to this laboratory in the future to do more research together.

9. Advisor's remarks (if any):

She was working much hard in our laboratory (Tokushima University) to learn the cell-base and the animal-base experimental techniques. It must be grate opportunities for her to consider the mechanism how the synthesized conjugate and nanoparticles work in the macrophage cells and the rheumatoid arthritis model mice. We hope that she would be a great researcher through this invaluable JSPS program and to work together as a research collaborator in near future.

JSPS Summer Program 2018
Research Report

1. Name: Ary PIZARRO-CHONG （ID No. SP18417）

2. Current affiliation: École de Technologie Supérieure (ETS), Université du Québec à Montréal (UQAM)

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Gifu University

5. Host researcher: Prof. Hironao Yamada

6. Description of your current research

There are currently an estimated 10 million wheelchair users in developed countries. Up to 70% of regular MWC users suffer from chronic upper-limb pain and musculoskeletal disorders associated with MWC propulsion. Research is necessary to better understand the biomechanics of MWC propulsion so that training programs can be developed and adapted to specific patients. A MWC simulator is a very helpful device for such research and training because it provides an environment where propulsion conditions can be reproduced reliably in a safe, repeated and controlled manner. A new MWC simulator is currently being developed by Prof. Félix Chénier's team in Montreal. This simulator will maximize immersion and realism by incorporating haptic interfaces to reproduce propulsion reaction forces on the pushrims, a visual/sound system, a motion platform to provide vestibular feedback (sense of balance) and vibration, and a real-time computer that will simulate the 3D dynamics of the MWC in multiple virtual environments such as a tennis court, sidewalks or corridors. My contribution to this new simulator is the development and validation of the haptic interfaces between the user and the pushrims. The main short-term benefit of this simulator is the development of a unique platform to conduct three-dimensional biomechanical analyses of MWC use and to develop training programs to enhance MWC skills and propulsion techniques. Long-term benefits include better care for persons with disabilities: learning better MWC skills and propulsion techniques will likely increase their independence, decrease acute and chronic injuries, decrease caregiver burden, improve the MWC users' participation and quality of life, and reduce the number of readmissions to rehabilitation.

7. Research implementation and results under the program

Title of your research plan:

Learning about the hardware and software design of the Gifu University manual wheelchair simulator.
Research regarding the improvement of collision detection algorithm of the manual wheelchair simulator.

Description of the research activities:

The research involved the wheelchair behavior when it hits a wall. A real wheelchair stops when one of its casters or handrims hits a wall, and then that part vibrates. The wheelchair simulator simply stops and does not vibrate.

Any of four parts of the simulator can hit the wall: the left and right casters, and the left and right handrims. In order to distinguish which part of the simulated wheelchair hit the wall, we divided the wheelchair into four box colliders. These objects are simple to render for the graphics engine, but don't mesh exactly with the shape of the footrests/caster or handrims, which are round. The mesh collider fits the objects exactly but is taxing on the computer. Therefore, a compromise must be reached between complexity and computational demands. The vibration actuators can then be attached to the footrests and handrims in order to cause vibration right after a collision. The C++ code of the control computer must then be modified in order to activate the vibration motors.

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

I enjoyed living in the city of Nagoya while working at Gifu University. I had a great time at work with my colleagues who welcomed me with open arms, despite the language barrier. I enjoyed learning about the way Japanese people lived their lives. I also went swing dancing and blues dancing in Nagoya. I walked around Nagoya every weekend. It was a great cultural experience. I recommend this program to anyone.

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Diana Popova （ID No. SP18418）

2. Current affiliation:

University of Victoria, Computer Science Department

3. Research fields and specialties:

Engineering

4. Host institution: National Institute of Informatics

5. Host researcher: Dr. Ken-ichi Kawarabayashi

6. Description of your current research

Massive, complex, interlinked information is collected by scientific research in different spheres of natural and social sciences. Graphs are commonly selected as a model of such information: graphs can successfully represent imprecise, uncertain, noisy data; graphs are well suited for the data structure analysis; graph theory has a well-developed mathematical apparatus forming a solid and sound foundation for graph research.

I have been working on design and experimental confirmation of new, scalable, and practical analytics for massive graphs: developing the Influence Maximization algorithms that calculate the most influential nodes and/or communities in the graph. State-of-the-art algorithms for the influential nodes calculation are not scalable to massive real-life graphs.

Central to my research are community-based analytics of graphs and diffusion of information through graphs. Runtime and required space are the primary considerations for the algorithms solving influence estimation and influence maximization problems: the networks of interest are massive, on the order of billions of edges. Recently, a new approach was proposed by Borgs *et al*. team from Microsoft Research: Reverse Influence Sampling (RIS) method. RIS is a fast algorithm for the influence maximization problem, obtaining a near-optimal solution.

Our algorithms build on the RIS idea. They allow computing of a set of seeds, with a theoretical guarantee, for large real-life social networks. The focus of the research is on minimizing required space. All other influence maximization algorithms have to run on expensive powerful machines with vast amount of main memory (1 TB). Our algorithms should run on a consumer-grade laptop (main memory of 16 GB) successfully calculating a theoretically guaranteed solution.

7. Research implementation and results under the program

Title of your research plan:

Scalable Analytics of Massive Graphs

Description of the research activities:

Working in close contact with Professor Kawarabayashi, I coded several new ideas aimed at further lowering the required space while computing influence maximization on the large social networks and web graphs.

After a discussion, we narrowed the proposed algorithms to two new algorithms, CutTheTail and CutTheTail2.

I selected eleven graphs of different types: social networks, which were the main focus of the research, but also other types of graphs (word associations, collaboration graphs, citations graphs, and others). This was done with the goal of testing our algorithms on graphs with different structures.

