RESEARCH REPORT

1. Name: Jeffrey ADLER （ID No. SP17001）

2. Current affiliation: University of California, Santa Cruz

3. Research fields and specialties:

Linguistics

4. Host institution: Keio University

5. Host researcher: Prof. Shigeto KAWAHARA

6. Description of your current research

My research focuses on the way language is stored in memory. Specifically, I investigate the way Japanese speakers have memorized a certain complicated pattern of the Japanese language. Many words in Japanese, known as Sino Japanese words, are derived from Chinese. Sino Japanese words are distinct from native Japanese words. Certain combinations of sounds that native Japanese words never contain exist only in the Sino Japanese lexicon. The question I aim to answer then, is whether these unique Sino Japanese patterns are memorized as exceptional or irregular in the Japanese language, or if they are stored as *productive* patterns. Productive refers to the idea that speakers will extend these patterns to novel words. To that end, in my research I present native Japanese speakers with novel words, and give them choices about how they would pronounce them. In this way, we gain an indirect probe into how Japanese speakers unconsciously internalize Sino Japanese words, and by extension, how language learners, in general, interpret exceptional patterns, during word learning

7. Research implementation and results under the program

Title of your research plan:

Memory and Sino Japanese root fusion.

Description of the research activities:

Together with Prof. Kawahara, I have developed an experiment appropriate for the setting in Japan that will allow me to meet the research goals. This involved carefully selecting novel Japanese words that reflect different aspects of Sino Japanese, assigning these words plausible ideographs, and administering the experiment to students. I have met with various linguists throughout Japan, and presented preliminary results at local conferences. Together with my advisor at my home institution, I will now continue this work with native speakers of Japanese living in California.

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

I've had an absolutely incredible time in Japan thanks to the JSPS program. I have vastly improved my Japanese language abilities, experienced a new culture, and made lots of academic connections.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Malcolm Ammons （ID No. SP17002）

2. Current affiliation: University of Michigan

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Masahiro KURATA

6. Description of your current research

My research encompasses a variety of projects generally focusing on enhancing the performance of steel structures. Much of my current research effort has been focused on experimentally and numerically evaluating the behavior of welded transverse plate to Hollow Structural Section (HSS) connections. This particular connection has been thoroughly investigated in the past but has more recently garnered interest due to changes in the limit state equations in the American Institute of Steel Construction (AISC) design provisions. By conducting an experimental program and robust numerical parametric study, a more comprehensive understanding of the behavior of this connection will be realized and more economical connections will be able to be designed. Additionally, I have been pursuing the application of lightweight, high-damping materials within the voids of hollow structural sections to help mitigate vibrations and lessen residual damage from large building accelerations induced by seismic and wind loads. Specifically, my research has been focused on determining materials that are suitable for void fill applications by first characterizing their behavior under cyclic loading, and then numerically and experimentally assessing their performance at component and system levels.

RESEARCH REPORT

1. Name: Alexis C. Billings （ID No. SP17003 ）

2. Current affiliation: University of Montana

3. Research fields and specialties:

Biological Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof Atsushi Ishida and Dr. Toshitaka Suzuki

6. Description of your current research

My research is focused on the ecology and evolution of animal signaling systems, specifically the alarm call signaling systems in birds. When presented with a potential predator, birds will produce “mobbing” alarm calls. These calls attract others to a predator’s location to harass and distract the predator to force it from the area. These mobbing events involve numerous individuals across species. These calls are species-specific and can be altered to encode vast amounts of information about the predator and its threat level. My research is focused on how birds are assessing risk, encoding this information in their mobbing alarm calls and how this information is being used by other species to assess risk. My research has revealed that even though mobbing alarm calls are often regarded as acoustically simple, they can be altered to encode important information about predators and this information is being used in asymmetrical ways by multiple species in a communication network about danger.

7. Research implementation and results under the program

Title of your research plan: Masking vs. distraction: how anthropogenic noise affects the use of mobbing signals in Japanese tits (*Parus minor*)

Description of the research activities:

We tested how Japanese tits (*Parus minor*) respond to conspecific mobbing signals when presented with distracting road noise or masking road noise to test the mechanism that causes animals to respond less to signals in the presence of noise. We presented Japanese tits with four treatments: (1) a control, unaltered conspecific mobbing calls, (2) distraction, conspecific mobbing alarm calls with road noise after the call, (3) masking, conspecific mobbing calls with the lower frequencies removed and (4) distraction + masking, conspecific mobbing calls with road noise overlapping the signal. We played back all four treatments at 14 sites in Karuizawa, Nagoya, Japan where Japanese tits are present. We recorded how many individuals approached the speaker (a common response to hearing conspecific mobbing alarm calls) and made acoustic recordings of all vocalizations produced in response to the stimuli. Preliminary results suggest that the mechanism that causes Japanese tits to respond less to conspecific alarm signals in the presence of noise is due to distraction over masking. Fewer individuals approached the speaker in response to the distraction and distraction + masking treatments than to the control or the masking treatments.

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

I gave a talk at the laboratory of Ethology in Kyoto University where I was able to meet and interact with Japanese professors, postdocs, and graduate students.

9. Advisor's remarks (if any): It sometimes happens, especially in the field research, that experimental design required to be changed according to the environmental conditions, such as unpredictable seasonal difference in animal behavior and unexpected weather conditions. Alexis' flexibly did this by focusing on the influence of anthropogenic noise on vocal communication in birds. The experimental design allows controlling the influence of "masking" and "distraction" by anthropogenic noise. This study is important as follows: (i) animal behavior and cognition: it may provide insights into how animals process information from noisy conditions and (ii) conservation biology: it help us to assess how man-made noise influences anti-predator communication which is vital for most wild animals.

7. Research implementation and results under the program

Title of your research plan:

Experimental and Numerical Investigations of Supplemental Damping for Energy Dissipation

Description of the research activities:

Six steel HSS braces with three different diameter-to-thickness ratios, D/t, were experimentally tested under quasi-static cyclic axial load until fracture. Four of the braces were filled with lightweight, pourable and expandable polyurethane foam, and two of the braces were unfilled. The behavior of the unfilled braces was used as a baseline to assess the influence of foam on the brace performance in regard to energy dissipation and ductility. It was anticipated that the foam-filled braces would delay the initiation of local buckling, leading to a longer brace fracture life and subsequent increase in ductility. Experimental results confirmed this conjecture, with filled braces fracturing one cycle later than their unfilled counterparts. To solely assess the influence of the foam, two of the foam-filled braces had foam inserted into them using a hole in one of the endplates that were welded to the braces. The other two filled braces used different hole configurations along the length of the brace to assess the viability of foam-filled braces as a retrofit option. To address the physical limitations imposed by experimental testing and increase the robustness of the current dataset, a significant numerical parametric study is underway using finite element models calibrated using experimental data.

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

I thoroughly enjoyed my time here in Japan and am already planning to return sometime in the near future. This was an enriching experience from a cultural and research perspective and I look forward to working with my research collaborators for years to come.

9. Advisor’s remarks (if any):

Malcolm achieved many research milestones during his stay. A complete experimental dataset for foam-filled steel braces and high-fidelity finite-element models are some but not all. He worked closely with counterpart students in my research group and developed strong friendship and mutual trust. One of his counterparts will visit Michigan this fall.

RESEARCH REPORT

1. Name: Garrett Bredell （ID No. SP17004 ）

2. Current affiliation: University of California – San Diego

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: Musashi University

5. Host researcher: Dr. Kuniaki Nemoto

6. Description of your current research: This project is the first to examines voters' evaluations of legislators who change party affiliations between elections in democratic systems. Party switching is important because it weakens accountability between voters and their political representatives in otherwise strong democratic institutions. Voters may support a legislator and their party during an election, but the legislator may "jump ship" after winning the election to another party, attenuating the linkages between voters and their representatives. This project will examine how voters react to party switching and whether they punish or reward legislators who change their party affiliations. There is to date no research that explores whether voters reward or punish party switching, and under what institutional and political conditions these effects may change. Japan is an excellent location and case for this study, where party switching has previously resulted in shifts in governing coalitions and majority party status.

7. Research implementation and results under the program

Title of your research plan: “Evaluating the electoral costs of party switching in the consolidated democracy of Japan”

Description of the research activities: The primary purpose of this project’s research agenda under the JSPS Summer Program was the preparation and delivery of a survey experiment to be conducted by the end of August. This survey was designed and refined under the advisement of Dr. Nemoto and other academics to include questions and survey treatments to isolate the electoral effects of party switching amongst the Japanese electorate. The development of the survey also required contextualization in the political science and Japanese studies literature, and both designed and framed as a means to isolate cognitive effects that have previously been theorized in the political science literature, but never directly measured in a survey setting.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): The NSF-JSPS Summer Program has been an incredible and enriching experience. As a previous student of Japanese language, I found my Japanese skill have developed through daily immersion, sometimes by necessity, and other times in casual conversation. I have also attended several academic conferences and talks on a wide-range of social science topics, and watched as scholars from across the globe engaged in cross-cultural dialogue on issues of importance to all participants. Finally, I was able to communicate with Japanese citizens and voters on a day to day basis, asking about their knowledge of party switching, and whether they have strong feelings about the practice.

RESEARCH REPORT

1. Name: JEFFREY BROOKS （ID No. SP17005 ）

2. Current affiliation: New York University

3. Research fields and specialties:

Social Sciences/Biological Sciences

4. Host institution: National Institute of Physiological Sciences

5. Host researcher: Dr. Norihiro Sadato

6. Description of your current research

My research is on face perception. In particular, I am interested in how we understand and categorize the emotions that others are feeling based on their facial expressions. My current research aim is to understand cultural differences in the perception of emotional facial expressions between Japanese and American individuals. In particular, I am interested in the role of differences in conceptual knowledge (e.g. differences in how Japanese and American people thing about a given emotion such as “anger”) on how they are perceived from facial expressions, and in turn how this is reflected at the level of patterns of activity in the brain. Our hypothesis is that emotions that are more conceptually similar will also be more similar in terms of how they are perceived, and that this will be reflected at the level of brain activity. Moreover, we expect this pattern of similarity to be different between cultures. To investigate this, I am running an international study in which I collect behavioral and neuroimaging data from Japanese and American participants. Under the program, I was able to complete data collection and begin analysis for the Japan phase of my project. I am currently analyzing the data, and when I return to the United States, I will also run an identical study on American research subjects and complete the final analysis comparing the datasets from both countries.

7. Research implementation and results under the program

Title of your research plan: The influence of cultural differences in emotion conceptual knowledge on emotion perception: a neuroimaging investigation

Description of the research activities: Under the 8 week program, I was able to complete data collection and begin analysis for the Japan phase of my project. When I arrived, I programmed the behavioral and neuroimaging tasks and we scanned 20 subjects at the National Institute of Physiological Sciences over the course of two weeks. The fMRI (functional Magnetic Resonance Imaging) task consisted of passive viewing of emotional facial expressions corresponding to the six "basic" emotions (Anger, Disgust, Fear, Happiness, Sadness, and Surprise). Performing a brain scan while participants completed many trials of this task allows us to measure each person's average neural response to facial expressions from each of these emotion categories. In addition to the functional (task-related) scans, we also collected a high-resolution anatomical scan and a diffusion weighted scan (to measure white matter) for each participant. Participants also completed behavioral tasks (e.g. questionnaires and computer-based tasks) designed to assess how conceptually similar each participant found each pair of emotion categories, as well as how similarly they were perceived. In an initial analysis of this behavioral data, we found that each participant's subjective conceptual similarity ratings strongly predicted their "perceptuals similarity" data. The next step will be to show that the perceptual similarity data in turn predicts their neural similarity data.

RESEARCH REPORT

1. Name: Louis Buccella （ID No. SP17006）

2. Current affiliation:

University at Buffalo

3. Research fields and specialties:

Biological Sciences

4. Host institution: University of the Ryukyus

5. Host researcher: Dr. James Reimer

6. Description of your current research

Essential to reef ecosystems, corals create structural framework, which allow the inhabitance of many other diverse organisms. The majority of corals largely depend on symbiotic algae, called *Symbiodinium*, for survival. Environmental threats can cause the breakdown of this symbiosis (dubbed “coral bleaching”), but not all symbiont types, or coral species, are equally susceptible. Current evidence suggests that there are many different species of *Symbiodinium,* many of which are undescribed. As environmental threats become more severe, there is a greater need to identify and investigate these host-symbiont combinations.

Soft corals or octocorals are corals composed of a soft tissue structured by sclerites. Although these corals have been generally less affected by bleaching than hard corals, far less research has been done on them. Okinawa, Japan, is not only home to a large diversity of these octocorals, but many of their symbiont relationships are currently unknown. In this study we aim to survey these corals and identify their respective symbiont types.

7. Research implementation and results under the program

Title of your research plan:

Identifying Octocoral-Symbiont Associations in Okinawa, Japan

Description of the research activities:

First, a list was created identifying the coral species we indented to sample. Using SCUBA or snorkeling, these octocorals were sampled from locations throughout Okinawa. A small sample (~5cm) was cut from each colony and was preserved in 95% ethanol for identification/analysis.

Molecular analysis was then used to identify the *Symbiodinium* types. DNA was first extracted, and Polymerase Chain Reaction (PCR) was used to amplify the target loci. These target loci were the ITS2 and psbAncr regions of DNA, both commonly used to identify *Symbiodinium*. The products of these two loci were then sent to a lab for sequencing.

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

My research experience in Japan could not have gone better! My host lab was full of amazing and kind people who helped show me a large part of the Okinawan Prefecture, both tourist attractions and the coral reefs. It was a privilege and a blessing to be able to study with so many new friends!

9. Advisor's remarks (if any)

RESEARCH REPORT

1. Name: Joseph CAMPBELL （ID No. SP17007）

2. Current affiliation: Arizona State University

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Osaka University

5. Host researcher: Prof. Koh HOSODA, Assist. Prof. Shuhei IKEMOTO

6. Description of your current research

My current research focus is human-robot interaction, specifically physical cooperation in high-dimensional and multimodal systems. These are challenging scenarios, since they typically require many learning demonstrations, are difficult to probabilistically condition with, and are computationally demanding. However, many interesting human-robot interactions must contend with such conditions. For example, vision-based scenarios may benefit from introducing other sensor modalities if visual occlusion is likely. Furthermore, additional modalities can be used to model latent variables to aid in safety and/or ergonomics during human-robot interaction.

Biologically-inspired -- especially pneumatically-actuated -- robots also suffer from many of the same difficulties while often experiencing highly non-linear dynamics. I have worked towards developing a theoretical framework that applies algorithms from the well-established field of robot localization to human-robot interaction with the goal of improving accuracy and computational efficiency in multimodal systems. This project will examine how well my algorithm can enable human-robot interaction in pneumatically-actuated robots.

7. Research implementation and results under the program

Title of your research plan:
Multimodal Interaction Algorithm for Human-Robot Interaction with Biologically-Inspired Robots

Description of the research activities:

My primary research goal in Japan was to enable physical human-robot interaction between a human and a pneumatically-actuated humanoid robot in Prof. Hosoda's lab. To this end, I created a novel human-robot interaction algorithm which combines elements of interaction primitives and simultaneous localization and mapping. After spending time familiarizing myself with the robot, developing a suitable real-time interaction framework, and determining an appropriate training method, I was able to successfully model a handshake scenario between a human and robot that is both temporally and spatially robust. Although high levels of accuracy require per-person calibration in order to tune the model to each individual, generalization appears to be possible given enough training demonstrations. A second scenario in which a human and a robot cooperatively solve a puzzle game is currently being developed with results being prepared for publication.

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

This was an incredible cultural opportunity for me. I was able to spend time with the lab members at my host institution; go sight-seeing in Osaka, Kyoto, Nara, and Kobe; and participate in several summer festivals. Additionally, this research opportunity has created interest in continuing collaborative research between my host and home labs.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Elizabeth G. CLARK （ID No. SP17009）

2. Current affiliation: Yale University

3. Research fields and specialties:

Biological Sciences

4. Host institution: Tohoku University

5. Host researcher: Prof. Akio ISHIGURO

6. Description of your current research

Brittle stars, close relatives of sea stars, have evolved a specialized form of rapid locomotion in which they coordinate whip-like movements of their five arms. This unique strategy has several interesting features. Brittle stars can move in any direction without needing to turn. They can adjust their locomotion strategy to recover from lost or damaged arms without significant loss in capability. Most remarkable is that the processes of stimuli interception, decision-making, and coordination of over 1,000 skeletal elements during locomotion are conducted without a brain. The way in which the nervous system is configured to perform these complicated tasks while operating under decentralized control is unclear. All of these interesting aspects of ophiuroid locomotion have been investigated for their applications to robotic engineering.

The research group of Professors Akio Ishiguro and Takeshi Kano at Tohoku University incorporates advantageous features of animal locomotion into the design and construction of novel robots. A main focus of the group is to engineer mobile robots operating under decentralized control. The approach of the group is to observe live animals in the lab and integrate their capabilities into their robot designs. Here, we used this approach to investigate how the decentralized ophiuroid nervous system is set up to control locomotion.

7. Research implementation and results under the program

Title of your research plan: Insights into the Control Setup underlying the Resilient Decentralized Locomotion of Brittle Stars

Description of the research activities:

The ophiuroid nervous system consists of a circular nerve ring at the center of the body that connects to the five radial nerves that run along the length of each of the arms. The hypothesized functions of the nerve ring range from performing complex tasks approaching those of a central nervous system to simply connecting adjacent arms. Analyzing the role of the nerve ring in implementing coordinated locomotion is critical to determining the setup underlying decentralized ophiuroid motor control. We approached this with a series of experiments using live ophiuroids. We compared locomotory behavior before and after severing the nerve ring and varied the number and position of places where the nerve ring was cut. Through these experiments, we collected data on the role of the nerve ring in transmitting information, coordinating arm movements, and recognizing and recovering from damage. We found that the nerve ring is critical for transferring information between the arms, yet ophiuroids are able to adjust their locomotion strategy to recover from nerve ring damage. We plan to use this information to design a resilient decentralized robot.

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

Travel to Tokyo, Kyoto, Nagoya, Okinawa, Sendai and Sapporo. Sightseeing at Matsushima, Enoshima, and Kamakura. Attended Sendai Tanabata Festival. The JSPS/NSF EAPSI program was a wonderful experience both as a research opportunity and as a cultural immersion. I would highly recommend this program to other graduate students.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Kimberly Cory （ID No. SP17010）

2. Current affiliation: West Texas A&M University

3. Research fields and specialties:

Biological Sciences

4. Host institution: National Institute of Polar Research

5. Host researcher: Dr. Goto-Azuma and Dr. Tobo

6. Description of your current research

The research looked at different non-proteinaceous ice-nucleating particles that can be typically found within the atmosphere. Our project specifically looked at proxies for cellulose that has been found within the atmosphere through air sampling. Cellulose is known to be found in the air samples while being 5% of the total mass concentration of the sample (Hiranuma et. al, 2015). It has been sampled biannually to have a mass concentration of ~ a few μg m^{-3} (Hiranuma et. al; 2015) where other particles have been measured at comparable concentrations, such as Black Carbon (0.99 ± 0.02 μg m^{-3}; Dumka et. al, 2010) and Mineral Dust (<5 μg m^{-3}; Prospero, 1999). We aimed to measure the surface-scaled ice nucleation activity of all the non-proteinaceous samples by using the Cryogenic Refrigerator Applied to Freezing Test (CRAFT) system that was developed at the National Institute of Polar Research (Tobo, 2016). The five cellulose samples that were experimented on in Japan will be compared to two cellulose samples that were done in the United States. By doing this, it will allow for a comparison of different types, manufacturers, and size of particles. This will allow us to look at the implication of multiple cellulose particulates in the atmosphere through immersion freezing and how they affect the cloud interaction.

7. Research implementation and results under the program

The results for the project showed that there were differences in the ice nucleation based on the makeup and length of the particle itself. Once at the colder temperatures (-25℃ to -30℃), the curves tend to vary which points to artifacts in the droplets. This shows that the droplets are not as homogenous. The implications on the atmosphere is that the more particulates there are within the atmosphere, the droplets will freeze at a warmer temperature. From here, there needs to be further focus on the warmer temperatures (-5℃ to -25℃).

Title of your research plan:

Ice nucleation properties of non-proteinaceous biological particles

Description of the research activities:

For the research, we created solutions of cellulose that was given from a company. The solutions were based upon a known weight of the cellulose sample added to a set amount of water to create a .1 weight percent. After the solutions are created, we use the CRAFT to test the immersion freezing of 49 droplets and document how many droplets are frozen every half a degree from 0℃ to -30℃. From there, we observe the difference in the curves and behavior of the water droplets to determine any significance.

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

Japan is an amazingly beautiful country, and I am very grateful to be able to broaden my education as a scientist and student through this program. The people of Japan are extremely kind, and they were showing me all of the area of Tokyo. As a foreigner in a different country, I especially appreciated that I they took the time to take me and make me feel comfortable.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Bianca CUNG （ID No. SP17011 ）

2. Current affiliation: University of California, Irvine

3. Research fields and specialties:

Social Sciences

4. Host institution: Kyoto University

5. Host researcher: Professor Toru IIYOSHI

6. Description of your current research

Massive open online courses (MOOCs) have attracted the attention of millions of users around the world. While MOOCs have the potential to extend access to education, they also have the potential to exacerbate existing educational gaps. Institutional goals for and approaches to MOOCs vary widely. This is especially true across countries and cultures. MOOCs in Japan are still in its relatively early stages compared to its U.S. counterparts. Nevertheless, Japan's growing involvement in MOOCs could also give way to new MOOC perspectives and potential solutions to current educational issues, such as ways to support students in online learning environments.