I tested the new algorithms on eleven graphs, with different parameters. The results were presented in graphic and table formats.

I started writing a new paper on the research showcasing the new algorithms and presenting the results of the testing.

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

I am very happy to be selected for JSPS Summer Program: it allowed me to work with a leading authority in graph research, Professor Ken-ichi Kawarabayashi.

I plan to include the research into my doctorate dissertation and complete it this year.

I liked very much the week in Shonan Village: Japanese language classes were fun and proved to be useful while communicating with my homestay hosts.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Ethan Sauve （ID No. SP18419 ）

2. Current affiliation: University of British Columbia

3. Research fields and specialties:
Chemistry

4. Host institution: Nagoya University

5. Host researcher: Prof. Shigehiro Yamaguchi

6. Description of your current research

Artificial lighting currently accounts for 19% of global electricity consumption, and is forecast to increase by 80% by 2030 unless the implementation of energy-efficient lighting improves. Organic light-emitting diodes (OLEDs) are an emerging technology that have the potential to significantly reduce the energy consumption of artificial lighting. They consist of a series of stratified thin films of emissive organic compound that are situated between two electrodes. Their light weight, durability and excellent efficiencies compared to traditional fluorescent light sources make them excellent candidates for use in solid-state lighting applications. However, the high costs and short lifetimes of current OLED devices have significantly hindered their broad implementation.

Based on recent research by the Yamaguchi group, I postulate that the concept of kinetic stabilization by structural constraint rather than steric bulkiness can be applied to OLED materials, potentially leading to significant improvements in device lifetime. I proposed to test this hypothesis by first examining the electron transport/hole blocking molecule 2,2′,2"-(1,3,5-Benzinetriyl)-tris(1-phenyl-1-*H*-benzimidazole) (TPBi). TPBi is the most widely used electron transport layer (ETL) used in some of the most efficient OLEDs to date. However, a well-known problem in the OLED literature is that while device performances are often reported to be quite high, device stabilities in general are often poor, particularly at the high brightness levels required for solid-state lighting. We propose to start with TPBi, and to expand our model to other archetypical OLED molecules if the structurally constrained TPBi analogue shows improved performance characteristics in devices.

7. Research implementation and results under the program

Title of your research plan:

Structural constraint as a method to improve OLED device lifetimes.

Description of the research activities:

Synthesis of precursor materials based on literature reports was performed. As well, DFT calculations on possible target materials (including the aforemention planarized TPBi analogue) were performed to determine frontier orbital energy levels. The DFT calculations indicated a number of boron containing analogues would also be of interest. The boron containing materials could conveniently be obtained via one or two additional steps from the same chemical precursor required to synthesize the planar TPBi analogue. Small scale (<0.5 g) test reactions were performed before reactions were performed on bulk scale (>10 g) and several steps conveniently did not require purification by column chromatography, allowing the first seven steps of the synthesis to be carried out successfully. Unfortunately, the final steps of each compound are yet to work. These steps will thus need to be completed at the home institution.

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

The JSPS program has been wonderful e both for my research and in terms of personal experience. I was able to learn many new scientific techniques. Additionally, I had a great time interacting with Japanese students and exploring Japan.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Ju Jing TAN （ID No. SP18420）

2. Current affiliation: Centre de recherche du CHUM, Department of Medicine, Université de Montréal

3. Research fields and specialties:

Biomedical Sciences

4. Host institution: Research Center of Health, Physical Fitness and Sports, Nagoya University

5. Host researcher: Dr. Kishio FURUYA

6. Description of your current research

Adenosine triphosphate (ATP) is widely known as an energy-carrying molecule. In response to physical forces, cells can also release ATP as an extracellular signaling molecule to regulate many physiological and pathophysiological functions. For example, in the lungs, extracellular ATP stimulates surfactant secretion, which helps us to breathe. However, excessive ATP release, such as observed in ventilator-induced lung injury (VILI), has detrimental pro-inflammatory effects. The exact mechanism of ATP release remains poorly understood. The main goal of my doctoral project is to study the effect of mechanical stretch on ATP release in the lung. I use advanced imagery techniques to characterize stretch-induced ATP release in an *in vitro* and an *ex vivo* rat lung models. In Dr. Kishio Furuya's laboratory at Nagoya University, I used his microscopy system that allows simultaneous bioluminescence imaging of ATP release and infrared cell/tissue imaging to study an *ex vivo* model. My aim is to better understand the mechanisms and the regulation of stretch-induced ATP release in mechanically-ventilated lungs. This knowledge may suggest potential therapeutic targets for pharmacological modulation of extracellular ATP levels in respiratory diseases and clinical complications, such as acute respiratory distress syndrome (ARDS) and VILI.

7. Research implementation and results under the program

Title of your research plan:

Real-Time Imaging of ATP Release in Rat *ex vivo* Lung

Description of the research activities:

Rat lungs were filled with medium containing luciferin-luciferase and placed in a newly designed artificial thoracic chamber, in which negative pressure was applied to inflate them. ATP bioluminescence was recorded with a real-time ATP imaging microscopy system, which allows simultaneous imaging of bioluminescence of ATP release and infrared imaging of cell/tissue. We succeeded in recording obvious ATP release induced by lung inflation with stable negative pressure. Movies were analyzed to localize specific sites of ATP release, and light signals were measured to quantify ATP responses. Our current results indicate that cells do release ATP when lung inflation occurs. Inhibitors of the candidates for ATP release pathways were tested, but no definitive result has been obtained yet. Nevertheless, further detailed analysis of our data will be pursued in Montreal. Moreover, I attended the Mechnobiology Lab's meetings, where I had an opportunity to present my work. I also visited several research laboratories at Tokyo University (Dr. K. Yamamoto and Dr. T. Jo), as well as Nippon Medical School (Dr. H. Takada).