The current study examines engagement patterns of students in science MOOCs taught by KyotoUx. It attempts to replicate the results of a prior study (Kizilcec, Piech, & Schneider, 2013) though it also adopts a different coding method to better fit varying course structures. By characterizing the different engagement patterns found in MOOCs, this study identifies specifically students who are likely to complete the course and students who are initially highly invested in the course but then drop off. A closer analysis of the usage patterns of these two groups of students in light of instructor goals highlights areas in need of better support.

Differences between completing students and disengaging students in the quality of their written work also provide an in-depth understanding to why disengaging students drop out and what additional forms of support are needed. In order to identify early flags for struggling students, the current study connects click behavior with eventual written work that indicate signs of struggle. Similarly, the study also codes for signs of satisfaction. Content-related written output is categorized into high, moderate, and low quality to uncover usage patterns that lead to higher quality contributions to the course.

7. Research implementation and results under the program

Title of your research plan:

Investigating the Convergence between Engagement Patterns, User Perceptions, and Course Outcomes in Science Massive Open Online Courses

Description of the research activities:

Research activities thus far include instructor interviews, cleaning and investigation of MOOC clickstream data, and a joint review of students' discussion forum posts. Four in-depth interviews were conducted in total. Additionally, two Kyoto University courses that use the MOOCs as part of a flipped classroom were observed. Clickstream data was analyzed for engagement patterns. For the review of the discussion forum posts, two researchers reviewed a series of discussion forum posts and developed a coding scheme for the study. Parts of a potential research paper was written.

Upcoming analyses will connect the coded discussion forum posts with clickstream activity and course completion rates.

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

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Gerald Eaglin （ID No. SP17012）

2. Current affiliation: University of Louisiana at Lafayette

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Dr. Gen Endo and Dr. Hiroyuki Nabae

6. Description of your current research

Flexible cable driven systems are commonly used around the world. Examples of these types of systems include various types of cranes as well as Cable Driven Parallel Manipulators such as the Skycam used for sporting events as well as China's Five-hundred-meter Aperture Spherical Telescope (FAST). One of the benefits of cable driven systems is that they can be designed to operate in a large workspace. However, one of the drawbacks is the possibility of inducing vibration when the flexible system is commanded to move. Research is being conducted at the University of Louisiana at Lafayette to design methods to plan a path for the system to move without producing significant levels of vibration.

Input shaping has been used to command a flexible system to move without having vibration after the move has been completed. This involves intelligently determining how the system should be commanded to move. Part of the original command is delayed so that the superposition of the responses to all parts of the command results in a vibration amplitude that is below a chosen threshold. This is used when the desired command is already known. The goal of the research project at the University of Louisiana is to design a method to autonomously plan a low vibration path using input shaping methods for a flexible system.

7. Research implementation and results under the program

Title of your research plan:

Vibration Reduction in Electromagnetic Actuators Based on Displacement Amplification

Description of the research activities:

Research was conducted on an electromagnetic actuator capable of sub-millimeter stoke lengths. Actuators such as this are able to achieve the desired motion with high precision and a short rise and settling time. However, a trade off of rapid motion for this type of actuator is overshoot and subsequent residual vibration. The research conducted at Tokyo Institute of Technology focused on improving the performance of these actuators.

PID control was combined with input shaping to reduce the overshoot and amplitude of residual vibration of the actuator. The dynamics of the actuator are nonlinear, causing the response of the actuator to depend on the set-point when using PID control. When the PID gains are tuned about the midpoint of the maximum stroke length of the actuator, set-points above the midpoint tend to result in overshoot and vibration. Input shaping was applied to reduce this unwanted vibration and overshoot.

Input shaping successfully reduced the overshoot and residual vibration of the response of the actuator. Input shaping did not completely mitigate the residual vibration possibly due to the application of integral gain causing the transfer function to be a third order system. This makes it difficult to properly determine the resonant frequency needed to tune the input shaper. Future work can be done to design a new type of input shaper which accounts for the non-ideal dynamics of the actuator subject to PID control.

RESEARCH REPORT

1. Name: Elizabeth Fahsbender （ID No. SP17013）

2. Current affiliation: University of South Florida

3. Research fields and specialties: Biological Sciences

4. Host institution: Hokkaido University, Center for Zoonosis Control

5. Host researcher: Professor Hirofumi Sawa

6. Description of your current research

New diseases are emerging at an increasing rate. Since it is difficult to contain epidemics, it is important to screen for possible outbreaks in order to rapidly respond to protect populations. In the past, methods for detecting viruses were lacking in that they could only detect close relatives of previously described viruses, therefore missing novel virus outbreaks and underestimating virus diversity. My research is transforming the field by using molecular techniques such as metagenomic sequencing to discover novel viruses and decipher how these viruses interact with various animals.

7. Research implementation and results under the program

Title of your research plan:

Exploring tick-associated viromes from Japan and the US, a comparative approach

Description of the research activities:

Tick specimens, including lone star ticks (*Amblyomma americanum*) from Florida, USA and *Amblyoma americanum* ticks from Amami Island, Japan, were collected using the flagging method. Lone star ticks are aggressive feeders that have been increasing in prevalence, and expanding in distribution throughout the United States. Their voracious feeding habits, and the fact that they are carriers of both *Rickettsia* and phleboviruses, make them perfect sampling candidates. Adult male and female, larvae, and nymph Lone star ticks (n = 141) were morphologically identified, surface sterilized and homogenized in lysis buffer. The homogenate was split for total nucleic acid extraction using the blackPREP tick Kit. The rest of the homogenate was filtered through a 0.45 µm filter and nuclease treated for virion purification.

Total DNA extracts was screened for *Rickettsia* using a *Rickettsia*-specific PCR assay. A pan phlebovirus RT-PCR was used to screen for phleboviruses. For the non-targeted approach, viral purification was performed to provide a larger proportion of viral sequences over a direct metagenomic approach. Pooled homogenates, based on sex and life stage, were centrifuged to remove host cells. The supernatant was filtered through a 0.45 µm filter and nuclease treated to destroy any free DNA. Following virus particle purification, total nucleic acids (DNA and RNA) were extracted using TRIzol. DNA and RNA libraries for NGS will be prepared using Nextera and NebNext® library preparation kits, respectively. An Illumina MiSeq platform was used to sequence the libraries.

Sequence data is being analyzed using CLC genomics workbench. Sequences were trimmed and assembled using the default settings of CLC. Resulting contigs were compared against a non-redundant database using BLAST.

The resulting data will be published in a peer-reviewed journal, and presented at a national meeting such as the American Society for Virology. Additionally, viral sequences of interest will be used to design PCR primers to screen individual ticks to explore prevalence and distribution patterns.

The data collected from this project will fit into larger projects being conducted in Dr. Breitbart's lab at the University of South Florida, and at Hokkaido University. The data obtained from the proposed project will fit into this project by providing complimentary data for another region (Florida), where similar tick-borne diseases are found. The viral metagenomic data will provide a snapshot of total tick-associated viral diversity in both Hokkaido and Florida. Moreover, the project will provide

preliminary data regarding the potential role of *Rickettsia* in shaping the tick virome, which can be used to design in depth studies relating to tick-endosymbiont-virome dynamics. The analysis will primarily focus on eukaryotic viruses, but we expect to find bacteriophages that will contribute to understanding the complexities of the tick microbiome. The viral data collected will also be incorporated into the NSF-funded Assembling the Tree of Life (AToL) project in the Breitbart lab which is exploring small, circular single-stranded DNA (ssDNA) viruses in invertebrates. In my initial pilot study, I discovered a novel ssDNA virus in lone star ticks, indicating there may be undescribed ssDNA viruses in ticks.

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

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Lindsay D. FIELDS （ID No. SP17014 ）

2. Current affiliation: University of South Florida

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Kyoto Prefectural University of Medicine

5. Host researcher: Prof. Jin NARUMOTO

6. Description of your current research

The most common method of diagnosing Obsessive-Compulsive Disorder is the Yale-Brown Obsessive Compulsive scale, which measures the severity of symptoms without regard to compulsions. However, this scale only considers the quantifiable time and energy lost, while also relying on potentially fallacious self-reporting. Furthermore, current systems of brain imaging arrest mobility and thus make it virtually impossible to objectively observe physical compulsions. As such, this research is focused on developing a model of compulsivity based upon Minsky's Society of Mind. The objective is to develop a model which would predict, given a set of environmental parameters, the probability of an individual with OCD performing compulsive behavior and the prevalence of such behavior. Each neurological agent, represented by an automaton, has a certain probability of reacting to a stimulus and moving into one of two varying excited states. Based on the final state of the automaton, the agent will send excitatory or inhibitory signals to surrounding agents, which also have a certain probability of changing states. If the final agent within the cycle shifts into an excited state, the subject will perform a compulsion. By applying this concept to the worry circuit, a computer algorithm was designed which implied that the likelihood of compulsive behavior can be predicted using a function of the number of compulsions performed previously.

7. Research implementation and results under the program

Title of your research plan: Developing a Predictive Model for Compulsivity in Individuals with OCD

Description of the research activities:

A clinical research study was performed to obtain data from in vivo exposure therapy for individuals with OCD, including the number of compulsive rituals performed at varying levels of exposure severity as well as the amount of time spent performing each ritual. The data obtained through the study was analyzed and used to assess the precision of the predictive capabilities of the model and adjust as necessary.

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

The JSPS program provided me with not only the capabilities to broaden my professional global reach as a scientist, but also afforded a unique cultural opportunity to experience a society other than my own. Globalization plays a large role in scientific discovery. Research priorities, especially those that relate to mental health, are often transnational and demand a global perspective. Furthermore, given that compulsions are often determined by an individual's principles, societal differences can impact differences in manifestation and treatment practices. Thus, performing this research in Japan allowed me to develop an international perspective for OCD. Finally, it will provided me the opportunity to expand my knowledge of another country so that I may continue to network as an international liaison, both within my own department and abroad, with greater ease in the future. During the summer, I also had the opportunity to experience the Gion Matsuri as well as Gozan no Okuribi.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Steven Robert Fleming （ID No. SP17015）

2. Current affiliation: University of North Carolina at Chapel Hill

3. Research fields and specialties:
Chemistry and Biological Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Dr. Hiroaki Suga

6. Description of your current research

Enzymes responsible for the biosynthesis of natural products can catalyze uncanny reactions to provide biologically interesting chemical scaffolds. A particularly useful class of natural product is the RiPPs (**Ri**bosomally synthesized and **P**ost-translationally modified **P**eptides). Studies have shown that unlike other natural product pathways, the enzymes responsible for RiPP biosynthesis are often charged with a higher degree of promiscuity which provides a nice starting point for natural product engineering.

To thoroughly and quickly analyze the vast number of RiPP enzymes, it is necessary to use a high throughput technology to study them – their substrate recognition and mutational tolerance. mRNA display is such a technique which screens trillions of ribosomally synthesized peptides, ergo it is a perfect way to synthesize and study RiPP substrates with their corresponding enzymes.

The goal of my current research is to use mRNA display technology to study the enzyme PaaA which takes its peptides substrate (PaaP) and modifies two glutamic acids. To study this reaction, I will use two focused mutagenized libraries focusing on two different recognition sequences of the substrate PaaP. Using unnatural amino acid incorporation, I will incorporate a biotin molecule at the N- terminus of all mRNA displayed molecules. After treating with PaaA, I will metabolize all peptides with free remaining glutamic acids using protease Glu-C and then pull out all biotinylated peptides with streptavidin beads. Only peptides modified by PaaA will still contain their proper mRNA tag which can then be sequenced to reveal the promiscuity of PaaA.

7. Research implementation and results under the program

Title of your research plan:

Using mRNA Display to probe RiPP enzymology

Description of the research activities: To begin this research, I learned from the Suga lab how to easily incorporate unnatural amino acids into *in vitro* translated peptides – an art I'd failed at in my home lab. Namely, I was taught how to synthesize and purify high quality tRNAs, how to charge them with amino acids, and how to use them in translation mixtures to make unnatural peptides. With these new skills, I then assembled my PaaP libraries via PCR and transcribed them into RNA. Before screening the libraries, it is imperative to make sure that the system is performing properly. Thus, I made a natural construct of PaaP and confirmed activity of PaaA with substrates containing unnatural amino acids (i.e. an N-termnal biotin). Then, I went about to optimize the selection technique. First, I optimized the amount of charged tRNA that I must add to my translation mixtures and the amount of streptavidin (a protein with high affinity for biotin) beads necessary for complete biotin-tagged mRNA displayed library capture. I have started the full screening process of PaaA reaction on PaaP libraries, but unfortunately, preliminary data suggests that there may be RNase contamination in my stocks of PaaA. I am in the process of confirming this suspicion, and if true the protein will have to be further purified before continuing with selection. Once material is confirmed clean, I shall finish the selection at home or return this winter to complete the experiments.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I am very grateful for my time in Japan. The scientific knowledge and skills that I learned will truthfully be essential for the remainder of my Ph.D. Additionally, I will never forget how much I have enjoyed living in Tokyo. I've found it to be a very exciting city after being here for two months and wish I could stay longer. I am genuinely considering returning for a post-doc position. Some of my favorite memories of the past couple of weeks include: climbing Mount Fuji, my home stay, and a trip to Okinawa.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Austin Fox （ID No. SP17016）

2. Current affiliation: Oregon State University

3. Research fields and specialties:
Physical Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Professor Hiroshi Funakubo

6. Description of your current research

There is a pressing need to discover and understand environmentally benign and sustainable replacements for Pb-based materials in all applications. For piezoelectric materials (those that convert mechanical stress into electric displacement and the converse) previous exemptions from legislative restrictions are expiring, even though suitable replacements have not yet been brought to market. One class of materials that shows promise as a replacement is based on $Bi_{0.5}Na_{0.5}TiO_3$(BNT). Although these materials appear competitive in bulk embodiments, efforts to assess their suitability in thin film applications such as actuators, accelerators, ink jet printing, microelectromechanical systems (MEMS), resonators, and transducers are lacking. In bulk form, BNT-based materials belong to a class of materials called relaxor ferroelectrics, which show enticing properties with regards to electric field induced displacement mechanisms that are just beginning to be understood. Many of these compositions show the strain and polarization behavior that is characteristic of a reversible field-induced relaxor-to-ferroelectric phase transition; these are known as ergodic relaxors. BNT-based materials in thin film embodiments do not exhibit the same enhanced properties that are found in the bulk. In particular, the ergodic relaxor compositions that have been studied in thin films do not show the signs of a reversible field-induced relaxor-to-ferroelectric phase transition, but rather behave similar to normal ferroelectrics and have comparatively low displacements. This differing response between bulk and thin films should be understood for this promising material system to be viable for real-world applications. Currently, work is being done to understand the process-structure-property relationships in BNT-based materials using conventional characterization methods such as x-ray diffraction, atomic force microcopy, scanning electron microscopy, and electromechanical measurements. While some progress has been made with the conventional methods, the novel *in situ* 2D XRD method used during this summer program has elucidated a deeper understanding of strain mechanisms in thin film embodiments.

7. Research implementation and results under the program

Title of your research plan:

In situ Structural Characterization of Lead-free, Bismuth-based Piezoelectric Thin Films

Description of the research activities:

2D X-ray diffraction (XRD^2) was used during the summer program to complete *in situ* measurements of crystal structure during and after applying electric field. Initial data analysis shows two interesting phenomena. First, an irreversible structural change occurs with increasing applied field. It may be caused by an irreversible phase change from a pseudo cubic phase to a mixed rhombohedral/tetragonal phase and/or the migration of oxygen vacancies. Second, atomic strains are found to be greater than macroscopic strains measured by double beam laser interferometry. This means that there is no or very little extrinsic contribution (non-180° domain wall motion) to the piezoelectric effect in these thin film embodiments. There also must be damping of the effects occurring. This damping is likely due to the existence of pores within and between the film layers. The ergodic relaxor compositions show very similar atomic response to the non-ergodic relaxor composition meaning that in bulk there must be a large extrinsic contribution or the atomic strains in films are limited by clamping or local compositional inhomogeneity or defects.

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

I feel as though I got to thoroughly explore the Tokyo area making friends through activities such as bicycle polo and rock climbing. I really enjoy the festival culture and how helpful and welcoming everyone is. The way science is supported in Japan is incredible and facilities are impressive. The isolation required to complete my work was difficult at times but I would absolutely suggest anyone to come do research in Japan.

9. Advisor's remarks (if any):

I am deeply appreciative of the JSPS and the NSF for supporting Austin in this work.

RESEARCH REPORT

1. Name: Carl A. GABRIELSON （ID No. SP17017 ）

2. Current affiliation: University of California, Santa Barbara

3. Research fields and specialties:
Social Sciences

4. Host institution: Hitotsubashi University

5. Host researcher: Prof. Fumika SATO

6. Description of your current research

I am interested in military-society relations, and specifically in how militaries use culture and cultural education to help support their goals. Right now, I am focusing mainly on how U.S. bases in Japan become sights of cultural exchange and cross-cultural learning, and on how that affects both interpersonal and international relations.

7. Research implementation and results under the program

Title of your research plan:

Orienting the Troops: teaching and learning Japanese culture on U.S. military bases

Description of the research activities:

I visited five U.S. military bases in Japan and joined their mandatory cultural orientations for newcomers, as well as Japanese culture and language classes. I have interviewed orientation instructors, organizers and participants, officials from public affairs and community relations offices, a Japan Self Defense Forces member working on a shared base, and the commander of one of the bases. I also collected printed materials about Japanese culture, manners, history, etc., from all of the bases.

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

I visited the Kintai Bridge in Iwakuni for the first time. It was very beautiful. I also learned how to tie an obi for a men's yukata.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Heather E. GLON （ID No. SP17018 ）

2. Current affiliation: The Ohio State University

3. Research fields and specialties:
Biological Sciences

4. Host institution: Hokkaido University (Akkeshi Marine Field Station)

5. Host researcher: Prof. Masahiro NAKAOKA

6. Description of your current research

My research centers around the biogeography and systematics in the circumboreal-temperate genus of *Metridium*. Due to the historical taxonomic uncertainty within the genus and the range of names applied throughout the geographic range, comparative work is needed to define species boundaries and understand the speciation radiation of *Metridium*. I aim, through extensive collection and comparison of individuals and populations, to determine definitive species grouping within *Metridium*. To better understand the evolutionary processes that resulted in speciation, I will also be investigating the biogeography of *Metridium* using population genetics techniques to investigate movement and dispersal within this genus. Big picture, I will explore the potential directional movement from the Atlantic to the Pacific (or vice versa) through connectivity in the Arctic Ocean. These data will also lead to building hypotheses within the Atlantic of movement from one side to the other, as well as within the Pacific. Fine scale sampling along the glaciation margin range of *Metridium* will enable me to identify potential southern, deep, or micro refugia that existed during the last glacial maximum serving to preserve species. Through identifying the geographic locations of where bottlenecks historically occurred and applying this to the current knowledge of distributions and the diversity within *Metridium*, I will be able to use another line of evidence to support taxonomic hypotheses. Experiments on the temperature and salinity limitations of *M. senile* will contribute to the ecological understanding of the species in Japan.

7. Research implementation and results under the program

Title of your research plan:

Survival limitations of the fluffy sea anemone (*Metridium senile*) in Japan

Description of the research activities:

Metridium senile, the fluffy or plumose sea anemone, is a common circumboreal-temperate species present in northern Japan. Over a period of 40 days, I investigated the environmental tolerance of *M. senile* collected from the Akkeshi estuary under laboratory conditions at Hokkaido University's Akkeshi Marine Biological Station. Specifically, I determined the maximum temperature as well as the maximum and minimum salinities survivable by *M. senile*. These limitations indicate that any changes in climate may influence the potential distribution of *M. senile*, particularly in Akkeshi estuary where these extremes may be acutely felt. In addition to temperature and salinity experiments, I was able to collect in several locations throughout Hokkaido for my broad-scale biogeography study in *Metridium*. These collections serve as the most western collections to date in my dataset and will inform my hypotheses of distribution, speciation, and evolution.

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

I was able to build relationships with members of the Nakaoka lab while experiencing living at the field station in Akkeshi. I was also able to travel around Hokkaido and thoroughly enjoyed being able to see Northern Japan, as the scenery is unique to this region, and there are many food specialties including great ice cream.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: LaTeeka Gray （ID No. SP17019 ）

2. Current affiliation: Indiana University-Bloomington

3. Research fields and specialties:

Social Sciences

4. Host institution: Gifu University

5. Host researcher: Dr. John G. RUSSELL

6. Description of your current research

What are the lives of African-Americans in Japan like? African-Americans come to Japan and stay in the country for a variety of reasons. They occupy spaces within the Japanese economy such as CEOs, translators, and bartenders, but their ties to the country oftentimes are deeper than financial opportunities. For some individuals Japan offers new social freedoms that are not seen as equally available to them in the United States, while for others Japan poses a crisis to their Black identities as they are racialized and othered in familiar and new ways by the Japanese and other foreigners.

The JSPS Summer Program project is part of LaTeeka Gray's larger research that deals with reminoritization, transnationalism/expatriatism, race, and community structure of African-Americans residing in the Greater Tokyo area.

7. Research implementation and results under the program

Title of your research plan:

American Minority Experience and Community Structure in Japan

Description of the research activities:

Originally, the segment of the project conducted under the JSPS Summer Program included Cultural Consensus Analysis (CCA) and Social Network Analysis (SNA). Due to scheduling and concerns surrounding participant burden (the amount of time and/or energy required of a participant to complete a research task), CCA was replaced with more traditional interview methods that could be conducted simultaneously with SNA. Overall, the aim shifted towards collecting information on the community demographics and structure.