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

Since my arrival in Japan, I felt that I was well taken care of by JSPS. My first week of orientation at the Shonan Village Center, as well as my time spent with the Nakahama Family, helped me to recover from the jet lag and to be more exposed to Japanese culture. During my fellowship in Dr. Kishio Furuya's laboratory at Nagoya University, I conducted many experiments that are useful for my Ph.D. thesis. Outside of my work, I enjoyed sightseeing and eating various types of food. With other JSPS fellows, I also visited Kyoto, Hiroshima, Nara and Osaka. Overall, it was a wonderful experience, both professionally and personally, and I could not have wished for more. I would like to thank Dr. Kishio Furuya, and his team, for receiving me in the Mechanobiology Lab. He not only supervised my work, but also sought the best for me throughout my stay in Japan. I extend my thanks to JSPS for this wonderful opportunity, which helped me to improve my skills and to become a better researcher in my field.

9. Advisor's remarks (if any):

Ju Jing worked with new artificial thoracic chamber system and get remarkable results, which will help our understandings for the roles of ATP in the lung. He also enjoyed staying in Japan very much. I believe these are valuable experiences for his research life in the future.

JSPS Summer Program 2018
Research Report

1. Name: Andy Tran （ID No. SP18421）

2. Current affiliation: The University of British Columbia

3. Research fields and specialties: Chemistry

4. Host institution: Kanazawa University

5. Host researcher: Prof. Motohiro Mizuno

6. Description of your current research

One aspect of the MacLachlan Group (The University of British Columbia) works with sustainable material synthesis and development. Cellulose nanocrystals (CNCs) are being extensively studied for their vivid structural colouration as well as their mechanical properties. Derived from cellulosic sources, they represent an avenue of biodegradable and renewable resources towards material fabrication. CNCs can be dispersed in water, and adopts a chiral nematic liquid crystalline organization. Current research regarding the development of CNC films is underway to provide a more nuanced understanding of the self-assembly process. To further understand this process, we investigated the influence of evaporation in developing CNC films in an effort to broaden our understanding starting from CNC suspensions to film formation.

For this collaboration between the MacLachlan and Mizuno Group, porous materials were developed at The University of British Columbia and characterized by scanning electron microscopy, circular dichroism spectroscopy, and infrared spectroscopy. Subsequent characterization methods were performed at Kanazawa University as stated in section 7.

7. Research implementation and results under the program

Title of your research plan: New proton conducting materials

Description of the research activities:

The confinement of imidazole in a porous support framework demonstrated high proton conductivity. Herein, we search for new porous frameworks to improve the efficiency and mobility of imidazole-based proton conducting materials. During my

stay at Kanazawa University, we combined the established work of the MacLachlan and Mizuno Groups and prepared a free-standing mesoporous silica support impregnated with imidazole. Mesoporous silica represents a promising support framework where the dimensions and compositions can be finely tuned to accommodate a wide range of host-guest interactions between the matrix and adsorbed imidazole molecules. By using the highly porous silica framework, templated from cellulose nanocrystals, we hoped to develop a new class of proton conducting materials that showed superior performance compared to existing systems.

At Kanazawa University, silica-imidazole composite materials were characterized by solid-state ^{13}C nuclear magnetic resonance spectroscopy (NMR) to confirm the presence of imidazole within our materials. Further characterization with thermal gravimetric analysis (TGA) allowed us to determine the amount of impregnated imidazole. Finally, electrochemical impedance spectroscopy (EIS) allowed us to measure conductivity through our silica-imidazole composites.

Our results show promise and we see an increase in proton conductivity in these composite samples. Further work will be pursued, and I hope this collaboration will continue to flourish in the future.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): The first cultural experience in Japan left a positive impact. During a homestay in Hayama, I was educated on the traditions, values, and everyday life of Japanese citizens living in a small town in Hayama. The experience was excellent, and the homestay family ensured that I was able to integrate into their household as well as teach me about the language and formalities. During my stay at Kanazawa, lab members were very helpful and often participated in traveling around Japan to visit different cities (each with their own unique traditions and customs). Overall, Sokendai University, Shonan Village Center, the Mizuno Group, and fellow peers at Kanazawa University were instrumental in ensuring a warm and welcoming environment where I was able to smoothly integrate during this summer program.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Ping Yu Xiong （ID No. SP18422）

2. Current affiliation:

Queen's University, Kingston, Ontario, Canada

3. Research fields and specialties:

Medical, Dental and Pharmaceutical Sciences

4. Host institution: The Jikei University School of Medicine

5. Host researcher: Prof. Susumu Minamisawa

6. Description of your current research

I am currently working in Dr. Stephen Archer's lab at Queen's University, Kingston, Canada as a graduate student enrolled in the Clinician Investigator Program. My research/clinical interests focus on Group 2 pulmonary hypertension (PH) or pulmonary hypertension due to left heart diseases, such as aortic stenosis, mitral stenosis, and left sided heart failure. My project focuses on looking at the changes in mitochondria dynamics in Group 2 PH rat models and whether interventions targeting mitochondria fission and fusion can improve diseases outcomes.

Fujimoto et al. (2017) from Dr. Susumu Minamisawa's lab in Jikei University School of Medicine, Tokyo, Japan recently developed a novel Group 2 PH rat model by partially banding the left atrium with a metal clip to increase the left atrial and pulmonary venous pressure, which mimic mitral stenosis in human. I am interested to learn the left atrial banding surgery, study the changes in mitochondria dynamics, and test therapeutic interventions in this novel Group 2 PH rat model.

7. Research implementation and results under the program

Title of your research plan:

Surgically Created Left Atrial Stenosis: A Rat Model of Group 2 Pulmonary Hypertension

Description of the research activities:

I learned the left atrial stenosis surgery from Dr. Shunsuke Baba. Together we submitted a manuscript and a video entitled, “Surgically Created Left Atrial Stenosis: A Rat Model of Group 2 Pulmonary Hypertension” to the Journal of Visualized Experiments describing the step by step protocol of how to perform the left atrial stenosis surgery. I wrote the manuscript, performed video editing, and provided voice over recording for the video.

In addition, I was also working on Dr. Naritomo Nishioka’s project, “The effect of acute pressure and volume overload on the right ventricle.” In this project, I introduced a new method for isolating the pulmonary artery. With this new method, the mortality due to pulmonary artery rupture decreased drastically. Moreover, I demonstrated how to perform right heart catheterization in rat to measure pressure-volume loops. I also performed rat echocardiography.

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

Overall, I had a fantastic time over the past two months. In addition to working in Dr. Minamisawa’s lab. The lab members also took me to experience Japanese culture after work. For instance, we had memorable trip to Hakone to enjoy onsen there. Dr. Nishioka also cooked traditional Japanese food, Yakisoba. I will remember my Japan experience for a lifetime.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018

Research Report

1. Name: Shun-Wei Julia Yang （ID No. SP18423）

2. Current affiliation: University of British Columbia

3. Research fields and specialties:

Medical, Dental and Pharmaceutical Sciences

4. Host institution: Keio University Hospital

5. Host researcher: Dr. Masashi Tsuruta

6. Description of your current research

My current research at the University of British Columbia examines the microbiomes of the gut-lung axis and measures telomere attrition using paired lung and small intestine tissue from human immunodeficiency virus (HIV) infected donors. Previous studies have demonstrated the existence of a gut-lung axis and its proposed role in altering immune response and respiratory disease pathogenesis. The lung and gut microbiome has been individually studied in the context of HIV infection; however the gut-lung axis in HIV remains relatively unexplored. Whether alterations in the gut-lung axis contribute to the propensity towards age-related diseases observed in HIV is unclear. There are three specific aims in this project: (1) to quantify bacterial population in lung and small intestine tissue of HIV donors, (2) to analyze effects of HIV infection on the microbial composition of lung and small intestine and (3) to compare microbial compositions and total bacterial count to characteristics such as telomere length, CD4+ T cell count and viral load.

7. Research implementation and results under the program

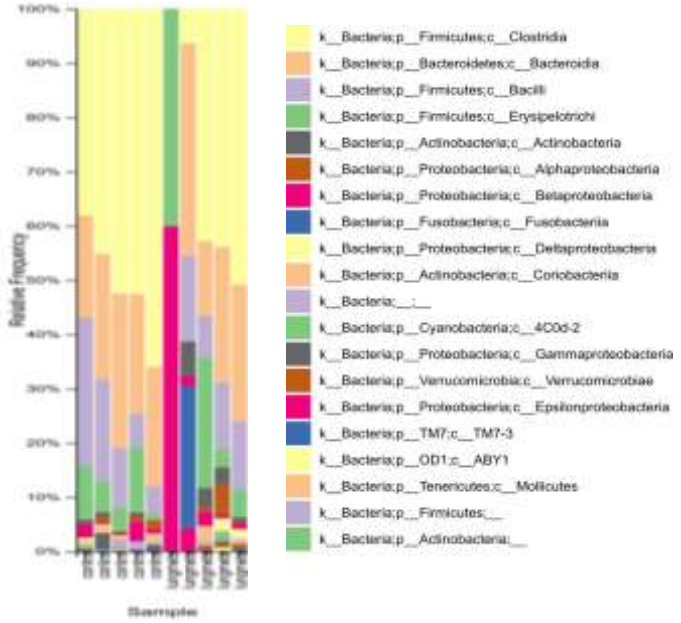
Title of your research plan:

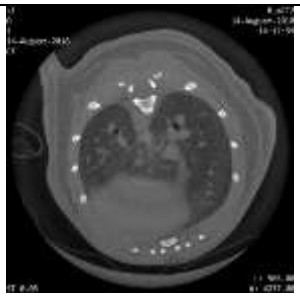
Role of microbiome and smoking-induced surfactant protein-D in lung metastasis model

Description of the research activities

This project focuses on the microbiome and release of surfactant protein D (SP-D) due to smoking in a lung metastasis model. Unfortunately due to time constraints, we were not able to use the long term inflammatory bowel disease model and decided to focus on smoking in the lung metastasis model. In this model, the mice were subjected to three weeks smoking followed by tail injection of cancer cell line CMT93. In the CT image below at two weeks post, both control and smoking mice have not yet developed lung metastasis. Once the mice develop lung metastasis, they will be sacrificed for microbiome analysis and analysis of SP-D distribution and expression using immunohistochemistry staining.

Using next-generation sequencing data from a previous cohort, we found that the most prominent phyla to be Firmicutes followed by Bacteroides. The chart below shows taxonomic distribution by class in each sample. Clostridia, Bacteroidia and Bacilli were the most abundant classes in both lung metastasis and control mice.





Control Lung

Smoking Lung

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

It has been a wonderful experience working with Dr. Tsuruta, Dr. Makino, Koshikawa-san and the many other members of the department. During my time here, everyone has been so kind and eager to share their knowledge and research. I am so grateful to have been able to come here and learn, meet fantastic people and experience Japanese culture.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Erik BECHER （ID No. SP18501）

2. Current affiliation: Stockholm University

3. Research fields and specialties:
Biological Sciences

4. Host institution: Osaka University

5. Host researcher: Prof. Toshihide YAMASHITA

6. Description of your current research

Proper guidance of axonal outgrowth through permissive cues is a vital part of creation, regeneration and repair of nerve cells in our central nervous system (CNS). Nevertheless, for the creation of highly specific and stable connections, repulsive signaling is just as important. Guiding and repulsive signaling work together to establish, correct and balanced connections between brain areas.