In hopes of capturing a preliminary model of the social network of African-Americans as it relates to a Black community, the researcher had participants be ethnically and racially inclusive in their listings. This resulted in a network that included people who are not of African descent, but are integrated into the community through some means of engagement (i.e. hosting events, marriage, entertainers working the same circuit). A total of 98 individuals and 292 relationships between these individuals were documented in the community network. Within the documented community, there are five sub-communities present. With additional surveying, the researcher plans to fill in some of the gaps appearing in the current social network graph.

Although the social network generated using this data is not complete, it does provide preliminary insights into the community structure of African-Americans in the Greater Tokyo area. The number of ties to and length of time involved in the Black community in Japan varied greatly. Although thousands of people who identify as Black hold memberships to online community groups, it was not rare to find individuals who have lived in Japan for several years that have in the last few months begin to seek out connections to other people of African-descent for in-person interactions. While some individuals are only recently establishing community ties, several highly visible members were sought out by individuals new to Japan. Emphasis on having a Black social group to retreat to was common as it was viewed as necessary to keep oneself psychologically healthy due to strain created by being in Japan.

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

A memorable experience for me was when I learned how to make makizushi with my host dad. I've never done that before and it was my host dad's first time, as well. This resulted in my host mom having to give us a lot of instructions. Periodically she would come and fix the messy rolls we were making.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Madelyn K. GREEN (ID No. SP17020)

2. Current affiliation: Boston University Graduate Medical School

3. Research fields and specialties:
Biological Sciences

4. Host institution: Jikei University

5. Host researcher: Prof. Yoshinori KAWAI

6. Description of your current research

In attempting to better understand the human migratory patterns from Asia into North America, biological analyses of the prehistoric, historic, and modern human populations that inhabit these regions has been conducted. In past biological anthropology research, dental trait characteristics have been used to map migration and relatedness of Asiatic human populations, breaking down the general Asian population into two groups, Sinodonts and Sundadonts. These two dental complexes are characterized by specific morphologies. Sinodont populations display more derived, or evolutionarily recent, expressions of morphology whereas Sundadonts display more ancestral, or evolutionarily retained traits. In short, the Sinodont dental complex is derived from the Sundadont dental complex, through a mixture of evolutionary processes and migrations. Furthermore, given the hereditary and evolutionary relatedness of Native Americans populations of North America to Asian populations, dental trait characteristics study results reveal a primarily Sinodont dental complex trend with Native American populations.

The tracking and understanding of population relatedness due to the definition and identification of the Sinodont and Sundadont dental complexes have been beneficial when assessing prehistoric and historic populations. However, using these complexes to assign ancestral affiliation with modern populations is no longer appropriate for several reasons. Due to the separation of Native American and Asian populations on a temporal, geographical, and biological scale, both population groups have diverged on separate life history trajectories. This means that using the Sinodont dental complex as a method to align the two populations in one ancestral category is due for reanalysis. Additionally, reducing the diverse groups of Asiatic and Native American populations into a single ancestral affiliation is overly simplistic.

This research project focused on the analysis of a modern Japanese Asian skeletal population to be compared against a modern Seminole Native American dental cast collection. Nonmetric scoring of the dental characteristics typically seen in the Sinodont dental complex and a metric measurement of each tooth in the individual's dentition was conducted. Using these two different methods, the primary investigator collected data for approximately 300 individuals while in Japan. The data will be compiled using ANOVA statistics upon return to Boston University in order to assess the relatedness of the two sample populations, both within the same population and among the two different

populations.

7. Research implementation and results under the program

Title of your research plan:

Discernment of Japanese and Native American Ancestry Using Nonmetric and Metric Dental Traits

Description of the research activities:

Upon arrival at Jikei University, the primary investigator was able to take inventory of the individuals housed in the skeletal collection and input demographic information (i.e, institution sample number, age-at-death, and condition of dentition) into her personal data program. In parallel to conducting inventory of the collection, a review of the methods being applied was done by the researcher to ensure that time was not wasted.

Over the span of the nine-week researcher period, the researcher analyzed the skeletal remains of approximately 300 donated individuals at Jikei University. This number was below the estimated amount when the research was proposed, though serves as an acceptable sample size to compare and contrast with the Native American population.

Qualitative analysis of the condition of each individual was recorded before the nonmetric and metric methods. This included any abnormalities, the quality of preservation of the dentition, and specification of the type of tooth loss present. Analysis of the nonmetric traits of the dentitions were completed in concordance with the Arizona State University Dental Anthropology System (ASUDAS) and with the supplementation of exemplary dental plaques to serve as references. The metric measurements of the teeth were performed twice on each tooth (mesiodistal and buccolingual dimensions) using digital calipers. All data was recorded into an excel spreadsheet and backed up onto a separate hard-drive at the end of each working day.

The final week of research served as a fact-checking and photographic period. The researcher ensured all data was correctly recorded and took photographs of dentition for to be beneficial examples of the dental traits being researched. Statistical analysis will be conducted at the researcher’s home institution, Boston University, under the guidance of her advisor, Dr. Sean Tallman.

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

This program sponsored by Japan Society for the Promotion of Science was a wonderful experience. I am so pleased and grateful for the opportunity to not just visit Japan, but to also become integrated into the day-to-day life. I have had the opportunity to learn Japanese culture, both historically (through temple visits, museum tours, and story-telling) and modernly (through living in a Japanese share-house and social visits with my lab colleagues). I was able to climb Mount Fuji, a terrific and awesome feat and experience, alongside 7,000 fellow climbers. Exploration of Tokyo's different neighborhoods and my time in Jikei University's lab yielded a deep respect for this country and a desire to return to Japan, both for research and social endeavors.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: GRIFFIN, Kara （ID No. SP17021 ）

2. Current affiliation: Southern Methodist University

3. Research fields and specialties:

Social Sciences

4. Host institution: Sophia University, Institute of Comparative Culture

5. Host researcher: Dr. David SLATER

6. Description of your current research

This project constitutes preliminary dissertation fieldwork directed at understanding the subjective experiences and perceptions of risk and insecurity in relation to crime and policing from the perspective of police officers and individuals in the community in Tokyo, Japan. I am specifically interested in determining how individuals and local organizations construct narratives of risk and insecurity and where/with whom they locate the source of that risk. This research will attempt to place itself in dialogue with the existing ethnographic literature on policing in democratic societies as well as further explore the construction of risk and policing in a changing political, social and economic landscape characterized by global interconnectedness. It is intended to inform my dissertation research on the experience of insecurity, specifically in relation to the construction of policing and crime in Japan in the lead up to the 2020 Tokyo Olympics. The project uses ethnographic fieldwork methods including semi-structured interviews, observations, surveys, and content analysis of print and digital media.

7. Research implementation and results under the program

Title of your research plan:

Investigating local police and public experiences of insecurity and risk in Tokyo, Japan

Description of the research activities:

During this summer program I have accomplished my research goals, including collecting data for subsequent analysis, developing contacts with local researchers, and refining my research topic and questions.

I visited numerous field sites throughout Tokyo including sports venues and stadiums, police stations and memorials, museums, recreation centers, and various community events such as festivals, sporting events, and other gatherings. I engaged in observations, interviews, questionnaires, and discussions with participants at the aforementioned venues. I also collected a variety of media including police publications, academic journal articles, news media, periodicals, and social media posts.

In July, I made a trip to Kyoto where I engaged in archival and museum research and met with informants and police officials who provided additional insights into my project.

Throughout the summer, I had productive conversations with scholars at Sophia University and other institutes in Tokyo. In total, I attended eight academic conferences and lectures pertinent to security and policing, which produced invaluable networking opportunities and allowed me to gain a deeper understanding of current research in the field.

As a result of these activities, I am prepared to begin work on my dissertation research.

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

This program has been an outstanding opportunity for both research and cultural experience. I was able to improve my Japanese language ability by attending private classes and having conversations with local residents. As a result, I have made many friends with local residents and foreign visitors. I also had the opportunity to visit numerous historical and cultural sites including temples, shrines, gardens, museums, and public events. These activities have allowed me to gain additional familiarity with and appreciation for Japanese culture.

9. Advisor's remarks (if any):

Kara has made excellent progress in her pilot project. She has made contacts, collected interviews, and generally set the stage for her actual dissertation research. So far she has made excellent progress and I fully expect her to be able to begin the actual research on schedule in very good shape. Should you need any other consultation with me, please contact me directly at my email d-slater@sophia.ac.jp.

RESEARCH REPORT

1. Name: William Hancock （ID No. SP17022）

2. Current affiliation: Georgia Tech

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: Toyota Technological Institute

5. Host researcher: Dr. Makoto Miwa

6. Description of your current research

We aim to develop neural network language models for commonsense story understanding tasks. We work off of the corpus provided from LSDSem 2017 and aim to improve upon current state of the art results. This shared task presents a list of simple five-sentence stories. Each story has both an appropriate and inappropriate ending. The aim is to train a language model that can distinguish which are the appropriate endings.

7. Research implementation and results under the program

Title of your research plan:

Commonsense Reasoning in Story Understanding

Description of the research activities:

Under the guidance of Dr. Miwa, I developed neural architectures for story understanding. We approached the problem in two ways:

One: We developed neural models that we intuitively felt would model the task well. Inspiration was based off of prior language modeling experience in other tasks. We predominantly used RNNs with pre-trained word embeddings. Preliminary results show that our model improves upon that of an existing submission to the shared task. More analysis is needed to confirm these results, however.

Two: We added knowledge from external sources to the system. We use external tools to add this knowledge, E.G. Stanford's CoreNLP toolkit. We show that adding sentiment information noticeably improves recognition of the appropriate ending.

Given more time, we would like to extend the knowledge that we provide the system. I am particularly interested in semantic parsers and their ability to encode commonsense knowledge to aid in this task.

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

The hospitality of the lab has been wonderful, and I have felt completely supported by the university as well as my colleagues.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Taylor A. HARRIS （ID No. SP17023）

2. Current affiliation: University of South Florida

3. Research fields and specialties:

Chemistry

4. Host institution: Kwansei Gakuin University (Kobe-Sanda Campus)

5. Host researcher: Prof. Tsukasa OKIYONEDA

6. Description of your current research

Cystic Fibrosis (CF) is a fatal child-hood genetic disorder, caused by mutations of the CF transmembrane conductance regulator protein (CFTR). The most common CFTR mutations is ΔF508 (ΔF508-CFTR), a deletion of a phenylalanine at position 508, which resides in the nucleotide binding domain 1 of the CFTR protein.

The goal of this work was to identify small molecules and/or drugs that can bind to and stabilize the NBD1 domain of ΔF508-CFTR (ΔF508-NBD1) with *in silico* and experimental efforts.

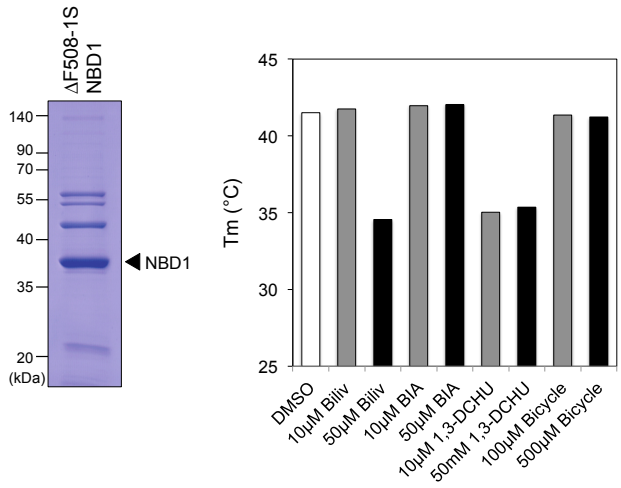
7. Research implementation and results under the program

Title of your research plan: Understanding the Chemistry behind Cystic Fibrosis

ProBiS (https://probis.nih.gov) was used to identify small molecules which could potentially bind to ΔF508-NBD1. Bicyclomycin, biliverdin, and dicyclohexylurea were found to be potential ligands based on their binding specificity. Additionally, VX-809 and 5-bromoindole-3-acetic acid (BIA) were investigated due to being known to bind to NBD1. Due to computational obstacles, no successful docking or molecular dynamic (MD) simulations were run to determine the stabilizing effects of these molecules.

Though the computational results were inconclusive, differential scanning fluorimetry (DSF) experiments of ΔF508-NBD1purified from E. *coli* in the presence and absence of these drugs were run to determine potential stabilizing effects *in vitro*.

Description of the research activities: Below are the results from the DSF experiment.



This figure shows that biliverdin (biliv) and dicyclohexylurea (DCHU) increased the melting temperature of ΔF508-1S-NBD1 purified from E. Coli, thus may have some stabilizing effect on the NBD1 *in vitro*.

We plan to continue this project upon the conclusion of this program.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): Coming to Japan to do research was an amazing, once in a lifetime experience. I've now been seriously thinking about returning after I complete my doctoral program. Thank you, JSPS, for this great opportunity! I hope the fellows to come have similar experiences as I did.

9. Advisor's remarks (if any):

In this short period, Taylor made a great accomplishment as she found chemicals which may stabilize the NBD1. We would like to continue this project as a collaboration to discover reagents that can stabilize the NBD1 in vitro and in vivo.

RESEARCH REPORT

1. Name: Nicholai M. Hensley （ID No. SP17024 ）

2. Current affiliation:

University of California, Santa Barbara (UCSB)

3. Research fields and specialties:

Biological Sciences

4. Host institution:

National Institute of Advanced Industrial Science and Technology

5. Host researcher: Dr. Yasuo MITANI

6. Description of your current research

A main challenge for biologists is addressing how complexity arises from the genetic code and changes over evolutionary time. This is especially true for behaviors, which emerge from the integration of many different biological processes, from genes to neurons. Extremely conspicuous behaviors, like those used to secure mates, are captivating and differ widely among closely related species, but assessing their genetic origins remains unknown. Current research is attempting to use many different techniques to answer how behaviors are produced at the individual level. However, these fail to incorporate how behavioral differences arise between species, an important step in describing how behavioral diversity evolves.

For my PhD thesis, I am using the bioluminescent mating displays produced by Caribbean ostracods to describe how molecular differences between species lead to behavioral diversity. In this system, I can leverage the fact that the genetic basis of bioluminescence is well known: male ostracods use the enzyme luciferase and its substrate vargulin to produce complex displays of light to attract mates. By expressing luciferase from many species, I will characterize differences in their ability to generate light, and correlate this with measurable differences in mating displays. In traveling to Japan, I have had the opportunity to learn techniques developed and optimized by my ongoing collaborators, and applied those skills to answer questions about behavioral genetics. Specifically, I have worked closely with Dr. Yasuo Mitani to generate synthetic plasmids with luciferases from various species which I have collected, attempted to express these proteins with, and test them *in vitro*. This work will allow me to (1) assess protein differences between species, and (2) test how specific amino acid changes affect protein function, and (3) compare differences to their behaviors.

7. Research implementation and results under the program

Title of your research plan:

Connecting genes to behaviors in ostracod bioluminescent mating displays

Description of the research activities:

While here in Japan, I have been able to take luciferase genes from 3 species of luminous ostracod and subclone them into an expression vector in *Pichia* yeast. This was performed by multiple rounds of PCR, restriction enzyme digestion, and ligation. Subsequent transformation into *E. coli* and sequencing confirmed the presence of the insert. The work has proven to take more time than was expected, and as such, I have had to pare down what I believe would be accomplished in my time here in Japan. However, producing these vectors has been crucial for my future success and plans for this project, and I consider it a success. I will take these plasmids and express them in yeast back in the US.

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

I had the opportunity to explore Japan before the start of the EAPSI, and some of Hokkaido during EAPSI, thanks to the generosity of this program. My host and his colleagues at AIST have been extremely kind to me and have shown me many of the great foods of Japan.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Katarzyna HITCZENKO (ID No. SP17025)

2. Current affiliation: University of Maryland

3. Research fields and specialties:

Social Sciences

4. Host institution: RIKEN

5. Host researcher: Dr. Reiko MAZUKA

6. Description of your current research

My research uses computational modeling to test hypotheses about how infants learn their native language so quickly and robustly. One of the first linguistic challenges infants face is discovering what the sound categories of their language are, a task that involves grouping sounds that vary continuously into discrete categories. As an example, in Japanese, unlike in English, the length of a vowel can change the meaning of a word: [toko] means 'bed', but [toko:] with a lengthened final vowel means 'travel.' Japanese-learning infants need to group [o] tokens into short vowels and long vowels, whereas English-learning infants need to group all [o] vowels together regardless of their duration. Learning sound categories is a hard problem because there is substantial overlap between sound categories that masks which sounds should be grouped together into a category. My research used models to investigate whether this overlap is, at least in part, due to systematic sources of variability and whether incorporating knowledge of this variability can improve sound learning. We used the Japanese vowel length contrast as a test case because no models have successfully learned this sound category system.

7. Research implementation and results under the program

Title of your research plan: Using prosody to learn sound categories

Description of the research activities:

Initially, we focused on one particular source of variability, namely prosody, or the rhythm and intonation of speech, which systematically lengthens vowels in particular positions and causes overlap in the duration of short and long vowels. Our idea was that knowing how prosody affects the duration of vowels and factoring out its influence could be helpful in learning the Japanese sound categories. To test this, we incorporated prosody into an existing computational model of sound category learning and tested whether this improved learning. However, contrary to our expectations, the prosodic model did not outperform the base model.

This result suggested to us that factoring out prosody alone could not solve the learning problem. However, it was still possible that factoring out many sources of

variability at once could help. To study this, we considered the best-case scenario and explored how much factoring out systematic variability could *in principle* help, if the effects of all of the relevant factors were known. The factors we considered for each vowel were: vowel quality (a, e, i, o, u), whether it was accented, its position in a sentence, the part of speech of the word, and identity and duration of the neighboring sounds, which are all thought to affect the duration of a target vowel. We fit logistic regression models using two approaches: in both, the goal was to predict whether a vowel was short or long, but the independent variables differed. In the first approach, we compared a model that used the vowel's absolute duration as the sole independent variable (i.e. a model that did not factor out systematic variability) to a model that regressed out the influence the other relevant factors had on duration (i.e. a model that did factor out systematic sources of variability). We found that factoring out variability did not improve our ability to predict whether a vowel was short or long. In the second approach, we used the identified factors as additional predictors rather than regressing out their influence on duration. We found that this combination of factors resulted in 99% accuracy in predicting whether a vowel token was short or long. Taken together, these results suggest that an approach that relies on factoring out systematic sources of variability may not be a successful approach to learning the vowel length contrast in Japanese, and, therefore, may not be how infants learn the sound categories of their language. Instead, the fact that adding the variables as additional predictors helped suggests that there may be other statistical regularities in the language they hear that infants could exploit.

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

I am grateful to Dr. Reiko Mazuka's whole lab, JSPS, and NSF for such a wonderful opportunity and experience. Dr. Mazuka is a giant in the field, so it was incredible to have access to her expertise and support, and she and her lab were extremely welcoming. I was able to travel and visit another lab at Kyoto University, thanks to Dr. Mazuka, as well as visit Hiroshima, Kyoto, Yakushima, Mt. Fuji, and other beautiful places in my free time.

9. Advisor's remarks (if any):

It has been pleasure to host Ms. HITCZENKO in our lab. She has worked tirelessly trying to consider factors that could possibly contribute to the long-short vowel distinction. Members of my lab, who have been working on corpus analyses, have learned a great deal from her, not only the specific models she has been working on, but also about being a graduate student in an American university. I hope this experience will enrich the future research of both Ms. Hitczenko and members of my lab.

RESEARCH REPORT

1. Name: Kevin B. HOWARD （ID No. SP17026 ）

2. Current affiliation: University of Notre Dame Department of Physics

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: RIKEN, Spin-Isospin Laboratory

5. Host researcher: Tomohiro Uesaka

6. Description of your current research

My research as an experimental physicist is focused on constraining collective nuclear structure properties that pertain to the equation of state for nuclear matter. The most direct means by which the curvature of the equation of state (EoS) is studied are the compressional mode giant resonances. The nuclear incompressibility for infinite nuclear matter, which is related to the curvature of the EoS, is determined via experiments on the isoscalar giant monopole and dipole resonances on finite nuclear systems. The Isoscalar Giant Monopole Resonance (ISGMR) can be regarded as a rapid and spherically symmetric vibration of the nuclear density in which the volume of the nucleus expands and contracts without breaking radial symmetry. Determining the frequency of this oscillation, which is quantum mechanically equivalent to the driving energy of the resonance, allows for a measure of the bulk modulus of the nuclear system which is regarded as the incompressibility of the finite system. From this value, theorists can calibrate energy density functionals to the strength distribution for a finite system to subsequently perform quasiparticle random-phase approximation (QRPA) calculations that determine the nuclear incompressibility for infinite matter on the same theoretical basis.

To these ends, a major open question in nuclear physics is why neutron-rich nuclei which do not have closed shells have experimentally lower values of the ISGMR energy than the QRPA calculations which can reproduce ground-state observables as well as the ISGMR strength distributions in “standard” nuclei such as ^{90}Zr and ^{208}Pb. My current research is working towards making measurements near and at such closed shells to the ends of guiding theory towards an explanation for this phenomena. Prior to my time at RIKEN, a systematic study on the molybdenum isotopes was completed to these ends, and with my affiliation with RIKEN we also have completed an experiment on ^{132}Sn, a highly rich, radioactive isotope which also happens to have doubly-closed proton and neutron shells. The results of these studies are highly anticipated in the nuclear structure community.