However, following injury these systems continue to work to stabilize the neuronal architecture and thus prevent neuronal repair. Two main players in repulsive signaling are the proteins neogenin and the nogo receptor 1 (NgR1). While one can found abounded evidence of the involvement of both receptors after injury, NgR1 is also involved in plasticity mechanisms of the CNS.

During my master thesis project, I had the change to do research on the regulation of NgR1 through the N-Methyl-D-aspartic acid receptor (NMDA receptor). The JSPS summer program enabled me to investigate neogenin with similar techniques and approaches.

In sum, I was trying to research, though pharmacological treatment of primary hippocampal cell cultures, the regulation of neogenin through methods like immunocytochemistry, quantitative confocal laser scanning microscopy and western blot.

7. Research implementation and results under the program

Regulation of Neogenin in Primary Hippocampal Cell Culture

Interestingly, we could observe a downregulating effect after pharmacological treatment targeting the NMDA receptor. Considering that this, in the CNS abounded, receptor is often described in the context of memory formation, this results could indicate new rolls of neogenin apart from inhibition after injury in memory formation and plasticity of the brain.

Description of the research activities:

Before the regulation of neogenin could be investigated a considerable part of the project was focused on creation of an experimental model. Therefore, I cultivated primary hippocampal cell cultures from mice. These cultures are relatively homogenous and develop axons, dendrites, synapses and express NgR1 as well as neogenin in cultures.
When the cultures reached a mature state, they were treated with several drugs, such as NMDA and finally formalin-fixated.
Through a technique called immunostaining and sophisticated microscopy techniques the examined neogenin receptor can be made visible and quantified.
In addition, neogenin levels can be observed on the protein level through quantitative immunohistochemistry methods as western blotting.

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

Working and studying in foreign countries, especially as distant as Japan, is without doubt an enriching experience. Even though the general lack of English lead to bizarre misunderstandings, I enjoyed my time here immensely.

Especially, hiking on paths through the nature of this beautiful country or to dive into the curious parallel universe of the Osaka night life, is just breath taking.

In addition, I felt most welcome in my laboratory - thanks to my lovely laboratory colleges and supervisors.

9. Advisor’s remarks (if any):

He made the most of this opportunity and proceeded his research successfully. He immediately opened up to us and cooperated with us. He learned a lot of things not only the special knowledge of our research but also Japanese culture and history. Also, he taught us what he knows without stint. Now, I approve that this program was better than we had expected.

JSPS Summer Program 2018

Research Report

1. Name: Javier CRUZ （ID No. SP18502）

2. Current affiliation: Uppsala University

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Ritsumeikan University

5. Host researcher: Prof. Satoshi KONISHI

6. Description of your current research

My field of research is MicroSystems Technology, in particular microfluidics, which are miniaturized fluidic systems that offer very interesting properties for chemical, biological and healthcare studies. With the dimensions in the range of a human hair, within these channels reactions happen extremely quickly, require tiny amounts of reagents and allow study of single individuals (e.g. cells or bacteria). Because of their capacity to perform multiple tasks and their reduced size, these systems are usually referred to as Lab on a Chip (LOC). LOCs have been studied and developed in the last decades in closed channels. In my research at Uppsala Unviersity and during this period at Ritsumeikan University, we aim at developing open systems (microchannles without physical walls) which offer different features that are advantageous for some applications (e.g. access to the cells, mixing by Marangoni effect, purification of microparticles…etc). In order to trap and manipulate liquids in such systems we created virtual walls by means of surface energies; i.e. surface tension and nanostructures.

7. Research implementation and results under the program

Title of your research plan:

Open microfluidics – Geometry and surface energies as virtual walls

Description of the research activities:

During the first days we discussed the motivation to develop open microfluidics, what is needed to create such systems and possible means for their fabrication. After this, we started the design of the new systems while I was also introduced to the laboratory and the use of the facilities in the CleanRoom with students.
Once the design was finished we could fabricate the masters that allowed us to investigate the means to create the open microfluidics.

We obtained positive results within these two months; we gained understanding of the physics of the phenomenon and we could develop a method to fabricate hydrophobic open microfluidics. We also integrated such systems with Prof. KONISHI's "balloon technology", which implemented control over their use.

The evaluation of the system will be continued by students of KONISHI's LAB.

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

These two months in Japan have been wonderful and I am very thankful to JSPS for this opportunity.

It's been an incredible experience in many ways; the first week with all the participants of JSPS, spending a weekend with a Japanese family, visiting a new lab from the opposite side of the world and sharing our knowledge, travelling around such a beautiful country full of nature…

9. Advisor's remarks (if any):

Ritsumeikan University has summer holidays in the last one week of the program. It was possible to accelerate his plan by better time management.

JSPS Summer Program 2018
Research Report

1. Name: Julen Goicolea （ID No. SP18503）

2. Current affiliation: Karolinska Institutet

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

4. Host institution: University of Tokyo

5. Host researcher: Professor Noboru MIZUSHIMA

6. Description of your current research

Alzheimer's disease (AD) is a devastating neurodegenerative disorder that affects elderly population and it is the most common cause of dementia. Defects in autophagy, an intracellular process by which cells capture and degrade unwanted proteins and cellular parts, have emerged as key drivers of the accumulation of cellular waste products that lead to progressive neuronal dysfunction in AD. Studies in our group have shown that the cleavage product of the antioxidant protein Thioredoxin-1, Thioredoxin-80 (Trx-80), is completely depleted in AD brains. Also, recent data in our lab suggests that overexpression of Trx-80 increases the levels of proteins that regulate the formation of autophagic structures. In light of these results we aim to specifically assess how Trx-80 modulates autophagic activity.