7. Research implementation and results under the program

Title of your research plan: Measurements of Collective Properties of Exotic Nuclei using Radioactive Ion Beams

Description of the research activities:

In spring of 2016, I participated in an experiment at RIKEN's Radioactive Ion Beam Factory on the study of ^{132}Sn using a deuterium active target-time projection chamber (AT-TPC), named CAT-S. During the tenure of the fellowship, in addition to working on data extraction of previous experiments, I designed and subsequently constructed a test chamber for a larger area thick Gas Electron Multiplier (TH-GEM) than that which was used in the former experiment. TH-GEM is an instrument which allows for the amplification of small ionization signals that result from particles interacting with the active target gas. The purpose of this test chamber is to measure the optimal gain settings for voltages and gas pressures for the large-area THGEM when it is installed within the larger CAT-M, which will allow for greater kinematical range for experiments as well as a large effective area and target thickness during experiments.

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

I had a truly wonderful experience in Japan. I have had several experiences in this country due to various collaborations and the general interest of my research area amongst Japanese physicists, but I have not had the opportunity to have the free time to travel and take in the culture as much as I would have liked. The highlights of my trip were the overwhelming hospitality of my host family, and that of my host researchers and colleagues at CNS and RIKEN. I had a wonderful visit to Nara, and was pleased to see that even the Japanese deer are characteristically friendly. I would thank JSPS formally for giving me the opportunity to participate in this program, and would recommend the experience to anyone interested.

RESEARCH REPORT

1. Name: HUYNH Samantha （ID No. SP17027 ）

2. Current affiliation: University of Southern California, Los Angeles CA, USA

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Advanced Telecommunications Research Institute International

5. Host researcher: Mitsuo KAWATO, PhD (Group Director) and Tomoyuki NODA, PhD (Research Advisor)

6. Description of your current research

My PhD research focuses on the use of an upper extremity exoskeleton for the use of daily tasks and rehabilitation for children suffering from Cerebral Palsy (CP) under Dr. Terrence Sanger at the University of Southern California (USC) Biomedical Engineering Department. I am focused on the design, proof of concept and validation testing of in-house prototypes that use pneumatically actuated muscles (PAMs) to help assist in movement. The muscles use electromyographic (EMG) signals from the patient in order to activate the hardware for the device.

Based on previous investigations done by the Sanger Lab, the EMG signals from CP patients can vary in strength, duration, and consistency compared to results from control groups. Therefore, the exoskeleton must be capable of reading, discerning, and using the intended muscles for assisting the patient. The exoskeleton must also be compliant in nature, such that the use of the skeleton is intuitive for users. This principle drives the current research in using pneumatics to power the device, as pneumatic muscles mimic human muscles in actuation.

In order to accommodate the input EMG signal for muscle actuation, a robust controls platform with the appropriate filtering capabilities must be developed, as well as hardware with the necessary responsiveness and compliance for the safety of the users. As the device is intended for children, size considerations as well as ease of use is paramount in the development phase. The parameters for the skeleton are specialized, and it is important to validate the hardware in terms of working pressures, exerted force, and displacement as to best optimize the muscles for use. The NSF EAPSI award in collaboration with JSPS and ATR has provided me with invaluable insight and opportunity insofar as testing my

prototype muscles against a proven industry alternative and how to become a better researcher.

7. Research implementation and results under the program

Title of your research plan:

Description of the research activities:

The purpose of this investigation is to compare an alternative power source, solely pneumatically driven muscles, to pneumatic-electric muscle actuators (PEMA) for compliance control in the exoskeleton frame for assistance in upper body mobility. We will be using pneumatically actuated muscles (PAMs) and electric-pneumatic hybrid actuators to compare their feasibility in advancements to the exoskeleton. Unfortunately, using EMG to initiate activity in the muscles was unfeasible at this time, but the groundwork for its use is underway.

This summer was spent investigating and developing the necessary components to the controls algorithms and platforms for exoskeleton activation using EMG; identifying the necessary hardware and testing parameters necessary for testing the physical components of the muscles; familiarization with ATR's controls and engineering principle in order to apply these techniques to the current research done at USC.

The PAMs developed at USC were tested under lateral load testing against ATR's PEMA and the following mechanical properties were tested: approximate exerted force, applied pressures, linear displacement. These characteristics greatly impact the future development of the exoskeleton, as the physical capabilities of the muscles must meet the standard capabilities of human muscles for daily activities such as: feeding oneself, lifting light objects, operating communication devices. The results of these experiments showed that the PAMs do indeed meet the minimum requirements for the exoskeleton project, but that considerable development to hardware composition for safety must be done.

A manuscript highlighting the advances in the hardware and software development for the actuation of the PAMs is underway.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): My time in Japan has been an experience that I will never forget and plan to continue throughout the course of my life.

ATR's work ethic and environment has cultivated within me a newfound sense of dedication and understanding for engineering. I aim to return to America with renewed vigor and enthusiasm for my research. I have never felt as safe, nor as welcome than I have since coming to Japan. There is a certain sort of enthusiasm in sharing cultures, and despite many misgivings from many well-meaning individuals, Japan is no exception to that. In fact, the tattoos and Mohawk have made me more friends than I would have had otherwise

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Emil Saber Iqbal （ID No. SP17028）

2. Current affiliation:

Virginia Commonwealth 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: University of Tokyo

5. Host researcher: Hiroaki Suga

6. Description of your current research

Many biologically relevant peptides and proteins contain macrocycles to stabilize tertiary structures and protect against proteolytic degradation. Researchers have developed several macrocyclization techniques to create peptide mimics of biological structures, most notably: lactam bridging, Grubbs metathesis, dibromoxylene cyclization, azide-alkyne "click" chemistry, and head-to- tail cyclization to name a few. Though all these methods create large macrocyclic peptides, all require a bridging moiety of substantial size. Evolutionarily pressures have optimized biological macrocycles to create many surface contacts in ligand-protein interactions; large bridging moieties can sufficiently disrupt this optimized network negating any benefits of stability conferred. This project will focus on integrating a method of methylene bridge disulfide creation into the peptide ligand discovery platform of mRNA display. This platform is the most powerful method of peptide ligand discovery, capable of simultaneously creating and screening 10 13 unique peptides. Because the methylene bridge cyclization introduced in the proposed work is only a single carbon, this method will be offer a tool to create large libraries of peptides having a minimally disrupting bridging moiety. This technology will be initially applied to a screen for trypsin inhibitors and will ultimately be be added to the growing toolkit for identifying peptide ligands inhibiting protein-protein interactions.

7. Research implementation and results under the program

Title of your research plan:

Creation of libraries of methylene thioacetal bridged peptides for ligand discovery

Description of the research activities:

During my stay at University of Tokyo, I was trained on the Flexizyme RAPiD system for peptide ligand discovery. This technique was developed by Dr. Suga's laboratory and has been used in a range of applications targeting protein-protein interactions. This technique allows for the creation of a trillion-member barcoded library of peptides, which can be used to screen against any given protein target. I performed a selection against a eukaryotic translation factor (eIF4E) and obtained sequences for selection winners. Currently work is being done to characterize our selection winner for its binding affinity towards eIF4E and any possible drug like properties it might have.

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

I have had an amazing summer being able to grow as a person and as a researcher in Japan. I was not very familiar with Japanese culture and cuisine before this trip, so I made it a point to experience as much as possible. Additionally, my host lab is renowned in my field as one of the best in the world, so being here working alongside such talented scientists was a great honor. I really hope to come back to University of Tokyo to do a postdoc!

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Michael Izumiyama （ID No. SP17029 ）

2. Current affiliation: San Francisco State University

3. Research fields and specialties: Biological Sciences

4. Host institution: Osaka City University

5. Host researcher: Dr. Satoshi AWATA

6. Description of your current research

Sexual selection is one of the primary forces driving evolution and has been a subject of intense interest in evolutionary biology. Historically, studies of sexual selection have focused on males, while sexual selection on females has received relatively little attention. This may be due to the fact that sexual selection on females is difficult to detect, owing primarily to two confounding factors: 1) The number of sires (fathers) may be an underestimate of the number of mates, and 2) it is difficult to distinguish between a fecundity trait (e.g. body size) and sexual selection on females. To address these concerns, we investigate sexual selection on Surfperches (Embiotocidae). Embiotocids have internal fertilization, prolonged gestation, and live birth providing us with a system that allows us to overcome the criticisms that have so far plagued studies of female sexual selection. I am utilizing genetic data to investigate the direct fitness benefit (increased number of offspring) associated with increased number of mates in surfperches.

7. Research implementation and results under the program

Title of your research plan:

Sexual selection on female Embiotocidae: Is the number of sires an accurate estimate of the number of mates?

Description of the research activities:

To determine the if the number of fathers is an accurate estimate of the number of mates we assessed three aspects of *Ditrema temminckii* reproduction. First, we determined the average number of fathers in *D.temminckii* broods using microsatellites. This summer we assigned paternity to previously collected samples of *D.temminckii* to obtain the average number of fathers to compare with the number of mates. Second, we determined the location of sperm storage in *D.temminckii*. Samples of *D.temminckii* ovaries were fixed and sectioned to determine where sperm storage occurs in the ovary. Third, we used variable microsatellites to determine if there is a significant difference in the number of mates compared to the average number of fathers. We extracted DNA from *D.temminckii* ovaries from mating seasons to look for the minimum number of mates. The work conducted this summer provided valuable preliminary data for a future in-depth study of sexual selection on females. Dr. Awata and our lab will continue to collaborate to answer questions of sexual selection on females.

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

During my time with the JSPS summer program, I was able to experience many aspects of Japanese culture. One of the most impressive aspects of Japan was the rich history of Marine biology. I was able to visit the Hayama Imperial Villa where work from Emperor Showa was displayed it was very moving to see the work of an emperor/marine biologist as a fellow marine biologist. This summer I had the opportunity to explore regions of Japan which were secluded due to the location of the various marine station I visited. I was able to dive beautiful coral reefs in Iriomote Island, and dive shipwrecks and reefs in Sado Island the beautiful aspects of nature in Japan was something I never experienced

9. Advisor's remarks (if any): He studied very hard, and we have made big progress on the surfperch study. Also, he had a lot of valuable experiences such as Japanese culture, scuba diving, and experimental approaches.

RESEARCH REPORT

1. Name: Caitlin Jacques （ID No. SP17030）

2. Current affiliation: Washington State University

3. Research fields and specialties:
Biological Sciences and Molecular Genetics

4. Host institution: RIKEN Yokohama

5. Host researcher: Dr. Keiko Sugimoto

6. Description of your current research

As sessile organisms, plants need a complex set of systems to turn external signals into internal cues. The factors that they respond to include but are not limited to: water, salinity, temperature, and light (Demmig-Adams, 2002; Zhu, 2003; Wang et al., 2003). Plants can use light as an energy source and as way to sense and respond to their current environment. With small seedlings and a short reproductive time, *Arabidopsis thaliana* is a model system that is extremely useful for studying responses to light.

Using *Arabidopsis* as a model system, my primary focus as a member of the Neff Lab is to understand how light mediates seedling growth. One key group of genes involved in this process is the *AT-HOOK MOTIF NUCLEAR LOCALIED* (*AHL*) gene family. *SUPRESSOR OF PHYTOCHROME B-4* (*SOB3*) is *AHL*29 and was identified in an activation-tagging screen for suppressors of the long-hypocotyl phenotype of *phyB-4*, a weak *phyB* allele (Street et al., 2008). *AHL* family members are known to regulate hypocotyl elongation (Street et al., 2008; Zhao et al., 2013). We have now begun to understand how they do so at the transcriptional level (Favero et al., 2016). In a collaborative study between the Neff and Sugimoto labs, we used chromatin immunoprecipitation followed by quantitative real-time PCR (ChIP-qPCR) to demonstrate that SOB3 binds to the promoters of the auxin-associated genes *YUCCA8* (*YUC8*) and members of the *SMALL AUXIN UP RNA 19* (*SAUR19*) subfamily. This research indicated that SOB3 modulates hypocotyl elongation in seedlings by repressing transcription of these genes (Spartz et al., 2012; Mashiguchi et al., 2012; Favero et al., 2016). However, what still remains unclear is the relationship between SOB3 and other hormones. This question will be investigated by using ChIP-Seq in the Sugimoto Lab at RIKEN.

7. Research implementation and results under the program

Title of your research plan:

Investigating the roles of hormones in AHL-mediated seedling growth in *Arabidopsis thaliana*

Description of the research activities:

ChIP-Seq can be broken down into three main steps:

1) Preparation of plant material
2) ChIP
3) Library preparation and sequencing

1) Preparation of plant material (June 20th – July 7th): *proSOB3::SOB3-GFP sob3-4* seeds were plated on 1x MS media and stored in 4C/dark for three days. At the end of three days, they were moved into 25C and short day conditions (8hr/16hr). Harvesting began on day 5. The time points collected were: four hours after dawn (ZT4), nine hours after dawn (ZT9), and twenty-four hours after dawn (ZT24). Three replicates of each time point were made and harvested. Seedlings were frozen in liquid nitrogen and stored in -80C until ChIP.

2) ChIP (July 10th –August 10th): ChIP was conducted twice. The first round of ChIP only contained samples from the first replicate to ensure that the ChIP procedure worked. Samples from replicate two and three were done together in second round of ChIP. DNA collected from ChIP was stored in -20C until library preparation.

3) Library preparation and sequencing (August 11th – 18th): ChIP samples were prepared into libraries for sequencing. They will be sent to the sequencing center On August 22nd.

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

Dr. Sugimoto and the members of her lab were wonderful.

9. Advisor's remarks (if any):

1. Name: Danielle N JONES （ID No. SP17031）

2. Current affiliation: Kent State University, Kent, OH, USA

3. Research fields and specialties:

Biological Sciences

4. Host institution: The Primate Research Institute, Kyoto University

5. Host researcher: Prof. Yukiori GOTO

6. Description of your current research

My current research focuses on the neurochemical and genetic basis of social behavior in humans and nonhuman primates. I am particularly interested in elucidating the biological foundation of human-specific psychiatric disorders such as anxiety, depression, and antisocial personality disorders. I use immunohistochemistry and stereology to quantify differences in neurotransmitter levels across brain regions in nonhuman primates. I also use molecular laboratory methods to study genetic variation in genes involved in neurotransmission and behavior modulation. Currently, I am working on my master's thesis project, which is a study of the serotonergic innervation of the amygdala among four macaque species. The genus *Macaca* consists of 23 species and significant differences in social behavior have been observed among them. My project aims to connect past behavioral findings from the literature to macaque neurobiology. In doing so, I hope to contribute to our understanding of the evolution of social behavior and the brain within the primate lineage.

7. Research implementation and results under the program

Title of your research plan: The Role of Monoamine Oxidase-A Gene Polymorphism in Aggressive Behavior in Macaques

8. Description of the research activities:

The focus of our project was *MAOA* genetic polymorphism in rhesus and Japanese macaques. The *MAOA* gene encodes an enzyme that degrades several neurotransmitters and is therefore integral to brain function and behavior. Specifically, we tested whether *MAOA* allele frequency within the two species is associated with differential aggression between them. To do this, we genotyped each of the 111 monkeys for the *MAOA*-VNTR polymorphism, sequenced this region using representative monkeys that possessed each allele, and analyzed behavior to search for species-level differences in aggressive behavior. We hypothesized that the Japanese macaques would be, on average, less aggressive than the rhesus macaques and that the low activity *MAOA* allele (*MAOA*-L) frequency would be higher in the Japanese macaque sample. Our expectation to find a higher *MAOA*-L allele frequency in the Japanese macaque sample was based on the observation that the monoamine oxidase-A enzyme preferentially degrades serotonin, and low *MAOA* activity would therefore result in higher levels of circulating serotonin. Furthermore, high levels of serotonin have been associated with low levels of aggression and increased affiliative behavior in humans and nonhuman primates in past studies. Our hypotheses were supported in that 92% of Japanese macaque alleles were *MAOA*-L. Comparatively, only 35% of alleles in the rhesus macaque sample were *MAOA*-L. Based on our preliminary analysis of behavior, the Japanese macaques were also, on average, less aggressive than the rhesus macaques. It should be noted that behavioral data analysis is still underway and our finding of species-level differences in behavior is tentative. Additionally, we discovered a novel *MAOA* allele in the rhesus macaque sample. This suggests a more complex genetic component to behavior modulation in this species, which may be related to the wider geographic range and particularly flexible behavioral repertoire of rhesus macaques. In sum, our findings suggest that *MAOA*-VNTR alleles may contribute to species-level differences in aggressive behavior within the genus *Macaca*. Future studies will focus on the role of additional genes implicated in behavior modulation and the epigenetic regulation of such genes in individual monkeys. Such studies will help clarify the basis of individual differences in neurotransmission and potentially aid in the development of specialized therapies for psychiatric disorders.

RESEARCH REPORT

1. Name: Preeya KURAY （ID No. SP17032）

2. Current affiliation: Pennsylvania State University

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Osaka University

5. Host researcher: Prof. Tadashi Inoue

6. Description of your current research

Interpenetrating polymer networks (IPNs) are a combination of two or more permanently cross-linked polymers in network form. The polymers can be synthesized sequentially or simultaneously, and crosslinking inhibits large scale phase separation. Due to their viscoelastic characteristics and tunable glass transition region, IPNs have been found to be useful in energy damping applications. When synthesized simultaneously, an IPN is created by the concurrent reaction of the two polymers, which facilitates a large fraction of interface between the intertwined crosslinked systems. My current research involves investigating IPNs of polyurethanes and epoxies, and studying how the interface between the two domains affects the energy dissipation properties. Dynamic mechanical analysis and dielectric relaxation spectroscopy are used to explore mechanical and electrical energy dissipation.

7. Research implementation and results under the program

Title of your research plan:

Investigating the Fundamental Relationship Between Conductivity and Molecular Motion of Polymerized Ionic Liquids.

Description of the research activities:

Polymerized ionic liquids (PILs) are defined as single ion conducting ionononmers with a melting point below 100 degrees Celsius. They are desirable as electrolytes in energy applications such as batteries due to their mechanical stability and conductive properties. This study examines the effect of counter anion size on conductivity and segmental motion in imidazolium based backbone PILs. The PILs were synthesized by step growth polymerization of a diamine with a dibromoalkane; and then an anion exchange reaction procedure was applied using various counteranions (BF_4^-, TFO^-, NfO^-, $TFSI^-$, $HFSI^-$, and $PFSI^-$).

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

I was fortunate enough to have a culturally fruitful experience in Japan. My time in Osaka enabled me to visit friends that I have in Kansai due to previous research/work experiences in Japan. I was also able to take a business trip to Okinawa Institute of Sciences and Technology to visit a collaborating researcher.

9. Advisor's remarks (if any): Miss Preeya is an active and friendly person, and her participation in our research has been a good stimulus for our field and also for my students.

RESEARCH REPORT

1. **Name**: Raniero Lara-Garduno (ID No. SP17033)

2. **Current affiliation**: Texas A&M University

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

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

5. **Host researcher**: Takeo Igarashi

6. **Description of your current research**

Dissertation research involves the development of new digital tools for use in the field of clinical neuropsychology, with a goal to collect usage metrics from digital tools to develop a behavioral profile for patients with varying degrees of cognitive function. The tools developed have previously been close adaptations to existing paper-and-pencil examinations administered by clinicians. Analyzing this usage data with Machine Learning algorithms typically applied to digital sketch recognition, preliminary behavioral models have been constructed that can be used to classify participants based on high-level categories such as age.

7. Research implementation and results under the program

Title of your research plan:

Implementing and Analyzing 3-Dimensional Variants on Digital Neuropsychological Exams

Description of the research activities:

Development and user trial of a cognitive testing tool that leverage touch input and modern 3-D rendering technology, with the purpose to collect a richer set of behavioral data than would otherwise be possible with more conventional paper-and-pencil examinations.

The digital testing tool was written in C# on the Unity engine, with its user experience designed to be as intuitive and streamlined as possible. A participant can can complete the examination with one finger, using it to rotate a sphere comprised of numbered cubes in a simulated 3-dimensional space and, with the same finger, tapping the correct box in the sequence. When a participant taps the correct box, the box disappears, clearing the box from view and revealing more numbered boxes underneath. The examination is complete when all the boxes have been removed from view.

Despite a simpler input modality, high-level cognitive function is tested in ways that

the traditional paper-and-pencil Trail Making test does not. Participants are required to remember boxes that may be behind what they can currently see, and they must also be able to recognize numbers that may be upside down or skewed in unusual ways.

The testing tool was designed with various specifications to create as streamlined an experience as possible. Properly conveying depth perception of a 3-dimensional object projected into a 2-dimensional screen resulted in conscious visual design, such as the decision to integrate a metallic sheen on boxes so that light may reflect off their surface, a sky background that communicates the presence of a "sun" in the distance, and accompanying shadows that clearly indicate different degrees of perception and location of boxes relative to one another. The touch input implemented received similar scrutiny, undergoing various iterations and altered features. Input sensitivity to detect a tap was constantly altered to create the clearest differentiation between an intended tap and a brief drag action, and we experimented with various forms of movement friction as well as collecting a richer set of data by recording the physical location of the finger touches in conjunction with the sphere location.

This research program also yielded additional features not originally included in the proposal. A "B" variant of the test, which labels boxes in an order that alternates between numbers and letters (i.e., 1, A, 2, B, 3, C) was implemented, a feature analogous to the B variant of a traditional Trail-Making Test. Additionally, a "Playback" feature was added that reads existing participant data and plays back "tap" and drag actions on a sample sphere in real time, making it possible for a clinician or other researchers to observe a participant's behavior an arbitrary number of times.

This research program also included a user study which acquired test completion data from 20 members of the Japanese population. The test population centered on college-aged, cognitively healthy individuals. A research ethics review process was started in this research period, with the intent to complete it after the program's conclusion to secure the ability to publish with this data.

8. **Please add your comments, including any cultural experience during your stay in Japan (if any):** This program provided a highly enriching experience on a professional and personal level. Connections with other program fellows and lab-mates yielded invaluable results, with full intent to continue collaboration and communication.

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

RESEARCH REPORT

1. Name: Naomi Lewandowski （ID No. SP17034）

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

3. Research fields and specialties:

Biological Sciences

4. Host institution: University of the Ryukyus

5. Host researcher: Dr. Yuzuru Ikeda

6. Description of your current research

The overall goal of my doctoral research is to identify key behavioral and ecological factors in cephalopod reproduction that may inform conservation measures. Research completed at my home institution (Brooklyn College) focuses on the social behavior of the solitary, deep-sea Chambered Nautilus. My experiments aim to describe the role of scent and of centralized food sources in promoting social interactions and perhaps mate choice in the Nautilus. Results could reveal information that could lead to conservation in this already exploited group. Experiments done as part of the JSPS Summer Program will determine the effects of human activity and habitat quality on the reproductive behavior of oval squid. Along with members of my host laboratory, I have surveyed oval squid spawning grounds in multiple locations and have monitored oval squid mating behaviors in a controlled setting. The oval squid project aims to discover the habitat preferences of spawning squid and if these habitats are affected by human population density. These projects together will identify environmental, and human factors that influence cephalopod social and mating, behavior as well as lead to future conservation measures.

7. Research implementation and results under the program

Title of your research plan:

Oval squid reproductive behavior: Field and laboratory studies

Description of the research activities:

My summer research consisted of two components, a collaborative field project and an independent laboratory experiment. The goal of the field project was to survey shallow water ecosystems around Okinawa, observe oval squid egg clusters, and determine characteristics of their spawning habitat. We chose sites in order to sample near locations of differing human population density: near the center of Okinawa Island, the south of Okinawa Island, and Iriomote Island. Both seagrass and coral reef habitat were surveyed and egg clusters were found in areas of dense seagrass growth in central and south Okinawa Island. Each time an egg cluster was found, a quadrat was placed over the area and photographs were taken in order to determine the characteristics of the eggs and of the immediate surrounding habitat. However, no eggs were found in Iriomote island and the remote area will require further surveys in order to determine the preferred local spawning locations. Other laboratory members will continue the field work into the late summer and fall, and I will work with them remotely to analyze data and determine the results.

The goal of the laboratory component of my summer research was to determine how different habitats could affect the reproductive behavior of oval squid. Squid were captured via jigging and introduced into a large tank within the laboratory. The tank had three habitats reflecting the squid's natural environment: coral rubble, short seagrass, and tall seagrass which had been collected from the same location as their eggs were found. In a second round of trials I added a short and tall coral habitat to the existing habitats to give a wide range of choice. Squid were observed and their position in the tank was tracked to see if swimming patterns reflected any habitat preference. Mating behaviors were also observed and will be analyzed for habitat preference. After my completion of the summer program, other laboratory members will monitor the squid and record any spawning behaviors as well as the habitat chosen for spawning. Preliminary results suggest that squid may avoid areas of high complexity such as tall seagrass or coral and further data analysis will confirm this result and may suggest specific reasons for this behavior.

Overall this project gave me the opportunity to work with an organism that shows complex but characterizeable behaviors which may give insight into how different factors affect their reproduction. Further, oval squid are targeted heavily by fisheries and determining the details of their reproductive ecology could help to maintain their populations.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): Overall my experience during the JSPS Summer Program was phenomenal. Though I spent much of my time doing research, I also took advantage of my free time to explore Okinawa. I visited different parts of the island and spent time doing outdoor activities like fishing and snorkeling. I also visited local historical sites and had the opportunity to try many fantastic foods. Working with all of my laboratory members and becoming friends with them has easily been the most rewarding part of the entire experience and I cannot thank them enough for all of their help.

9. Advisor's remarks (if any)

RESEARCH REPORT

1. Name: Dana R. LOUIE （ID No. SP17035）

2. Current affiliation: University of Maryland

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: University of Tokyo

5. Host researcher: Professor Motohide TAMURA

6. Description of your current research

My primary research in the US consists of simulating the capabilities of the James Webb Space Telescope (JWST) Near Infrared Imager and Slitless Spectrograph (NIRISS) instrument during spectroscopic observations of exoplanets. In particular, I use my simulations to predict the signal-to-noise (S/N) that JWST is likely to attain during transmission spectroscopy of both already known exoplanets, as well as planets that will be discovered using the Transiting Exoplanet Survey Satellite (TESS).

TESS will launch in March 2018 to conduct a wide-field survey of most of the sky, searching for transiting exoplanets. However, in addition to discovering real transiting exoplanets, TESS will also detect some false positives. Thus, other instruments or techniques must be used to confirm which of the TESS discoveries are true transiting exoplanets, and which are false positives. One method to distinguish between real transiting exoplanets and false positives is multiband photometry.

Japan has recently developed the **Mu**lticolor **S**imultaneous **C**amera for Studying **A**tmospheres of **T**ransiting Exoplanets, or MuSCAT, located at Okayama Astrophysical Observatory. MuSCAT distinguishes light in three photometric bandpasses. By observing a candidate exoplanet in these three bandpasses and comparing the light curves, it is possible to distinguish between actual transiting exoplanets and false positives. The purpose of my research in Japan is to simulate MuSCAT performance to determine which of the anticipated TESS discoveries can be validated using MuSCAT.

In the US, I use the IDL programming language to produce my simulations. However, here in Japan, I am using the Python computer language since it is more accessible to astronomers who may need to use the simulation routines that I write. In addition, my work in the US deals with spectroscopic observations from space, while in Japan I am simulating photometric observations viewed through the Earth's atmosphere.

7. Research implementation and results under the program

Title of your research plan:

Multiband Photometry Simulations to Distinguish Transiting Exoplanets from Astrophysical False Positives

Description of the research activities:

I spent some time learning the Python programming language and reading scientific papers and books written about photometric ground-based observations and methods others have used in distinguishing false positives. In addition, I have started to create Python simulations.

I visited Okayama Astrophysical Observatory, where I took part in 2 nights of telescope observations using the MuSCAT instrument to observe two transiting Hot Jupiter exoplanets. The observations allowed me to better understand the operation and limitations of the MuSCAT instrument, as well as the output data products.

I gave 3 different presentations of my JWST/NIRISS work in the US. Presentations took place at NAOJ, at University of Tokyo, and during a 2-day Transiting Exoplanet Workshop meeting held in Miura. I varied the presentations to the audience, giving more background on exoplanet transmission spectroscopy at NAOJ and UT, and providing more information about on-line NIRISS planning tools at Miura.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I would like to continue to work with Japanese students and scientists that I have met, if possible. I lived in Japan before for 7 years, so re-experienced some aspects of Japanese culture and reconnected with some Japanese friends. The *best* new experiences I had dealt with using my language skills to try to do things in Japan. For example, I bought tickets to Skytree and also paid for something by mail order by using the machines at local convenience stores, which only had Japanese menus! The payment process was indeed very convenient!

9. Advisor's remarks (if any):

During her stay, she made a great seminar and good discussions with Japanese researchers. Her seminar was indeed fruitful especially graduate students. As she is good at speaking and hearing Japanese language, it was easy for graduate students and secretaries to communicate with her. I am glad if she really enjoyed her stay in Japan.

RESEARCH REPORT

1. Name: Thomas McCauley （ID No. SP17036）

2. Current affiliation: University of Miami

3. Research fields and specialties: Social science

4. Host institution: Kobe University

5. Host researcher: Dr. Yohsuke Ohtsubo

6. Description of your current research: Recent research suggests that the ubiquity of forgiving thought and behavior in humans reflects a psychological adaptation for forgiveness, which evolved in as a function of forgiveness' propensity to increase fitness gains by maintaining valuable cooperative relationships. However, our understanding of forgiveness' evolved design is based almost exclusively on studies conducted in Western societies, which tend to have unique interpersonal relationship patterns compared to other societies, such as those in East Asia. Given that a variety of interpersonal relationship processes are pertinent to forgiveness, stable societal differences in these processes may impact evolved forgiveness mechanisms. One important source of variance in cross-societal interpersonal relationship processes is relational mobility, the degree to which new social opportunities are available in a given society. Relational mobility has successfully explained previously puzzling cross-cultural differences in social phenomena such as self-disclosure in close relationships, and the relationship between self-esteem and happiness. Relational mobility may be relevant for cross-societal differences in forgiveness as well, as an index of the *number* of potential relationship partners one can choose from has implications for the *value* of those partners, compared to one's current partners. In societies where new relationship opportunities are scarce (i.e., low relational mobility societies), existing partners are extremely valuable, and victims are externally incentivized to give transgressors another chance. In contrast, in societies where new relationship opportunities are plentiful (i.e., high relational mobility societies), victims may be less motivated to tolerate easily replaceable transgressors. The purpose of this project was to investigate how forgiveness mechanisms operate across diverse societies, focusing on the United States (a high relational mobility society) and Japan (a low relational mobility society). We predicted that decisional forgiveness would be higher in Japan than the US, that emotional forgiveness would be higher in the US than Japan, and that relational mobility would mediate these differences. This study was pre-registered to increase transparency and reproducibility (https://osf.io/zkeks/, embargoed until 2018).

7. Research implementation and results under the program

Title of your research plan: A cross-cultural study of the relationship between social ecology and evolved cognitive systems for forgiveness.

Description of the research activities: **Methods**. We collected data from undergraduate students recruited from the College of William & Mary in the US (n= 168, females=100) and Kobe University in Japan (n_j= 158, females=86). All data was collected using computer-based surveys on Qualtrics. **Results**. We first examined cross-national differences in relational mobility, emotional forgiveness, and decisional forgiveness. The US was dummy coded as 1 in our analyses, and Japan was dummy coded as 0. Consistent with previous studies, relational mobility was significantly higher in the United States (M=4.45, SD=0.70) relative to Japan (M=3.97, SD=0.76; t(324)=5.88, p=10^{-8}, 95% CI [0.32, 0.64]). To our surprise, however, decisional forgiveness did not significantly differ between the United States (M=4.13, SD=0.61) and Japan (M=4.26, SD=0.92; t(324)=-1.52, p=0.13, 95% CI [-0.30, 0.04]). Similarly, emotional forgiveness did not differ between the United States (M=3.24, SD=0.88) and Japan (M=3.12, SD=0.82; t(324)=1.24, p=0.21, 95% CI [-0.06, 0.30]). We then examined the relationship between relational mobility and forgiveness. Relational mobility and decisional forgiveness were uncorrelated (r(324)= -0.002, p=.997), as were relational mobility and emotional forgiveness (r(324) = .07, p=.19). Finally, we examined if relational mobility mediated the relationship between country and each kind of forgiveness. Although we failed to detect an effect in the above analyses, significant path coefficients are not necessary to detect significant mediation in a full model (e.g., Hayes, 2009). However, mediation analyses were non-significant for both decisional forgiveness (β= -0.01, 95% CI [-0.05, 0.03]) and emotional forgiveness (β= 0.02, 95% CI [-0.02, 0.06]). Despite these null findings, our results were ultimately in the predicted direction: Japanese tended to display greater decisional forgiveness relative to Americans, and Americans tended to display greater emotional forgiveness relative to Japanese. Further, mediation analyses were marginally significant for emotional forgiveness, indicating that relational mobility's putative mediating effect on forgiveness may yet be valid. However, even if this is the case, relational mobility's effect on forgiveness appears to be much smaller than we initially presumed, and perhaps negligible.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): The cultural experience was life changing for me, both as a social scientist enamored with cultural behavior, and an outsider to Japan.

9. Advisor's remarks (if any): Dr. Ohtsubo was pleased with the project.

RESEARCH REPORT

1. Name: Siti Nur Sarah Morris （ID No. SP17037）

2. Current affiliation: University of California, Berkeley

3. Research fields and specialties:
Biological Sciences

4. Host institution: RIKEN Yokohama

5. Host researcher: Akiko Minoda, Ph.D.

6. Description of your current research

The triazine herbicide, Atrazine, is widely used by the US agricultural industry; its ubiquitous usage has led to its bioaccumulation in the drinking water reserves of 33 million Americans. Atrazine's pervasiveness is a cause of concern since the potential adverse health effects of the herbicide are not fully understood. Human population exposures are frequently in the low-dose range over a prolonged period of time, making it difficult to draw conclusions about long-term adverse health effects. Furthermore, atrazine has strong effects on microbial communities—extinguishing entire clades whilst promoting growth of others—thus suggesting an unappreciated microbiome component of atrazine susceptibility. Moreover, the bidirectional signaling of the gut-brain axis (GBA) indicates a connection between the gut microbiome, brain health and behavior. This suggests that perturbations in the microbiome may adversely affect the host's brain. However, the nuances of the how these prokaryotes influence the brain remain to be elucidated. To that end, Drosophila can be used as a model system to interrogate the connection between gut microbiome and behavioral and health outcomes. We conducted a dose response study at environmentally relevant concentrations of atrazine in D. melanogaster. Flies are assayed for metabolic and behavioral abnormalities and analyzed for the composition of their gut microbiome. These studies pinpoint genes and microbial populations related to atrazine-dependent behavioral abnormalities and health defects. As some behavioral or locomotor phenotypes may be subtle, we employed the cTrax automated behavioral detection system that tracks the movement of fruit flies restricted to two-dimensional surfaces for 5 min intervals. Analysis of this data measures the locomotor fitness, courting frequency, receptiveness of mating and aggression of treated vs. untreated populations. This high-content phenotyping provides substantial statistical power to discern subtle neurological or neuromuscular symptoms.

7. Research implementation and results under the program

Insights into the molecular basis of aging are key to developing diagnostic and therapeutic methods for alleviating age-related disorders. However, one of the difficulties in creating a

general age panacea is the fact that the chromatin environment within each cell ages differently. Therefore, one of the goals for aging research is to characterize how cellular populations change over time. This project will focus on immune cells because weakening immune response is a common complaint in the elderly.

The purpose of this project is to develop a Assay for Transposase-Accessible Chromatin sequencing (ATAC-seq) protocol for the characterization of epigenetic heterogeneity in mouse ILC2 cells. ATAC-seq is a novel method to determine the status of epigenetic chromatin modifications. Unlike other forms of sequencing, ATAC-seq is able to map nucleosome positions, thereby providing a multidimensional description of the cellular epigenome. Application of this promising technology to the question of ageing and ageing-related disease opens up new avenues of discourse and possible therapeutics.

Title of your research plan:

Developing a Novel Sequencing Method to Map the Aging Genome

Description of the research activities:

Practiced the ATAC-seq protocol with multiple permutations to better understand the technique.

Collaborated with the RIKEN murine labs to collect FACS-sorted ILC2 cells.

Optimized human-derived ATAC-seq to fit the mouse model.

Studied the bioinformatics-pipelines necessary for heterochromatin sequencing.

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

Visited various parts of Tokyo, Yokohama, Kawasaki, Kawagoe, Nikko, Hakone, Kawaguchiko, Kyoto, Nara.

Dressed as a geiko (Kyoto geisha) and celebrated multiple hanabi and matsuri dressed in yukata.. Ryokan in Hakone. Horseback riding in Kyushu. Experienced a blind ambulance ride. Got lost several times. Ate way too much food.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Breanna Morrison （ID No. SP17038 ）

2. Current affiliation: University of Arkansas

3. Research fields and specialties:

Social Sciences

4. Host institution: Doshisha University

5. Host researcher: Dr. Ayumi Tanaka

6. Description of your current research

This research looked to see if the mindset instrument may be used across cultures with a focus on American and Japanese middle and high school students. Additionally, there was a specific focus on how mathematical attitudes relate to the mindset instrument due to an increasing need for mathematical ability in the work force. The Dweck Mindset instrument is a relatively new instrument focused on evaluating one's theory of mind. One's theory of mind could be either an entity or incremental theory of mind. Those with an entity theory of mind view intelligence as something more static and unchanging. Those with an incremental theory of mind view intelligence as something more changing and is sometimes referred to as the "growth" mindset because you view intelligence can grow. There has been research showing that having an incremental mindset leads to more positive academic outcomes. There has also been research looking at how Western and Eastern cultures view learning. Eastern cultures tended to put more emphasis on effort and persistence while Western cultures viewed innate ability as more important than Eastern cultures did. However, there has not been much research done using the Dweck Mindset measure across cultures. Based on previous related research you would expect Eastern cultures to rate higher on incremental views of intelligence than Western cultures. It is not enough to just translate the instrument into another language and assume it is measuring the same thing. It should be determined if the measure is working similarly across cultures which is the purpose of this research.

7. Research implementation and results under the program

Title of your research plan: Evaluating the Psychometric Properties of a Measure of Mathematical Mindset Attitudes Across Cultures

Description of the research activities: Two American middle schools, one American high school, one Japanese junior high school, and one Japanese high school were surveyed. Teachers handed out surveys that included a variety of measures to students. There were 407 American students who filled out at least a portion of the survey and 426 Japanese students who filled out at least a portion of the survey. As hypothesized, those with a higher scores on an incremental theory of mind also tended to have higher scores on other positive attitudes such as math self-construct and math interest. The correlations between these measures were similar in both countries. Both countries showed poorer math attitudes in high school than in junior high with both country's high school students showing higher math anxiety and lower math self-efficacy. Measurement invariance was analyzed to determine if the mindset instrument could be used to compare the two country's students. While configural invariance seemed to hold, the mindset measure did not pass tests focused on stricter measurement invariance tests. Although Japanese students overall held poorer math attitudes, including having lower levels of incremental mindset theory, comparing American and Japanese students' means on the mindset measure may not be valid since measurement invariance was not established. However, the scales seems to work similarly within country. Further research will focus on slightly altering the wording of the mindset instrument and exploring other measures that will attempt to measure mindset while being more cross-culturally comparable.

RESEARCH REPORT

1. Name: Robert Nakata ID No. SP17039

2. Current affiliation:

None

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Ritsumeikan University

5. Host researcher: Professor Shigeru Takayama

6. Description of your current research

Remote sensing has many applications, including surveying and mapping, geophysics exploration, surveillance, search and rescue and counter-terrorism operations. Remote sensor systems typically use visible image, infrared or radar sensors. Camera based image sensors can provide high spatial resolution but are limited to line-of-sight capture during daylight. Infrared sensors have lower resolution but can operate during darkness. Radar sensors can provide high resolution motion measurements, even when obscured by weather, clouds and smoke and can penetrate walls and collapsed structures constructed with non-metallic materials up to 1 m to 2 m in depth depending on the wavelength and transmitter power level. However, any radar platform motion will degrade the signal of interest. We will investigate platform stabilization and motion compensation techniques to reduce and remove the radar signal distortion introduced by the platform motion. These techniques could be deployed on a drone platform and enable the detection of victims that are buried alive in a collapsed structure after an earthquake by using a radar to detect their respiratory motion. At Ritsumeikan University, I plan to continue work on integrating prior radar motion capture and compensation algorithms with camera image tracking that stabilizes the drone platform.

7. Research implementation and results under the program

Title of your research plan:

Multi-Sensor Methods for Mobile Radar Motion Capture and Compensation

Description of the research activities:

The radar sensor system was built from several components that are mounted on the drone: two radar sensor modules, preamplifier for each radar, an Arduino controller that digitizes the data and an on-board data storage memory card. To stabilize the drone in the horizontal direction, a laptop on the ground with control software tracks a stationary light source using the drone's forward camera. Onboard ultrasonic sensors track and stabilize the altitude. The control software adjusts the drone's motors to maintain a steady hover, thereby enabling the detection of respiratory motion by the radar.

Although the drone motion is reduced by the real-time control software, any remaining residual motion must be removed via signal processing. The data was processed using a motion compensation algorithm written in MatLab. Using a mechanical actuator to simulate respiration, the average signal improvement using this algorithm is 18dB (decibels) equivalent to a 66 fold increase in signal strength.

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

I am always amazed at the Japanese hospitality, starting with my homestay host, research host and in my daily interactions with colleagues and newly met friends. Even strangers on a train would go out of their way to provide directions. The juxtaposition of Kyoto's ultra-modern train station atrium and ancient temples impressed and inspired me in my daily commute.

9. Advisor's remarks (if any):

Using the drone mounted two radar sensors and camera, Dr. Nakata successfully constructed a remote system to measure very small respiratory motion in these 8 weeks only. In that research activity, he had very nice cooperation with our faculty and students. It has also been a great opportunity for us.

RESEARCH REPORT

1. Name: DanQuynh NGUYEN （ID No. SP17040）

2. Current affiliation: University of California, Santa Cruz, USA

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Osaka University

5. Host researcher: Prof. Kiyokazu NAGATOMO

6. Description of your current research

My research interest lies in the study of vertex operator algebras (VOAs) associated with the Virasoro algebra (Virasoro VOAs for short) and their modules. Such VOAs are among the most important objects in VOA theory because they play crucial roles in two-dimensional conformal field theory and string theory, to name a few. The irreducible and unitary highest weight modules of the Virasoro algebra are of significant interest because they give rise to physically feasible states. Virasoro VOAs over the field of complex numbers have been extensively studied while those over fields of prime characteristic are much more elusive. My summer project focused on determining the conditions on the prime characteristics for which certain classical results (i.e. over the field of complex numbers) remain true.

7. Research implementation and results under the program

Title of your research plan:

Modular Vertex Operator Algebras Associated with the Virasoro Algebra. A Closer Look at the Minimal Series of Central Charge $c = \frac{1}{2}$ and $c = -\frac{68}{7}$.