Professor Mizushima's lab has developed a fluorescent probe to evaluate autophagic flux: GFP-LC3-RFP-LC3ΔG. This fluorescent probe consists of a plasmid that allows the expression of GFP-LC3 (green) followed by RFP-LC3ΔG (red). GFP-LC3 expresses a functional LC3 that is degraded during the autophagy process together with GFP. RFP-LC3ΔG co-expresses RFP and a mutated form of LC3, which prevents its degradation through autophagy. When this probe is expressed in cells, it is cleaved by an enzyme inside the cell, generating comparable amounts of GFP-LC3 and RFP-LC3ΔG. GFP-LC3 is further processed and it localizes to the vesicles where it is finally degraded. On the other hand, as RFP-LC3ΔG cannot undergo further processing by the cell, it stays in the cytoplasm and it is used as an internal control. Hence, there should be a reverse correlation between the GFP/RFP signal ratio and the autophagic activity. The outcome of this is easily detectable and quantifiable by fluorescent microscopy or western-blot analysis.

7. Research implementation and results under the program

Title of your research plan:

Exploring the potential of Thioredoxin-80 as a modulator of autophagy on GFP-LC3-RFP-LC3ΔG expressing cells

Description of the research activities:

To find out whether Trx-80 modulates autophagic activity, we took 2 different approaches: Trx-80 extracellular treatments on cultured cells and intracellular expression of Trx-80 in different cell-lines.

Extracellular treatment of Trx-80 resulted in the activation of the mTORC complex. The activity of this complex inhibits the initiation of autophagy and due to this, it could be that Trx-80 treatment did not show any changes in autophagic activity in comparison to control cells. Also, this process was not affected either by an increase in Trx-80 concentration nor treatment length.

We are currently developing several cell-lines that overexpress Trx-80 and the effect of this expression on autophagy will be further studied in Sweden.

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

During this time I had the change to hike up mount Fuji, Mitake, Odake and Nokogiri. Also, together with other JSPS fellows explored the area of Tokyo and visited Kyoto. I also experienced a bath at a hot spring or onsen, tasted good sake and all kinds of delicious Japanese food.

9. Advisor’s remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Christoffer Hemmingsson （ID No. SP18504）

2. Current affiliation: Stockholm University, Department of Geological Sciences

3. Research fields and specialties:

Geochemistry

4. Host institution: Institute for Planetary Materials, Okayama University

5. Host researcher: Prof. Eizo Nakamura

6. Description of your current research

In my PhD project I work on the cycles of phosphorus (P), arsenic (As), and silica (Si) in the Early Proterozoic oceans. The aims are to investigate the effect of As on P-cycles and the implications of ocean chemistry on the rise of atmospheric oxygen during the great oxygenation event (GOE) ca. 2.4 billion years ago. In order to investigate elemental cycles in the Early Proterozoic, empirical models in the lab are conducted through adsorption and coprecipitation experiments of the mineral ferrihydrite. Ferrihydrite is thought to be a primary mineral formed in large quantities in the Early Proterozoic in junction with the deposition of banded iron formation. In addition, ferrihydrite is a mineral with a very large surface area and reactivity to ions in its surroundings. Initial data on Si-isotope fractionation during coprecipitation shows that the coprecipitation of ferrihydrite may reveal a different fractionation than from adsorption. Namely, the preferential uptake of heavy Si isotopes rather than the uptake of lighter Si isotopes from solution seen in adsorption experiments. In order to confirm the preferential uptake of heavy Si isotopes from solution during coprecipitation as well as the mechanism by which Si is fractionated further experiments were planned to be conducted at the Institute for Planetary Materials in Misasa, part of Okayama University.

7. Research implementation and results under the program

Title of your research plan:

Abiotic ^{30}Si-isotope fractionation in the Early Proterozoic

Description of the research activities:

The mineral 2-line ferrihydrite was synthesized in the presence of dissolved Si. Samples were taken over 3 days with the aim to see Si-isotopic fractionation together with mineral formation followed by possible isotopic exchange between mineral and solution. The precipitated mineral was characterized by transmission electron microscopy coupled to X-ray diffraction to ensure the correct mineral was formed. Sample concentration was determined with a Element XR (Thermo, ICP-MS). Samples were then adjusted in concentration for sample purification in order to separate Si from the remaining solution. The separated Si was analyzed with a Neptune plus, (Thermo, MC-ICP-MS) together with international standards to measure the isotopic ratios in samples and resultant isotopic fractionation.

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

I was able to visit Kyoto and experience the Gion festival together with a short trip to Nagoya to see some fireworks clad in a traditional Jinbei. I was also able to visit Hiroshima and Miyajima island. A final visit was made to the city of Matsue to experience the fireworks festival which was very lovely. In Misasa I the local festival with a lot of music and a dancing parade which was very fun.

9. Advisor’s remarks (if any):

Christoffer worked hard to complete his experiments and analyses, which were well planned before visiting my institute at Misasa. At the final stage of his stay at Misasa, we had a serious problem with newly installed MC-ICP-MS. This meant that he could not achieve the purpose of his project. For a period of time until the MC-ICP-MS was restored, he made an attempt to minimize interfering elements in the silicon fraction separated through ion-exchange chromatography. Shortly after the restoration of machine, this trial succeeded in highly accurate analysis of silicon isotopes, achieving his project very successful more than expected. From his attitude of working on experiments and research at Misasa, I found that he has already acquired the extraction and solution of scientific problems and thus he is highly potential of being independent competent researcher in his future.