Description of the research activities:

Prof. Nagatomo and I met twice a week, each lasting at least two hours, to discuss in detail a paper on Virasoro VOAs over fields of prime characteristic. We carefully studied each result in the paper as we believe that this approach will give us insights into our own objective: to extend these results to another minimal model (of a different central charge). We used Mathematica to carry out many lengthy calculations and confirm our conjecture (which is our main result this summer and whose proof is still our ongoing joint project.) In addition, at Prof. Nagatomo's invitation, Prof. Koga of Fukui University visited us for a few days in late July to discuss a topic on which he is an expert: singular vectors of the Virasoro algebra.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): This summer program has been an invaluable experience for me. Prof. Nagatomo is not only an expert in the field but also an incredible advisor. He gave me clear, detailed, and helpful guidance on my project, and he did so generously. In addition, Prof. Nagatomo and his wife were instrumental in helping me experience the Japanese culture. They were very kind to take me to visit Kyoto, Koya, and Nara. My stay in Japan this summer would not have been as successful and enjoyable - mathematically and otherwise - had it not been for Prof. Nagatomo. I am extremely grateful to him for everything he has done for me.

9. Advisor's remarks (if any): Miss DanQuynh Nguyen worked very hard during her stay at my institute. For instance, she learned many subjects related to her research by giving two-hour presentations twice a week. I strongly believe that this summer program helped her very much toward her PhD thesis. She also enjoyed weekends. (We made several short trips with my family.) Moreover, she visited several interesting places to know a part of Japanese culture. Finally, she had such productive days.

RESEARCH REPORT

1. Name: Tyler Parsotan （ID No. SP17041）

2. Current affiliation: Oregon State University

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: RIKEN

5. Host researcher: Dr. Shigehiro Nagataki

6. Description of your current research

My research is focused on the study of the most powerful explosions in the universe: Gamma Ray Bursts. These events provide a variety of information about the nature of compact objects, relativistic jets, the environment surrounding stars and the environment of the universe billions of years ago.

I work on understanding the production of the radiation from the Gamma Ray Burst jet, or collimated outflow, as it bursts through the star. The radiation gives us information about the structure of the jet as well as interactions between the jet and the star. In order to study this part of Gamma Ray Bursts I conduct simulations of the photons propagating through a Gamma Ray Burst jet and interacting with the material in the jet.

One question that hasn't been answered in the study of Gamma Ray Bursts is the relation between the peak energy of the time resolved spectra and the luminosity. Observations show that the two quantities evolve in a similar fashion, increasing and decreasing with one another, however, there are a number of observations in which the luminosity rises and falls but the peak energy simply decreases with time.

With the use of my simulations, I may be able to finally explain this seemingly random behavior between the peak energy and the luminosity.

7. Research implementation and results under the program

Title of your research plan:

Demystifying the Observed Gamma Ray Burst Tracking Between the Peak Energy and Luminosity

Description of the research activities:

For this research I've accomplished a variety of tasks. I've modified my simulations to be able to verify my host researcher's simulation. I have also investigated how the degree in which the peak energy and luminosity follow one another. As a result, I have come up with a method of quantifying the amount of tracking between the two quantities and this has shown that there seems to be a correlation between the degree of tracking and the location of the observer in relation to the jet.

Furthermore, during my time in Japan, I have contacted another researcher, Dr. Yonetoku, and begun collaborations with him. He will be looking at observational data to confirm whether my theoretical prediction is upheld in nature or not.

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

This research experience in japan has been a very integral part of my development as a young researcher. It has especially allowed me to become more globally minded with my research. Furthermore, personally, this experience has allowed me to experience an amazing country with rich culture and history. From the food to the shrines, I am thankful to JSPS for providing this amazing opportunity for me.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Melissa Plakke （ID No. SP17042）

2. Current affiliation: University of Pittsburgh

3. Research fields and specialties:

Biological Sciences

4. Host institution: Sokendai- Hayama

5. Host researcher: Dr. Prof. Kentaro Arikawa

6. Description of your current research

I am interested in studying how male and female reproductive tracts interact and evolve in response to one another. My current research focuses on the Cabbage White butterfly, *Pieris rapae*. A specialized organ in the female reproductive tract, called the bursa copulatrix, digests the large, complex ejaculate of the male, termed spermatophore. The spermatophore is composed largely of protein, which the female can use for egg production, though also acts to delay female remating. When a female *P. rapae* from the United States is mated to a *P. rapae* male from Japan, however, the females experience a delay in digestion of the spermatophore. This delay indicates that there is a mismatch in digestion between the two recognized subspecies. I am exploring this mismatch from the DNA, RNA, and protein level in order to identify the potential targets of selection.

7. Research implementation and results under the program

Title of your research plan:

Assessing Butterfly Evolutionary Divergence in a Post-mating, Pre-zygotic Interaction

Description of the research activities:

In Japan I collected and sampled the DNA and RNA from the Japanese subspecies of the Cabbage White butterfly, *Pieris rapae crucivora*. I collected DNA from 40 wild females in order to be used for whole genome sequencing. I also collected RNA from the reproductive tissues of F1 lab reared individuals. The extracted RNA will be used to perform tissue specific RNA sequencing. These sequences will then be compared to the European subspecies, *Pieris rapae rapae*, in order to assess differences. I have previously collected DNA from the European subspecies, and will collect RNA upon my return to the United States in an identical manner to that used to collect the RNA in Japan. In addition to my proposed research, I began a new study with my host researcher examining the structure and formation of the Japanese Swallowtail butterfly, *Papilio xuthus*.

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

One of the most memorable experiences in Japan was field work I conducted with the Arikawa lab. We traveled to the foothills of Mount Fuji to collect a migrating butterfly, the Chestnut Tiger, which is closely related to the Monarch butterfly of North America. While there we stayed at a ryokan, visited an onsen, and enjoyed local food. It was an amazing experience, both scientifically and culturally.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Sara Port （ID No. SP17043）

2. Current affiliation: University of Arkansas

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Okayama University

5. Host researcher: George Hashimoto

6. Description of your current research

Data collected on Venus from NASA and the USSR orbiters back in the 1970s-1990s detected unusual radar reflecting surfaces on the tops of its mountains. There are several theories on what could cause such a signal, but there is a consensus among the community that it is due to some material on the surface. Though we have yet to determine the composition due to its appearance in high altitude locations, it has since been dubbed “metallic frost.”

Our objective is to determine the composition of the metal frost. To conduct this research, I have a Venus simulation chamber at the Arkansas Center for Space and Planetary Sciences that replicates the temperatures, pressures, and atmospheric composition on Venus. We study the interaction between possible metal frost candidates, such as pyrite, pyrrhotite, and bismuth/tellurium/sulfur mixtures, as well as gases found on Venus, such as CO_2 (carbon dioxide), SO_2 (sulfur dioxide), and COS (carbonyl sulfide) at Venusian temperatures and pressures. My goal is to produce a mineral in my chamber that is stable in the cooler, highland conditions and unstable in the hotter, lowland conditions, just like metal frost.

7. Research implementation and results under the program

Title of your research plan:

Description of the research activities:

Our objective was to observe the effects of climate change on Venus’ atmosphere and surface composition. We worked with two major sets of codes: 1) a radiative transfer model of the Venusian atmosphere and 2) interactions between the atmosphere and the surface minerals. In the first code, we adjusted the temperature and the near surface concentration of SO_2. SO_2 is expected to make up anywhere from 130-180 ppm in the lower atmosphere. Since it is a greenhouse gas, an increase in atmospheric SO_2 would increase the surface temperature. However, SO_2 also

indirectly decreases the surface temperature. In Venus's atmosphere, SO_2 can form H_2SO_4 clouds, which have a high albedo. Therefore, an increase in SO_2 instigates an increase in H_2SO_4, which then decreases the amount of solar radiation absorbed by the atmosphere, thus decreasing the surface temperature. This demonstrates that there are two mechanisms at work affecting the surface temperature. In the second code, we adjusted the surface temperature to observe the effect it had on SO_2 concentration as well as sulfur bearing minerals. As you increase the temperature, you release sulfur from the minerals, thus decreasing the abundance of sulfur minerals and increasing the SO_2 in the atmosphere.

Unfortunately, we had several major fallbacks. We spent a great deal of the summer debugging the first code. The second code ran flawlessly even though we ran into a major obstacle involving carbon monoxide. Carbon monoxide is estimated to make up ~27 ppm in the lower atmosphere of Venus. Conversely, the code only calculated ~5 ppm. This implies that an unpredicted interaction is occurring in the atmosphere; one that we cannot determine unless we send a probe to Venus. This issue has been a reoccurring problem with other researchers attempting to model the composition of the lower atmosphere.

During this program, I was able to attend a JAXA (Japanese Spacy Agency) Akatsuki (Venus Orbiter) meeting in Tokyo. The PIs of the various instruments, as well as Japanese and foreign collaborators were all in attendance. During the meeting, they discussed the health of the orbiter, as well as new computing modeling results obtained from the data collected by Akatsuki. It was a great opportunity to meet the Japanese Venus team, and I look forward to seeing them again at the International Venus Conference to be held on Hokkaido in September 2018.

Though we did not meet the expectations that were set at the start of the application process, we have made progress in our research and I intend to continue this project after the end of this program. I have certainly learned a great deal regarding the many interactions and processes that occur in an atmosphere. I have also significantly improved my computer coding skills and I expect to apply my knowledge to my research in the future.

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

I greatly enjoyed my experience in western Japan, which is culturally different than Tokyo. I noticed several major differences, such as some of the vocabulary used and the food, but I also noticed minor differences, such as the fashion style and people's mannerisms. Japanese summers are filled with fireworks and festivals, and I took advantage of this as often as I could, even going to Shikoku for a dance festival. Overall it was an astounding and wondrous summer that I will not forget.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Gabrielle Ramirez （ID No. SP17044）

2. Current affiliation: Pennsylvania State University

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Kochi University

5. Host researcher: Dr. Yoshitaka Hashimoto

6. Description of your current research

I study rocks from subduction fault zones in order to understand the physical and chemical processes that influence earthquake behavior. These rocks record the deformation that occurs in the “seismogenic zone” or the part of the subduction zone that experiences earthquakes. Therefore, these rocks hold the key to understanding what processes are occurring in the subduction zone and what controls and modulates earthquake magnitude, location, and frequency. I’m particular interested in a “healing” process that occurs in subductions zones around the world. During a seismic event, hydrofractures occur within the rock. These hydrofractures are then “healed”, or sealed, with dissolution of silica from anastomosing microfault surfaces (i.e. scaly fabrics) and precipitation of quartz in the hydrofracture to create a vein. This fault healing mechanism changes the mechanical properties of the rock and we hypothesize that it can significantly modulate earthquake behavior. My current research is to use geochemical and microstructural observations to model the rates of this healing process and understand what factors, such as depth of deformation and the presence of geochemical reactions, affect these rates. The rate of healing through redistribution of silica can significantly influence earthquake behavior and potentially help us understand phenomena such as slow earthquakes.

7. Research implementation and results under the program

Title of your research plan:

Scaly fabrics and veins of the Shimanto Belt, Japan

Description of the research activities:

During my time at Kochi University with Dr. Yoshitaka Hashimoto, I collected samples from multiple field sites that contain deformed rocks from the range of temperatures that span the seismogenic zone. I also prepared samples and conducted two types of analyses: x-ray diffraction (XRD) and x-ray fluorescence (XRF). XRD gives me information about the mineral assemblage of the rocks and will help me to understand geochemical reactions that may be affecting the rate of sealing through silica redistribution. XRF gives me information about the elemental composition of the rocks and the degree of fluid-rock interactions which is important in the dissolution/precipitation process of sealing. Preliminary analyses of the data show systematic differences in mineral assemblage, such as the increase of illite and decrease of albite with increased depth of deformation. I will return to my home institution, Pennsylvania State University, to use this data to model rates of hydrofracture healing and continue to make microstructural observations using thin sections of my samples.

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

My time in Kochi, Japan was an amazing cultural experience. I had the opportunity to live in rural Japan and learn about traditional customs in a whole new way. One of my favorite experiences was the Yosakoi dancing festival in Kochi. Teams from all over the country come to dance and compete in a citywide parade. The dancing was excellent and the costumes were unique and beautiful.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Adrian A. Rivera-Torres (ID No. SP17045)

2. Current affiliation: Illinois Institute of Technology

3. Research fields and specialties: Mathematical and Physical Sciences

4. Host institution: National Institute of Informatics

5. Host researcher: Dr. Kae Nemoto

6. Description of your current research

My current research at IIT involves working with topics related to quantum field theory and high-energy physics. Those particular topics are unrelated to topics quantum information science, but have valuable applications within it, and quantum computation and cryptography is the field I would eventually like to work in.

My current research at NII and other universities involves multiple topics within quantum cryptography, such as quantum key distribution and secret sharing schemes.

7. Research implementation and results under the program

Title of your research plan:

Analysis on SLOCC Convertibility and Quantum Transformations on Higher Order N-Partite Greenberger-Horne-Zeilinger States

Description of the research activities:

The major goal of the project is to investigate the capabilities of the Greenberger-Horne-Zeilinger (GHZ) quantum state, in terms of quantum computation, cryptography and information science. What first began as an overview of the capabilities of the GHZ state in quantum computation, ended as a survey of the capabilities of the GHZ state in quantum secret sharing schemes. The main objective was applying Shamir's secret sharing scheme into quantum cryptography schemes, using the GHZ state as the quantum channel.

This involved four major aspects to be researched: a reliable quantum teleportation method (using an orthogonal basis that combines coherent states and polarization states,) Shamir's scheme in classical cryptography, the geometry of the GHZ states, and error correction methods through factorization. Once all four aspects were covered, a quantum secret sharing protocol using Shamir's scheme was synthesized.

Quantum teleportation may be carried out in different ways, but each method has its own quirks and practicalities. The best method was outlined in a research paper, using an orthogonal basis that is the direct product of coherent optical states, and the orthogonal polarization states.

The geometry and factorization of the GHZ states was outlined in several papers, so a method that encodes the message to be transmitted or splitted could be synthesized. Thus, the protocol was developed.

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

While I did spend a considerable amount of time working on the research project during the weekdays, I would visit special wards or cities in Tokyo on the weekends. I went to many of the major cities in Tokyo and explored many cities in the Kanto region, in prefectures like Saitama, Chiba and Kamakura.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: May Roberts （ID No. SP17046 ）

2. Current affiliation: University of California, Santa Cruz

3. Research fields and specialties:

Biological Sciences

4. Host institution: University of the Ryukyus

5. Host researcher: Associate Professor James Reimer

6. Description of your current research

The research conducted this summer was focused on better understanding how fish populations are connected across the Ryukyu Archipelago of southern Japan using genetic methods.

Samples of 5 focus species were collected from different islands in the Ryukyus including Iriomote-jima, Okinawa, and Amami-Oshima to test whether there are any genetic, and therefore larval dispersal barriers between regions of the archipelago. We are also testing whether reproductive modes of these fishes may influence levels of connectivity between islands at this scale. In the lab, DNA was extracted from 20 individuals per species, per island. Specific loci were then amplified, and are now being sequenced for future analysis.

This information will be useful for conservation and resource management, to help understand how the health of fish populations in one island may influence fish populations on other islands. It may be especially important for the Ryukyu Archipelago where some islands experienced severe coral bleaching events in the last couple years leading to visible degradation of the structure and health of these reefs. In addition, the centrally located island of Okinawa is rapidly being developed with disastrous effects to the marine environment. With increasing development added to the stressors of a changing climate, it is imperative that we understand how neighboring and still undeveloped reefs may be supporting populations in more degraded islands.

The samples collected this summer will also be used for current research on genetic characteristic that may help to identify types of species that are better at adapting to different/changing climates.

7. Research implementation and results under the program

Title of your research plan:

Connectivity and Genetic Population Structure of Coral Reef Fishes in the Ryukyu Archipelago

Description of the research activities:

Over the course of the program, much of the time was spent sampling for the 5 target species, which were collected on scuba. Islands visited for sampling were: Okinawa, Iriomote-jima and Amami-Oshima, and were chosen based on location within the Ryukyu Archipelago, as well as presence of a university field station or host researcher to facilitate permitting and research. Unfortunately, one island included in the research plan for sampling, could not be visited due to typhoon.

The latter portion of my time at the University of the Ryukyus was spent in the lab: first extracting DNA from the samples, running polymerase chain reactions (PCRs) to amplify target loci of the DNA, and then preparing the PCR product to be sent for sequencing.

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

This program has been an incredible learning experience for me and I am so grateful for the opportunity to do research in Japan with such wonderful and passionate researchers here. It was especially amazing and unexpected how helpful and generous the researchers were who I had contacted at the different islands for sampling. Through this program I was certainly able to make wider connections with additional Japanese scientists, who I hope to work with again in the future.

Over the course of my stay I especially enjoyed trying the different (and delicious) foods specific to the Ryukyus such as champuru, soki soba and mozuku, and well as visiting museums on local history (an especially powerful one was the Okinawa Peace Memorial Museum) and attending local summer festivals or matsuri.

9. Advisor’s remarks (if any):

May worked very hard during her short time here in Okinawa, and it shows. She met researchers on the various islands in the Ryukyu chain, and has made connections that will serve her well in her future career. I, for one, would welcome her back here any time, and hope we can collaborate in the future.

RESEARCH REPORT

1. Name: Kamrie Sarnosky (ID No. SP17047)

2. Current affiliation: Texas A&M University

3. Research fields and specialties:

Biological Sciences

4. Host institution: Tokyo Metropolitan University

5. Host researcher: Professor Shiro Kubuki

6. Description of your current research

Although it has been established that some semiconductors can effectively inactivate pathogenic bacteria, they require ultra-violet (UV) light to catalyze the reaction. Recycled materials can be used to create an iron-containing silicate glass (i.e. 15Na2O-15CaO-xFe2O3-(70-x) SiO2) that has been shown to be activated by visible light. The use of visible-light activated photocatalytic glass may follow the same mechanism of the generally accepted but expensive UV-activated photocatalytic glass and effectively eliminate pathogenic microorganisms. This study aimed to test the capability of iron-containing silicate glass to effectively inactivate pathogenic indicator organisms (*E. coli* K-12 MG 1655) by visible light-induced photocatalytic reaction and compare the effectiveness of iron-containing silicate glass to the well-established disinfection capabilities of TiO_2.

7. Research implementation and results under the program

Title of your research plan: *Photocatalytic inactivation of Escherichia coli K-12 by iron-containing silicate glass*

Description of the research activities:

Methylene blue experiments were conducted to ensure that the iron-containing silicate glass and TiO_2, a well-known photocatalytic disinfectant, were able to react in the experimental conditions. In this experimental set up, spectrophotometry is used to measure the concentration change in methylene blue solution, which will decrease as catalysts use light energy to decompose the organic dye. Both materials showed sufficient photocatalytic properties.

Photocatalytic iron-containing silicate glass was added in differing concentrations (0.13- 2.6 mg/ml) to a solution of buffered saline and 10^{6-7} CFU/ml of *E. coli* K-12. Aliquots were placed on a rotating shaker and irradiated with a 100 W metal-halide lamp for 120 minutes. A 1 ml sample was extracted, serially diluted and plated every thirty minutes.

In this short experiment, the iron-containing silicate glass did not appear to inhibit the viability of *E. coli* K-12. At higher concentrations (~1 mg/ml), a one log reduction can be seen after 2 hours of irradiation. This suggests that longer irradiation periods may be effective at bacteria inactivation. TiO_2 was also ineffective at decreasing cell viability over time under these experimental conditions. Future experiments should explore lower initial cell concentrations and optimal pH levels for photocatalytic disinfection.

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

During my stay in Japan I was able to explore much of Tokyo and travel to Kyoto, Osaka, and Okinawa. Other JSPS scholars and I climbed Mount Fuji to see the sunrise. I was also able to attend many festivals and try many foods. My lab mates were very kind and we had several gatherings where they taught me how to cook Japanese cuisine. My host family stayed in contact with me throughout my trip and I attended several HIPPO Family Club meetings to practice conversational Japanese.

9. Advisor's remarks (if any):

Although there are lots of problems for carrying out challenging research topic, Kamrie obtained very much interesting data concerning anti-biotic effect of photocatalytic silicate glass. I hope that she will continue this research and come back again and again to my lab.

RESEARCH REPORT

1. Name: Christopher Iliffe Sprague （ID No. SP17048）

2. Current affiliation: National Science Foundation (NSF)

3. Research fields and specialties:

Engineering

4. Host institution: Deep Space Mission Design Laboratory, Department of Space Flight Systems, Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency (JAXA)

5. Host researcher: Dr. Yasuhiro Kawakatsu

6. Description of your current research

In this research pursuit, it is sought to improve upon current high fidelity direct transcription trajectory optimisation methods for low-thrust trajectories, particularly for spacecraft operating in the Earth-Moon system. The undergoing development of JAXA's low-thrust lunar cubesat space mission to the Earth-Moon system's L_2 Lagrange point, EQUULEUS, presents itself as an excellent opportunity further develop upon its new trajectory optimisation methods.

With this mission hinting to increased trajectory optimality, with respect to propellant consumption, through the use multiple lunar flybys using the Sun's gravitational perturbation in the Earth-Moon system's weak stability region, it is desired to further explore the problem's solution space. The problem of spacecraft trajectory optimisation presents significant computational challenges in the regime of a low-thrust propulsion, as the resulting trajectories involve increasing mission durations, orbital revolutions, and thus discretisation resolution; thereby increasing the optimisation problem's dimensionality.

In order to decrease the dimensionality of the low-thrust trajectory optimisation problem and increase its fidelity, it is attempted to remove the need to include the discretisation of the trajectory's control profile within the decision variables. Rather, it is attempted to directly optimise a state-feedback controller function, namely a neural network, through evolutionary algorithms (e.g. self-adaptive differential evolution); thereby allowing for high fidelity control profile representations through adaptively discretised numerical integration. Hence the culminating decision variables become the departure time, arrival time, final mass, and parameters of the neural network controller.

Through this method it becomes possible to solve for adaptively discretised high fidelity representations of many revolution low-thrust trajectories. Moreover, it becomes possible to generate a real-time implementable state-feedback controller, which through sequential optimisation under a variety of trajectory boundary conditions, is able to generalise coherent control globally, through perception of its relative state to gravitationally influential bodies.

7. Research implementation and results under the program

Title of your research plan:

A Machine Learning Approach to Lunar Spacecraft Trajectory Optimization

Description of the research activities:

While at JAXA I developed a C++ software library for general spacecraft trajectory optimisation[1] through evolutionary neural network control, one of the first implementations of artificial intelligence in this context at JAXA. Through this development I worked with my colleagues to ensure my software library's implementability in the EQUULEUS mission. During my time at JAXA, I had the excellent resource of spacecraft trajectory experts to consult with about my ideas, which allowed for my research to develop more efficiently.

In the resulting software library[2] a novel transcription for high-fidelity optimal control of low-thrust many-revolution spacecraft trajectories was developed. In particular, the method operates by using an evolutionary optimisation algorithm (e.g. self-adaptive differential evolution) to iteratively choose neural-network controller parameters, a departure time, an arrival time, and a final fuel expenditure. At each iteration, using the chosen neural network parameters, the spacecraft's trajectory is propagated forward in time from the initial conditions (departure time, a priori fuel allowance) and backward in time from the terminal conditions (arrival time, final fuel expenditure). The difference in states between the forward and backward trajectories at the midpoint time is evaluated, and sought to be iteratively minimised to through an evolutionary optimisation algorithm. Hence, forming one continuous optimal control trajectory.

Through this method, a high fidelity, adaptively discretised, low-thrust, many-revolution, optimally controlled trajectory results; as well as a real-time implementable state-feedback neural network controller that can generalise its control policy to a variety of departure and arrival conditions. Thus, in comparison to conventionally used trajectory controllers, which rely on simplified linearised dynamics about a nominal trajectory, the resulting neural network controller forms a robust alternative that remain valid irregardless of the spacecraft's adherence to a nominal trajectory.

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

During my stay I had the opportunity to travel to Kyoto University to present my research to some of the Deep Space Mission Design Laboratory's collaborators. Most importantly, this gave me an opportunity to disseminate my research further and gain valuable insight, but also it allowed me to see some of Kyoto.

Additionally, I had such a great experience with my host family during the JSPS orientation, that I had the opportunity to stay with my host family again at the end of July. Second to the stay at my research institution, the home stay experience was my most valuable experience in Japan.

1 Trajectory optimisation is the problem of choosing the sequence of controls (e.g. thrusts) to transport a dynamical system (e.g. spacecraft) from an initial state (e.g. orbit around Earth) to a final state (e.g. orbit around the Moon), while minimising an objective (e.g. total fuel spent).

2 https://github.com/cisprague/NSF-1713973

RESEARCH REPORT

1. Name: Joshua Stuckner

（ID No. SP17049）

2. Current affiliation: Department of Materials Science and Engineering. Virginia Tech

3. Research fields and specialties:

Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Koji Harano

6. Description of your current research

My research involves implementing computer vision techniques to analyze microscopy images of materials and molecules. These techniques can vastly increase the speed of analysis.

The lab I am working in has a Transmission Electron Microscope (TEM) equipped with an electron camera which can capture 1600 frames per second at near atomic resolution. Frame by frame manual analysis is practically impossible on these video datasets.

7. Research implementation and results under the program

Title of your research plan:

Implementation of Computer Vision Techniques to Process High Resolution Video Datasets of Single Molecules in Motion

Description of the research activities:

The TEM video datasets taken with the high speed detector have very low signal to noise ratios. Two tools were implemented to increase the S/N: Gaussian down sampling and Chambolle total variation denoising. The improvement in video quality when using these tools is quite surprising and remarkable. These methods and other useful methods to handle these datasets were packaged in a graphical user interface (GUI) for easy use by current and future lab members.

I also made a tool to automatically determine bond type between reacting carbon nanoballs. TEM videos were taken of reacting carbon nanoballs in order to determine the reaction kinetics. The frame by frame analysis and counting of bond types was extremely tedious and time consuming. The tool which automatically determines bond type was implemented using machine learning. The detector and methods to create new detectors was packaged into a GUI for easy use by lab members.

Finally, I created a GUI to perform batch operations on folders of simulated images. These simulated TEM images were generated from a molecular model and compared to real TEM images using an algorithm to determine the real molecules conformation and conformational changes. The batch operations include automatically making the images a consistent brightness, binarizing the images, and merging images together. These operations make it more likely to find a good match between the real and simulated images. With this GUI, tasks which previously took many hours of tedious frame by frame operations, can now be performed automatically with just a few mouse clicks.

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

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Sean R. TACHIBANA （ID No. SP17050）

2. Current affiliation: Oregon State University

3. Research fields and specialties:

Mathematical and Physical Sciences

Chemistry Biological Sciences

Interdisciplinary and Frontier Sciences

4. Host institution: University of Tokyo

5. Host researcher: Moritoshi Sato

6. Description of your current research

Optogenetic tools have many applications in manipulating molecular processes in biological systems. Molecular photoswitching proteins, naturally found in plants, fungi, and bacteria, allow protein engineers to take advantage of their photosensitive properties to control biological functions. Dr. Moritoshi Sato at the University of Tokyo is a leading researcher in creating optogenetic tools. The Sato lab was able to selectively induce heterodimerization of a photoswitch, Vivid, by implementing electrostatic residues along the protein-protein interaction region. By introducing mutations around the cofactor domain, Dr. Sato was able to tune the light-dependent dimerization and the switch-off kinetics. Protein engineers emphasize the practical application of their system and cause current experimental procedures to rely on a high throughput trial and error technique. Ultrafast spectroscopy is able to probe the photochemical reaction within the system to give insight into the underlying mechanism. The overarching goal is to synthesize photoswitches (Vivid and Magnet varients) using Dr. Sato's protein engineering facility in order to analyze it with our unique Femtosecond Stimulated Raman Spectroscopy (FSRS) setup. FSRS is able to track photo chemical reactions from the ground state, to the excited state, and back down to the ground state on the femtosecond to picosecond timescale. This will provide information on key amino acid residues that can change the systems function such as, higher efficiency, dimerization, and switch-off kinetics. The optimization of the optogenetic tools will allow for diverse practical applications in neuron modulation, drug delivery, bioimaging, and biosensors. The synergistic collaboration of protein engineers

and ultrafast spectroscopist brings forth a fundamental understanding that will enable us to propose possible residue mutations which would effectively change the systems function and have the skills to make it.

7. Research implementation and results under the program

Title of your research plan:

Mechanistic understanding of light sensitive proteins for biomedical applications.

Description of the research activities:

During my time at the University of Tokyo, I was able to synthesize and purify 14 different Vivid and Magnet variants to be shipped back to Oregon State University. There, I will be able to analyze the different mutations around the chromophore using our ultrafast spectroscopy setup. Our technique allows us to probe the motions of the chromophore and surrounding residues upon light irradiation. With this information, we will have a better understanding of how these mutations effect the proteins overall function and possibly suggest other mutations.

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

Coming to Japan was very important for me not only for the unique collaborations but also to understand where I came from. I am a fourth generation Japanese American who grew up in Hawaii. Growing up, I would hear stories from my family and friends about fighting in World War II. Because of the war, my grandparents were never given the opportunity to learn our native language which is why many Japanese Americans growing up in Hawaii no longer can speak Japanese. The EAPSI program provided me with an opportunity to travel to Japan for my first time and experience my heritage. I am fortunate to have a strong lineage to Japan where I can actually trace my lineage back to one of the first families to travel to Japan. My family even has a family crest (kamon) which is uncommon in Japan. This was truly an experience I will remember.

RESEARCH REPORT

1. Name: James Thornhill （ID No. SP17051）

2. Current affiliation: Kennesaw State University

3. Research fields and specialties:

Agricultural Sciences

4. Host institution: Meiji University Ikuta Campus

5. Host researcher: Prof. Kosuke NOBORIO

6. Description of your current research

My research involves using plants as indicators of ecological health in radioactively contaminated areas, such as Fukushima Prefecture. The process of using plants as ecological indicators is called bioindication. This proposed research aims to utilize bioindicators as a much cheaper means of evaluating radiation activity in contaminated areas. Pictures can be taken of plant growth showing the effects of ^{137}Cs contamination on plants over time. The hope is to establish a radiation evaluation guideline, showing the growth cycle of common plant species in ^{137}Cs contaminated areas that the farmers can use to understand the long-term effects of radiation on living systems. For farmers in Fukushima who lack access to radiation monitoring technology, this will be a more convenient and understandable means of analyzing the radioactively contaminated areas. Bracken ferns (*Pteridium aquilinum*) and may lilies (*Convallaria majalis*) are the study species of choice due to their abundance in the Fukushima area. The plants are grown in the selected soils where they can be monitored daily. The growing period will last approximately six months. Pictures should be taken of the plants every day until harvest. At that point, plant tissue will be analyzed in a gamma spectrometer for the uptake of ^{137}Cs throughout the growing period. If there is significant ^{137}Cs uptake, the plants will then be considered for phytoremediation trials at participating farming locations.

7. Research implementation and results under the program

Title of your research plan: Using Bioindicators as a Technique for Evaluating ^{137}Cs Contamination in Fukushima Prefecture.

Description of the research activities:

- Collected soil samples from low, medium, and high radioactively contaminated areas in Iitate Village, Fukushima Prefecture
- Planted Bracken ferns and may lilies in soils collected from Iitate Village at Meiji University Ikuta Campus
- Collected wild type Bracken fern and may lilies for baseline ^{137}Cs evaluation in medium contaminated soil
- Established plant monitoring protocol for Prof. Noborio's students
- Established plant analysis protocol that will be used at end of experiment in December 2017

The project is established and is now in monitoring phase. Upon my departure, students working with Prof. Noborio will continue monitoring and complete the radiation analysis. The data management plan consists of monthly updates with pictures and results from analyses. The students completing the experiment hold the highest academic integrity and I give my full endorsement to their scientific abilities. I look forward to our collaboration and future workings together.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): My experiences in Japan include sightseeing and spending extra time with my host family, the Joo's. I spent three separate weekends with the Joo's over the course of my time in Japan. They treated me as a family member and went out of their way to accommodate for me. My appreciation goes beyond words for the way they shared their time, house, and holidays.

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

RESEARCH REPORT

1. Name: Lina Wang （ID No. SP17052）

2. Current affiliation: St. Cloud State University

3. Research fields and specialties:
Biological Sciences

4. Host institution: Hokkaido University

5. Host researcher: Dr. Yoshinao Katsu

6. Description of your current research

My current research focuses on how contaminants of emerging concerns affect the freshwater fish, *Pimephales promeals*, also known as the fathead minnow. This is done by assessing a variety of endpoints, including physiological, behavioral, and histological endpoints.

7. Research implementation and results under the program

Title of your research plan: **Membrane steroid hormone receptor activity of Fathead Minnow (*Pimephales promelas*) when exposed to a contaminants of emerging concern mixture**

Description of the research activities:

Over the past few weeks, I have been able to characterize the progesterone and corticosteroid receptors in Japanese hagfish. I exposed the two different receptors separately to 12 different hormones using the Reporter Gene Assay. The assay was repeated three times for each receptor type. In addition, we characterized an urban derived mixture of contaminants of emerging concern using a human mineralcortisteroid receptor and different concentrations of the mixture.

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

During my stay in Japan, I was able to see a lot of the country and culture! I enjoyed it very much! The ten weeks went by too quickly and I wish I could stay longer! I learned much about the assay I performed and its application to my current research project.

9. Advisor's remarks (if any):

It is the first time I have participated in the JSPS summer program. This program provides an opportunity for international exchange. My lab's members were able to spend a valuable two months. The fellow's work gave us an excellent result. I hope to apply to this program again if I have the chance. I am deeply grateful to the fellow and JSPS.

RESEARCH REPORT

1. Name: **Matthew J. Winans** （ID No. SP17053）

2. Current affiliation: West Virginia University, Biology Department

Morgantown, West Virginia, USA

3. Research fields and specialties:
Biological Sciences, Biochemistry, Genomics, & Agricultural Science

4. Host institution: Saga University

5. Host researcher: Dr. Hiroshi Kitagaki

6. Description of your current research

Research currently being investigated in Dr. Kitagaki's Agricultural and Biochemical laboratory at Saga University, Japan by Matthew J. Winans, Ph.D. candidate, West Virginia University, USA included hybridization of a newly discovered yeast (*Saccharomyces arboricola*) with industrial fermentation *S. cerevisiae* strain M22. Hybrid organisms often display phenotypes superior to each parent, known as hybrid vigor. The newly discovered Yeast has at least 4 novel genes and the most complete genome assembly besides the brewer's yeast (Liti, *et al., 2013).* Through fermentations of rice with traditional Japanese Koji (*Aspergillus oryzae)*, identification analysis of compounds in the sake mash were performed by Head Space Gas Chromatography – Flame Ionization Detector. The *S. arboricola* and yeast hybrid sake are two worlds first, to our knowledge. The benefit of hybridization to sake yeast is two pronged, hybridization battles production consistency issues by stabilizing sake yeast's notoriously unstable genome in addition to the probability of producing unique flavor compounds.

7. Research implementation and results under the program

Implementation of this research plan was largely successful. Preemptive planning was utilized to maximize time, such as initial dual approaches in hybridization. Minor setbacks including optimization of transformation protocol for the new species and equipment access (micromanipulator and GC-MS) were overcame swiftly and thoroughly.

Results under this funding allotment has produced Non-GMO hybrid *S. arboricola* X *S. cerevisiae* strains, *S. arboricola* transformed with HO endonuclease under Gal promoter for easy future hybridization, sake flavor analysis of new yeast species and hybrids. Ongoing and future work include analysis of metabolites in sake mash, analysis by powerful Gas Chromatography – Mass Spectrography, and experiments with

hybridization with Japanese sake yeast. Additional genetic analysis and hybrid spore micromanipulation will occur in collaboration at the JSPS fellows host institution, West Virginia University in Morgantown, WV, USA.

Introduction of the *Saccharomyces* yeast hybrid contributes to the body of genetic knowledge by enabling the *Saccharomyces* clade more available as a genetic tool for world wide researchers, both academic and industrial. Additionally, fermented food industries can benefits from this initial and the subsequent research potentially increasing production value. A hybrid yeast employed for brewing for example may help extend the duration of the yeast culture use by reducing spontaneous mutations that affect flavors.

Title of your research plan:

Exploring Newly Discovered Yeast's Potential Use in Biotechnology

Description of the research activities:

Saccharomyces cerevisiae and *Saccharomyces arboricola* were hybridized by micromanipulation. *S. arboricola and S. cerevisiae* were transformed with dominant drug markers for future hybridization purposes. Hybrid status was tested by multiplex PCR primers for unique ITS ribosomal DNA for each species in single colonies. Additional plasmids containing HO region under Gal promoters and dominant drug markers were acquired. Fermentation kinetics was performed of sake fermentations for 2 weeks. GC analysis of the head space and the metabolites were performed.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): The cultural and scientific experiences were too numerous to mention, but all were world class and will have a strong lasting impact on the young researcher

9. Advisor's remarks (if any):The student, Matthew J. Winans, Ph.D. candidate, had extremely high creativity, enthusiasm to research and experiments, sophisticated experimental techniques and intention to adapt to laboratory environments. The collaboration had a tremendously beneficial effect on the future collaboration.

RESEARCH REPORT

1. **Name:** Scott A. WIPPERFURTH （ID No. SP17054）

2. **Current affiliation:** University of Maryland

3. Research fields and specialties:

Mathematical and Physical Sciences

4. **Host institution:** Tohoku University

5. **Host researcher**: Prof. Kunio Inoue

6. Description of your current research

Natural radioactivity within the Earth powers many large scale Earth processes, such as mantle convection or plate tectonics. However, the magnitude of this power is not known. Radioactivity produces neutrinos, the flux of which can be measured on the Earth's surface to estimate the radioactivity of the bulk Earth. KamLAND, located near Kamioka, Toyama, Japan, is a large underground neutrino detector which measures the Earths flux of neutrinos. To understand the neutrino signal from the deep earth, and therefore the scale of radioactivity, we must understand the signal from the surface rocks. My research focuses on building a 3D geologic model of the entire crust, with emphasis on the crust closest to the KamLAND detector in Japan. With this model of the radioactivity of the Earth's crust we can predict the crustal signal at KamLAND. By subtracting the estimated signal (from Earth's crust) with the measured signal (from the entire Earth), we can provide constraints on the signal, and therefore radioactivity, from the volumetrically significant mantle.

7. Research implementation and results under the program

Title of your research plan:

Characterizing the radioactivity of rocks in central Japan:
Towards understanding the composition of the Earth

Description of the research activities:

My project is split in two parts: a global and a local radioactivity model. The local model consists of geochemical and geophysical data from the area between Tohoku Shikoku prefectures. The geochemical dataset consists of ~ 3,000 stream samples and ~ 5,000 rock samples, analyzed for their radioactivity. Geophysics data collected include 3D high-resolution seismic data extending into the mantle, crustal thickness, and geologically interpreted crustal cross-sections. A cross-section of the crust across the region near Shikoku and another near KamLAND provide the basis for the structure of the physical local model (i.e. NW dipping accreted terranes).

Another aspect of my work was the creation of a global crustal radioactivity model. This involved implementation of a recent model of the structure of the crust with global chemical information. Furthermore, much of my time was spent calculating the radioactivity of the crust from a combination of seismology and heat flow measurements.

Future work will be statistical analysis of the chemical information and further refinement of the geophysical model. The global model is near completion and will be merged with the local model (when completed) later this year to estimate the neutrino signal at KamLAND.

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

I have sampled the famous Sendai Gyu-tan, Hiroshima okonomiyaki, and Kobe beef (my favorite). My favorite experience was seeing a wild monkey near Mt. Zao (in Tohoku), or perhaps the paper streamers during the Sendai Tanabata Festival. I look forward to going home only because I get to use my new Japanese pull saw and chisels!

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Daniel WORKMAN （ID No. SP17055）

2. Current affiliation: Colorado State University

3. Research fields and specialties:

Interdisciplinary and Frontier Sciences

4. Host institution: : Institute of Environmental Radioactivity (IER), Fukushima University

5. Host researcher: Prof. Vasyl YOSCHENKO

6. Description of your current research

The research performed over the course of the JSPS 2017 summer program will contribute to the ongoing research being conducted by Prof. Yoschenko's forest radioecology team at the IER. Forested areas represent a large percentage of the land area impacted by the Dai-Ichii Nuclear Power Plant Accident of 2011. Understanding the fluxes of radiocesium (the major contaminant of concern) within the forest ecosystems has a broad range of importance related to forest management decision making, predication of the impacts within the forests and impacts to other ecosystems, and prediction of the long term status of contaminated areas.

Radiocesium is a nutrient (potassium) analog for plants and the transfer of radiocesium follows potassium uptake pathways. My research is focused on developing soil to plant transfer factors of radiocesium for understory plant species in the Fukushima forests. Additionally, we hope to develop parameters to better predict soil to plant transfer of radiocesium by determining the vertical distribution of plant root surface area and the vertical distribution of the different forms (soluble, exchangeable, and non-exchangeable) of radiocesium, stable cesium and potassium. Transfer factors are often used in modeling of ecosystems but tend to be representative of a set of conditions that are unchanging. Developing parameters that can that can account for the movement of radiocesium through soil layers, over time, and account for the mechanisms of uptake would be of value to increase our ability for long-term prediction of forest ecosystem conditions.

7. Research implementation and results under the program

Title of your research plan:

Radiocesium Soil to Plant Transfers in Fukushima Forests

Description of the research activities:

The summer research activities included both field sampling work and laboratory activities. Field sampling was performed to collect aboveground plant material as well as a 15-centimeter depth (cm) soil core containing the plant roots. A total of 12 plants along with the soil cores were collected representing a range of root structures and soil conditions. The different forms of radiocesium, stable cesium and potassium will be determined throughout the soil core in 1-cm intervals.

Analysis of root surface area through the soil core was performed first by separating the roots from the soil via a root washer. Separated roots are then placed onto lamination paper and laminated and these "root slides" were scanned into a digital image. Images will be analyzed via ImageJ to determine the 2-D roots surface area found within each 1-cm interval of soil. In the following months the laboratory analysis data will become available allowing for interpretation of our methods.

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

Fukushima prefecture is an area with unmatched agricultural innovation, incredible terrain, rich history, world class environmental researchers, the finest soba noodles, the finest Nihon-shu, and many wonderful people.

9. Advisor's remarks (if any):

I would like to express the deep gratitude to JSPS for support of our study. Mr. Daniel Workman has carried out a great work including both field sampling and laboratory analyses. Also, he contributed to the development of the research methods (extracting of roots and quantification of their surface areas). He showed excellent skill and motivation, and I evaluate highly his contribution.

RESEARCH REPORT

1. Name: Chao XU （ID No. SP17056 ）

2. Current affiliation: University of Illinois at Urbana-Champaign

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: National Institute of Informatics

5. Host researcher: Prof. Ken-ichi KAWARABAYASHI

6. Description of your current research

Hypergraphs are a generalization of graphs. Graphs comprise of edges connecting two vertices, while hypergraphs consist of edges connecting any number of vertices. Cuts are objects that capture how tightly connected a hypergraph is. The current research focuses on all kinds of cut problems arises in graphs, hypergraphs and more general functions. The cut problems are concerned with partition graphs/hypergraphs such that the cost is minimized. Specifically, we are interested in faster hypergraph cut algorithms, characterizing hypergraph cut functions, and also quickly approximate hypergraph cut functions.