JSPS Summer Program 2018
Research Report

1. Name: Piergiuseppe Mallozzi （ID No. SP18505 ）

2. Current affiliation:

PhD Student at Chalmers University of Technology

3. Research fields and specialties:

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

4. Host institution:

Waseda University, Tokyo

5. Host researcher:

Prof. Kenji Tei

6. Description of your current research

The aim of my research is to combine machine learning approaches with strong assurances of the autonomous systems safety-critical requirements with a particular focus on the automotive domain. The goal is to model a system that continuously evolves using machine learning techniques to drive the system's adaptations (e.g. reinforcement learning). At the same time, the preservation of the system's in variants must be respected. I am working on the integration of different state-of-the-art methods with the vision to build an autonomous system that can make safety-certifiable decisions.

7. Research implementation and results under the program

Title of your research plan:

Using formal methods to address Safe Exploration of Reinforcement Learning Agents

Description of the research activities:

During my period if Japan I have combined the techniques used by prof. Kenji Tei and his lab with my research on safety critical systems. We have used Modal Transistion System Analyzer (MTSA) to synthesize from the safety critical requirements of the system a monitor for the machine learning agent.

Such requirements first have to be transformed as safety properties formalized in the Linear Temporal Logic of Fluents, the formalism used to express properties in MTSA. The machine learning agent has been be modeled as a reinforcement learning agent, it try actions on the environment by trial-error with the goal of maximizing a cumulative reward.

Overall, first we have to express the goals of the system in terms of reward functions by observing how distant is the state of the environment (where the system acts) from the desired goal. Then we incorporate the feedback from the synthesized monitor into the reward to discourage the agent to take the actions that triggered the monitor. It this way we shape the rewards in a direction that brings the agent close to the goals and far from what the monitor detects as a violation of the invariants.

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 2018
Research Report

1. Name: Anna Martín Vilardell （ID No. SP18506）

2. Current affiliation: Karlstad University

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Nagoya University

5. Host researcher: Prof. Makoto KOBASHI

6. Description of your current research

Additive manufacturing (AM), or popularly known today as 3D printing, is a novel technology that is used to manufacture prototype parts by printing them layer by layer. This technology has penetrated every major industry from automotive, aerospace, defence and medical fields by recent advances on material science, process development, and enhancements on design consideration. It stands above conventional techniques due to its freedom to design without penalties and methods for optimization.

The present research is focused on the characterization of cellular lattice structures, which are promising solution for implant applications. They offer customize porous structures, thus promoting ossointegration, but at the same time offers a decrease of young's modulus resulting beneficial by avoiding aseptic loosening. The freedom design that offers AM technology is ideal for its production, as it cannot be achieved by conventional techniques.

Thanks to JSPS Summer program, we have been able to develop and perform a research plan on the characterization of Ti6Al4V cellular lattice structure samples.

7. Research implementation and results under the program

Title of your research plan:

Microstructural and mechanical characterization of cellular lattice structures by additive manufacturing for biomedical applications.

Description of the research activities:

The aim of the proposed project is the understanding of the mechanical performance and structure-properties relationship of Ti6Al4V cellular lattice structures. For that purpose, three different specimens have been developed through topological optimization, with high porosity and a young modulus close to the bone (E~20GPa):

(i) Specimen 1: Porosity: 55%; YM= 27.4GPa.

(ii) Specimen 2: Porosity: 60%; YM= 23.1GPa.

(iii) Specimen 3: Porosity: 65%; YM= 18.6GPa.

Microstructural analyses were mainly carried out by means of SEM and EBSD microscopy techniques. On the other side, mechanical characterization was analyzed by compression test. Therefore, fractured surfaces of the specimens after compression test have been analyzed, as well as the fracture mode of the samples. Additionally, FEM simulations of the compression tests have been performed on the 3D cellular lattice structure designs to be compared with the experimental data.

Experimental results have shown the same trend as the theoretical calculations. However, the measured young modulus values were much lower than the designed ones, as the manufacturing specimens had larger porosity. Further research needs to be performed on the optimization of additive manufacturing parameters. However, the approach to design cellular lattice structures through topological optimization seems promising to manufacture specimens with the customize specifications.

The project is promising. Thus, a second stage is being set up for the characterization of in-situ alloying of Ti6Al4V-Cu alloy cellular lattice structures for antibacterial performance for biomedical applications. For that reason, phase diagram analyses have being conducted for an initial characterization of this second part of the project.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): JSPS summer program has been such a great experience to learn and know more about Japanese culture. It has been a great chance to stablish new collaborations, understand new perspectives/points of view, and specially meet awesome people. I really enjoyed my stay in Nagoya, but also Japan. Definitely, one of my best live experiences.

9. Advisor’s remarks (if any): We had Dr. Anna Martín Vilardell in our research group for two months. I was impressed by her research achievement very much. She did good research and also gave us a good cultural stimulation. Although the JSPS program period was over, we are preparing for a new collaboration with her. This was definitely wonderful opportunity for me, too.

JSPS Summer Program 2018
Research Report

1. Name: Carl-William Palmqvist （ID No. SP18507）

2. Current affiliation: Lund University, Sweden

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Chiba Institute of Technology

5. Host researcher: Prof. Norio TOMII

6. Description of your current research

My research is on train delays, mostly for passenger trains. I try to identify the delay size, frequency and distribution in both time and space. I also try to find out what causes them, be it weather, passengers, technical problems, or timetable related mistakes, and when possible to quantify these impacts. Finally, I try to propose actions to reduce the delays, mostly in the domain of timetable planning. By assigning margins to the runtimes of trains, and appropriate dwell times at the station stops, it is possible to reduce and recover the delays, and I try to find ways to do this more effectively. My focus is on using large amounts of historical data, mainly train movement records from the traffic control system, and statistical methods to find out what has worked well, and not so well, in practice. This empirical approach is still quite uncommon in the field, which is often more focused on mathematical modeling or simulation. I also conduct interviews with timetable planners to understand their situation and perspective. Currently I am working on a paper about how train interactions (such as meeting and overtaking) affect the dwell time delays of trains, as these appear to be the most frequent, using data from both Sweden and Japan. Another paper I am working on instead considers the number of passengers getting on and off the trains, and the dwell time delays. After these two are done, I have one project that uses the empirical data on delays and interactions to better calibrate and validate microscopic simulation models, another project dealing with a macroscopic simulation model, and a third one with delays for freight trains.

7. Research implementation and results under the program

Title of your research plan:

Train Delays and Timetabling in Japanese Commuter Railways

Description of the research activities:

Interviews have been conducted with timetable planners from six Japanese railway companies, and technical visits to three traffic control centers. Extensive travel and field work with observations of dwell times, overtaking patterns, and platform design. Data has been shared from the respective countries railways and been integrated to the respective formats and databases. Considerable data analysis has been done on the Japanese railways, from a variety of perspectives: punctuality, delay distributions, train interactions and timetable revisions. One full paper has been written and submitted to an international conference, and an abstract to another one. Both are co-authored with the host researcher, and the abstract (and upcoming full paper) is also co-authored with another research student at the host researcher's lab, as well as some practitioners at a Japanese railway company. I have also met and gotten to know many excellent researchers in my field, whom I hope to work together with in the future.

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

The visit has included many interesting trips all over the country. Remarkable cultural experiences include ryokan, onsen, visiting some spectacular castles, religious sites, and gardens, and eating extremely fresh squid (and other delicious foods). Just experiencing the railway operations, with both the shinkansen and the commuter/metro systems in Tokyo during rush hours, was also very interesting and enlightening.

9. Advisor's remarks (if any):

JSPS Summer Program 2018
Research Report

1. Name: Veronica WALLANGEN （ID No. SP18508）

2. Current affiliation: PhD Student at Stockholm University

Visiting Research Scholar at Lawrence Berkeley National Laboratory

3. Research fields and specialties:
Mathematical and Physical Sciences

Engineering Sciences

4. Host institution: National Institute of Radiological Sciences (NIRS)

5. Host researcher: Dr. Taiga Yamaya

6. Description of your current research

Positron Emission Tomography (PET) is a functional imaging technique used to visualize physiological processes and can for instance provide information about abnormal cell activity, such as cancerous tumors. PET imaging can enable earlier and more precise diagnosis of cancer and other diseases, such as Alzheimer's and Parkinson's, and can also be used to monitor the dose delivered to the patient during particle therapy, so-called *in-beam* PET, for more efficient treatment.

During a PET scan the patient is injected with a radioactive tracer substance that accumulates in certain body regions. As the radiotracer decays, positrons will be emitted and will recombine with electrons inside the body, thereby causing two gamma ray photons to be emitted back-to-back. By detecting coincident photons and combining many such events the position of the decay can be determined and a distribution of the activity used to form an image. In general, abnormal cells will consume the glucose-like radiotracer at a higher metabolic rate than healthy cells and PET is therefore an excellent method to image cancerous tumors.

A PET detector module typically consists of a block of scintillator crystals which produce a burst of light as response to absorbing energy from interacting photons, coupled to photomultipliers (SiPMs), which convert the light into an electrical signal. Current PET detector systems are in need of increased sensitivity and resolution for improved image quality, and in-beam PET systems specifically require fast signal readout with minimal reconstruction. To achieve high position resolution the scintillator can be segmented into smaller voxels that provide both 2D position information as well as depth information. The Imaging Physics Team at NIRS has realized this with a novel 4-layer depth-of-interaction (DOI) detector. In addition, the detector performance can also be highly improved by using time-of-flight (TOF) modules that provide more precise timing information for the photon coincidence detection. My research is focused around the development of a DOI detector with TOF capability, which would combine these two technologies and thereby lead to greatly increased spatial resolution and image quality.

7. Research implementation and results under the program

Title of your research plan:

Functional Imaging for Improved Cancer Treatment

Description of the research activities:

Coupling of the DOI scintillator element to the SiPM is not straightforward and there are many parameters that are in need of optimization to achieve the best possible performance. I have been involved in setting up a data analysis framework for a DOI-TOF detector setup and conducted measurements using radioactive sources primarily using a one-layer crystal block to be used as a reference for further development. Using this framework I have made careful corrections of gain variations and saturation compensation from the recorded energy spectrum of each readout channel of the module. This module is of light-sharing type, which means that the signal is shared between several readout channels for a more accurate position estimation, an effect which is enhanced by using a light guide between the crystal block and the SiPMs. I have conducted measurements using lightguides of several different thicknesses to study how this property impacts the performance. While light sharing greatly improves position resolution it degrades energy resolution, and the latter is something which the gain correction relies on. Therefore, some difficulties in carrying out these corrections were encountered, but important conclusions for future improvements could be drawn.

The research work carried out constitutes a base to provide insight for continued development of a DOI-TOF PET detector, especially with regards to accurate corrections of the readout channel data, something which is crucial for high image quality. Successful channel calibration is an essential factor to enable using this type of module with crystals of even finer segmentation, thereby moving towards the highest resolution in the field.

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

In addition to being part of a prominent research team and having learnt a tremendous amount during the duration of the program, it has been great experience personally as well as professionally. I have really enjoyed learning about the Japanese culture and exploring the beautiful country of Japan. Apart from the cultural experiences organized by JSPS, and various travels and activities with the other JSPS fellows throughout the summer, the research team at my host institution has also been extremely welcoming and has taken great care of me. For instance, they were kind enough to dress me in a traditional yukata for one of the summer festivities held at NIRS.

9. Advisor’s remarks (if any):

Even for the short two months research stay at NIRS, Veronica showed her best effort to catch up the state-of-the-art PET physics, and helped to develop a special software to draw the best performance of our prototype PET detector. Congratulation for this great contribution.