7. Research implementation and results under the program

Title of your research plan:

Characterizing and Finding Faster Algorithms for Hypergraph Cuts

Description of the research activities:

Prof. Kawarabayashi and I meet almost daily to discuss ideas and work out difficulties in the implementation of our current ideas. The direction of research took a turn when we found it might be better to focus on a new kind of graph cut problem that might provide useful insight.

On the other front, I've visited Osaka University and discussed with Prof. Yutaro Yamaguchi, who have some expertise in characterizing hypergraph cut functions. During my visit, we discovered some proposed conjectures for characterizing hypergraph cut functions are false, and there is a lack of new approach to tackling the question. However, this does lead to a new question on approximating functions through hypergraph cut functions.

I've given talks on some progress on the cut problems to various universities in Japan, including giving a talk for Prof. Satoru Iwata's group at University of Tokyo, Prof. Hiroshi Nagamochi's group at Kyoto University, and Prof. Kazuhisa Makino at RIMS of Kyoto University.

Our work is still in progress and will continue after the end of JSPS program.

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

I'm lucky to be able to have meetings almost daily. The quick feedback process really pushes progress.

RESEARCH REPORT

1. Name: Thomas Maximilian BIRCH （ID No. SP17101）

2. Current affiliation: Durham University, Physics Department

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Centre for Emergent Matter Science (CEMS), RIKEN

5. Host researcher: Dr. Shinichiro Seki

6. Description of your current research

Skyrmions are nano-sized, topologically protected particles composed of magnetic moments. Competition between two magnetic interactions – ferromagnetic exchange, and the Dyaloshinskii-Moriya interations – in combination with critical fluctuations just below the paramagnetic phase boundary, stabilises a hexagonal skyrmion lattice perpendicular to an applied magnetic field. My research focuses primarily on the use of synchrotron-based x-ray techniques to investigate skyrmions. However, for this project, I worked with Dr. Shinichiro Seki using magnetic resonant microwave microscopy to study the resonant dynamics of skyrmions in Cu2OSeO3, an insulating skyrmion material which he discovered. Skyrmion resonances can be excited via microwaves, and the absorption spectra can then be recorded.

Our collaborators at the University of Warwick recently produced multicrystalline powder samples and single crystals of zinc-doped Cu2OSeO3. A previous paper reported that the conventional skyrmion region split into two distinct areas, separated by temperature, with the presence of zinc doping. These observations were made using powder samples. However, the measurements were performed with magnetometry, which cannot probe the nature of a magnetic phase. We therefore decided to use magnetic resonance measurements to identify the nature of the supposedly split skyrmion region.

While typically skyrmions only exist in a small temperature range close to the Curie temperature, recent studies have shown metastable skyrmions existing down to low temperatues when the material is supercooled through the skyrmion phase. Pure Cu2OSeO3 does not exhibit this metastable state. However there was a possibility that the inclusion of zinc atoms into the crystal structure would create pinning sites, preventing the skyrmions from being destroyed at lower temperatures, and this became a secondary focus of my summer project.

7. Research implementation and results under the program

Title of your research plan:

Supercooled Skyrmions in Zinc-doped Cu2OSeO3

Description of the research activities:

Magnetic resonances measurements were performed using Dr. Seki's equipment. Microwave spectra were recorded at a range of magnetic fields and temperatures, to map out the magnetic phase diagram of Cu2OSeO3 crystals with varying zinc doping. By rapidly cooling through the skyrmion phase, and then recording spectra at a range of magnetic fields, the volume fraction of the skyrmion phase, as well its extent in magnetic field, was measured. Firstly, measurements of the powder demonstrated that our results disagree with the previously reported split skyrmion phase in Zn-doped Cu2OSeO3. Therefore, we decided to focus on single crystals of Cu2OSeO3. These measurements confirmed that the presence of zinc doping in Cu2OSeO3 stabilises the metastable skyrmion lattice down to low temperatures. The two groups have now agreed to collaborate on additional research projects related to my work: looking at the nature of the supercooled phase in single crystals of Zn-doped Cu2OSeO3 with small angle neutron scattering, and using x-ray microscopy to directly image the resonant dynamics of skyrmions.

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

My cultural experiences began with the homestay, which I enjoyed so much, I am going back to visit my host family again before I leave. Highlights of the rest of my trip include visiting snow monkeys in Nagano, walking around the temples in Kyoto wearing yukata, the cultural experience evening during the induction week, living close enough to Tokyo to hang out in Ginza, Shinjuku, Harajuku, Akihabara and Shibuya to find a huge variety of bars and restaurants, the various summer and fireworks festivals, and the Tokyo summersonic music festival.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Phillippa Cooper （ID No. SP17102）

2. Current affiliation: University of Bristol

3. Research fields and specialties:

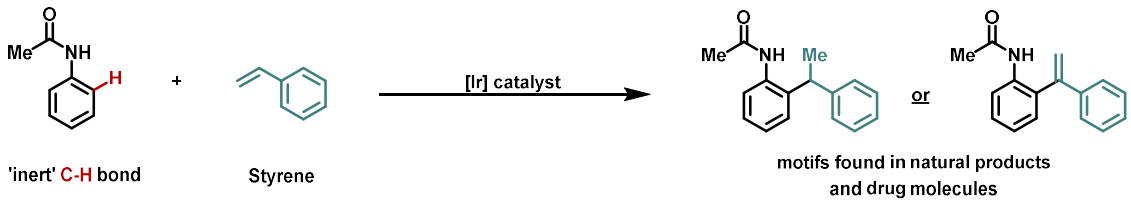
Chemistry

4. Host institution: ITBM, University of Nagoya

5. Host researcher: Professor Kenichiro Itami

6. Description of your current research

I am a second year PhD student at the University of Bristol in Professor John Bower's group. Here I employ iridium catalysis to selectively activate and functionalize otherwise inactive carbon-hydrogen bonds, to form new carbon-carbon bonds. This offers a step-economical and sustainable method to access useful and diverse molecular structures. These structures can be readily modified to afford various motifs which may be found in natural products or drug molecules.



Scheme 1: Developed Ir catalysed methodology to generate new C-C bonds

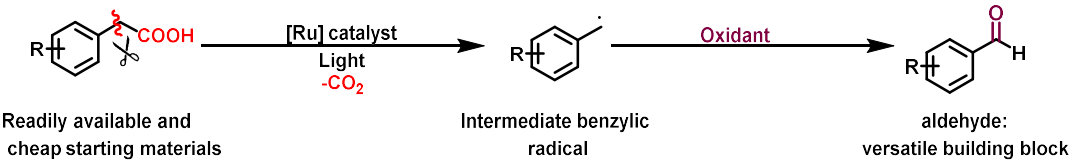
7. Research implementation and results under the program

Title of your research plan:

Photocatalysis as a tool for one-step, dual decarboxylation/ formylation reactions

Description of the research activities:

During my time in the Itami lab I got to work within the exciting field of photocatalysis. I employed a visible light activated Ruthenium catalyst to break a bond and remove carbon dioxide from a molecule. Followed by oxidation of the resulting benzylic radical to introduce a new functionality and new properties into the molecule. I was able to optimize the developed methodology and employ it to synthesize a range of aldehydes which are versatile building blocks as they can undergo a vast range of known transformations to yield diverse molecules which can then be utilized in pharmaceutical or materials chemistry.



Scheme 3: Dual decarboxylation/formylation reaction.

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

I have had the best time in Japan and I couldn't have wished for a better experience. I was able to travel most weekends, including to Kyoto to see the festival of Gion Matsuri, Osaka, Nagano to see the snow monkeys and go to an onsen village, I climbed mount Fuji and I watched Sumo wrestling. Thank you for organizing such a great program!

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Jonathan A. DAVIES （ID No. SP17103）

2. Current affiliation: University of Bristol

3. Research fields and specialties:

Chemistry

4. Host institution: Kyoto University

5. Host researcher: Prof. Jun-ichi YOSHIDA

6. Description of your current research

My PhD project is under the supervision of Professor Chris Willis, and is based on the development of new antibiotics. On a global scale there are few bigger threats currently facing human health than the rapid rise of antibiotic resistance. Consequently, the need to identify and develop new antibiotics is greater than ever before. The pleuromutilins (Figure 1) are of particular interest for their potent activity against gram-positive bacteria. They have also been used extensively in veterinary medicine for over 30 years without any evidence of significant antibiotic resistance.

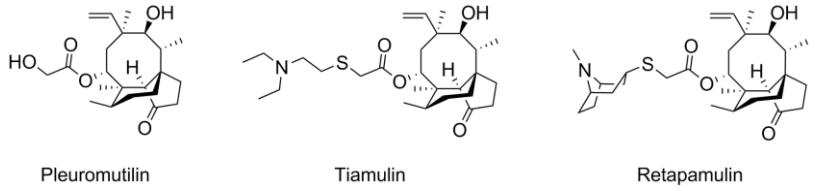


Figure 1. The structures of three pleuromutilin antibiotics.

Pleuromutilin is produced naturally in some basidiomycete fungi, such as Clitopilus passeckerianus, via an enzymatic pathway; however, large-scale fermentation of this fungus has proved challenging due to long growth times and relatively low titres. Recently, exciting work within Bristol has led to the successful recreation of pleuromutilin biosynthesis via expression of the pleuromutilin-producing gene cluster in a heterologous host organism, *Aspergillus oryzae*. This resulted in a ten-fold increase in pleuromutilin production and enabled each biosynthetic intermediate to be isolated and identified.

In this project I am synthesising unnatural substrates and exploring their biotransformations by using enzymes along the pathway to generate novel compounds. These products will also act as starting materials for the chemical synthesis of a diverse library of novel targets, which will then be examined through structure-activity relationship studies. The antibiotic activity of all novel compounds will be assessed and will inform the design of new target molecules.

7. Research implementation and results under the program

Title of your research plan:

The Application of Electrochemistry in Organic Synthesis

Description of the research activities:

During my time in the Yoshida group I investigated the application of electrochemistry in organic synthesis. Electrochemistry can be used to selectively oxidise organic molecules at specific positions forming reactive cations. The Yoshida group have found that these intermediates can be controlled though the use of a stabilising group. The accumulation of these stabilised intermediates in solution forms what is known as a "stabilised cation pool". This pool can then be reacted with a variety of nucleophiles to form novel compounds containing new carbon-carbon bonds.

My research was focused primarily on the optimisation of this new methodology and involved the electrochemical synthesis of a diverse library of organic compounds. My time in Japan how allowed me to gain an understanding of the fundamental principles of electrochemistry. I have also learnt how to build and use electrochemical reactors, and how to effectively plan and undertake electrochemical reactions.

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

My time in Japan has been one of the best experiences of my life so far. In the short time I have been here I have scaled the heights of Mount Fuji, conversed with an apprentice Geisha, lodged with the Buddhist monks of Mount Koya, attended a sumo tournament in Nagoya, watched a baseball match in Yokohama, worn a yukata to Gion Matsuri festival in Kyoto, experienced my first typhoon, and sea kayaked off the coast of Zushi beach.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Neil Fuller （ID No. SP17104）

2. Current affiliation:

University of Portsmouth

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: Institute of Environmental Radioactivity, Fukushima University

5. Host researcher: Dr Toshihiro Wada

6. Description of your current research

I am currently studying for a 3.5 year PhD entitled 'The biological effects of ionizing radiation on crustaceans: combining lab and field studies'. At present, there is a disparity between laboratory and field-based radioecology studies, with individuals in the natural environment reportedly more sensitive to radiation than those in the lab. Therefore, the focus of my current research is the combination of laboratory based radiation exposures and field studies of crustaceans. To date, I have conducted exposures of both marine and freshwater crustaceans to radiation and monitored effects on behavior, reproduction and DNA damage. These studies have been coupled with analysis of reproductive, developmental and genomic level effects on crustaceans at Chernobyl.

7. Research implementation and results under the program

Title of your research plan:

Radiocaesium Accumulation and Effects in the Japanese Mitten Crab, *Eriocheir japonica*, at Fukushima

Description of the research activities:

The present study aimed to assess the uptake and potential effects of Fukushima-derived radiation on the Japanese mitten crab, *Eriocheir japonica.* Crabs are internationally important model organisms in assessing radiation effects on the environment. Additionally, the Japanese mitten crab is an important target species for inland fisheries and a local delicacy. Four sampling sites with varying contamination levels due to the Fukushima Dai-ichi nuclear accident were selected. A total of 140 samples were collected by baited cage. Radionuclide contamination in both whole crab and individual tissue samples was assessed using standard and well-type gamma spectroscopy. Individuals were assessed for fluctuating asymmetry, a technique that assess departures from normal bilateral symmetry as an indicator of developmental stability. Lipid extraction of muscle tissues was performed for future stable isotope analysis that will provide an insight into the relationship between individual contamination levels and diet. Preliminary data suggests high levels of radiocesium (^{134}Cs, ^{137}Cs) contamination in *E. japonica* of 3000 Bq/kg, 30 times above the Japanese regulatory limit for consumption of 100 Bq/kg. This study is the first to demonstrate persistent high levels of contamination in a commercially and ecologically important crab species at Fukushima. These findings will support prefectural monitoring efforts of food products and provide invaluable data to international environmental radioprotection organizations.

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

The JSPS summer program has been an incredible experience both in terms of working environment and culture. Throughout my time at the Institute of Environmental Radioactivity I was fortunate to participate in a five day course led by the institute director, Dr Kenji Nanba, that provided an insight into the nuclear accident and its ongoing consequences for the prefecture. I have also been fortunate to be able to visit many beautiful areas in the Tohoku region and enjoy hiking, sight-seeing and lots of delicious local cuisine. This summer experience has stimulated my desire to return to Japan and pursue a career in research.

9. Advisor's remarks (if any):

Mr. Fuller, a PhD student of the University of Portsmouth, has worked hard both in the field and laboratory to reveal the spatial trends in radiocesium contamination levels of Japanese mitten crab and to elucidate the potential radiation effects on their morphology. His results will certainly contribute not only for future monitoring scheme of the Fukushima Prefectural Government, but also for the radioecological sciences.

RESEARCH REPORT

1. Name: Charles E. Gell (ID No. SP17105)

2. Current affiliation: Department of Chemistry, Lancaster University, UK

3. Research fields and specialties:

Chemistry

4. Host institution: I^{2}CNER, Kyushu University, Japan

5. Host researcher: Prof. Stephen M. Lyth

6. Description of your current research

Rotaxanes for the Enantioselective Binding of Chiral Anions

Rotaxanes are interlocked molecules consisting of a 'rod' like component called the axle, which is threaded through a 'ring' like component called a macrocycle. There is no chemical bond between the 'rod' and the 'ring', instead bulky groups are placed at either end of the 'rod', to prevent the macrocycle from de-threading (Figure 1).

Rotaxanes are commonly used as molecular machines, taking advantage of the relative motion of the 'rod' and the 'ring'. Although they have also been used as hosts to bind a variety of ionic and molecular guests. At Lancaster I am developing several 'families' of rotaxanes to bind biological relevant anions (pairs of chiral anions). We already have qualitive results to show that our rotaxanes can successfully distinguish between these guest molecules.

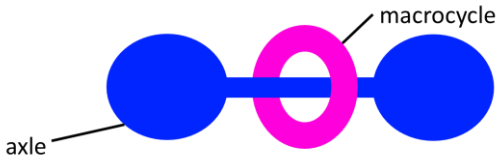
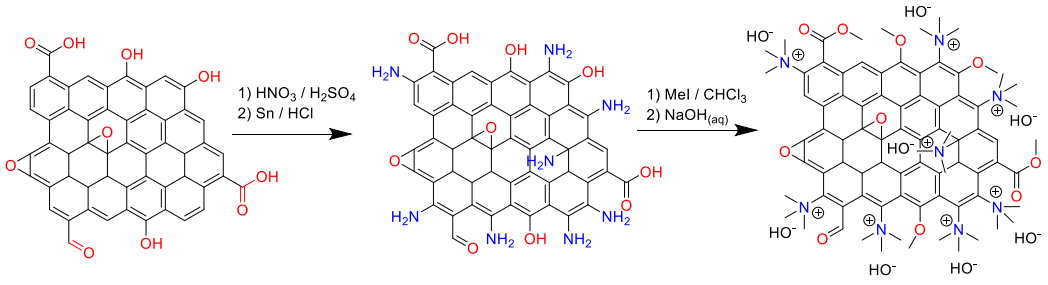


Figure 1 – A schematic representation of a rotaxane

7. Research implementation and results under the program

Aminated and Ammonium Graphene Oxide Membranes for Use in Fuel Cells

Graphene Oxide (GO) is a 2D material similar to graphite. However, it has additional oxygen functional groups. GO has been previously used by the Lyth groups as both an anion and proton exchange membrane in fuel cells. To enhance the conductivity of GO we tried to add amines, for enhance proton conductivity and then turned those into ammonium groups, for enhanced anion conductivity (Scheme 1).



Scheme 1 -Proposed Synthesis of aminated and ammonium GO

The nitration reaction was successful. However, the following reduction was unsuccessful. As the GO was reduced to graphite, with no signs of amine functionality and produced a powdery substance that could not form a membrane. As it was clear this technique would not work, research time was instead focused upon NCF (nanocellulose fiber) membranes.

CNF membranes are similar to paper. However, the structure of the material is more crystalline making the membrane more mechanically robust. NCF membranes have previously been used by the Lyth group as proton exchange membranes, as they have many desirable qualities (inexpensive, low gas permeability, high temperature stability, high mechanical strength), which make up for their lower conductivity relative to commercially available proton exchange membranes (Nafion). We theorised that addition of sulfonic acid groups to the surface of the CNF would enhance proton conductivity.

As CNF is not soluble in organic solvents, several methods were tried to sulfonate the CNF; filtering the sulfonation mixture through the membranes, powdering the CNF in a blender then sulfonating it and redispersing it in water and suspending CNF membranes in the sulfonating mixture. Of these the most effective and easiest was suspending the CNF membranes in the sulfonating mixture. This technique was used with 1,2,5 and 10 equivalents of sulfonating mixture. The membranes were then assessed for their proton conductivity (Figure 2). The resulting sulfonated membranes showed higher conductivity than the untreated CNF membranes, that does not decrease at higher temperatures.

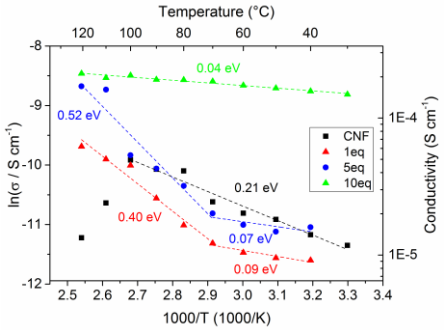


Figure 2 – Proton conductivities of sulfonated CNF

Interestingly, the 1,2 and 5 equivalents sulfonated CNF seems to have two methods of proton transfer, one at low temperatures (Grothuss mechanism, shallow line) and a second one at higher temperatures (vehicular mechanism, steep line). However, the 10 equivalents only has one mechanism (Grothuss mechanism), indicating that this degree of sulfonation,

In addition to the sulfonated CNF work, investigations have begun into development of an AEM (anion exchange membrane), through treatment of CNF with mesyl chloride in THF, followed by refluxing the activated CNF with an amine commonly used in AEMs in THF. These membranes will be tested in the near future.

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

RESEARCH REPORT

1. Name: Samuel Hatfield （ID No. SP17106）

2. Current affiliation: University of Oxford

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: RIKEN Advanced Institute for Computational Science

5. Host researcher: Dr. Takemasa Miyoshi

6. Description of your current research

The subject of my research is a statistical technique known as “data assimilation”. The goal of this technique is to combine (“assimilate”) observations of a physical system (“data”) with a computer model of that system. This is in order to improve the accuracy of the model and, as a result, its value as a forecasting tool. Data assimilation is used in such disparate fields as neuroscience, seismology and weather forecasting. The latter is my focus.

The weather is a chaotic system. This means that even small errors in the weather state at the start of a forecast, as represented in a computer model, will grow and eventually leave the forecast useless. This is sometimes referred to as the “butterfly effect”. As a result, it is essential to have an accurate estimate of the starting state of the weather, and if this estimate is improved, then we will be able to forecast the weather further into the future.

We can improve this initial estimate by assimilating more data or by assimilating existing data in a more intelligent way. The goal of my project is to improve the data assimilation process by using a recently developed technique called “inexact computing”. This technique proposes to lower the precision with which the atmospheric model is computed. Lower precision, inexact computations introduce errors into the simulation, but they consume less energy. Therefore, if the errors aren’t too big, we can save energy by reducing precision. We could even “reinvest” that saved energy to actually *improve* the simulation, with respect to the high precision simulation.

I have reason to believe that inexact computing can be used to improve data assimilation. Data assimilation is an inherently uncertain process, because the observations and the atmospheric model are imperfect. Therefore, the errors introduced when lowering precision may be acceptable. If we can lower precision, then we can afford to use a larger sampling size when assimilating the observations. This will result in a more accurate initial weather state estimate, and therefore a better quality weather forecast.

7. Research implementation and results under the program

Title of your research plan:

How low can you go? Reducing the precision of data assimilation to improve weather forecast skill

Description of the research activities:

Over the summer, I accomplished two results. Firstly, I demonstrated that when an atmospheric computer model is imperfect (compared with the real atmosphere), precision can be lowered further than when the model is perfect. Because models are always imperfect in the field of atmospheric data assimilation, this is a useful result. I then illustrated how the computational cost savings made by lowering precision could be "reinvested". I increased the sample size of the data assimilation after lowering precision, and this delivered higher quality data assimilation, compared with the high precision reference experiment. This results in higher skill weather forecasts.

The second result concerned the actual data assimilation algorithm. I lowered the precision of this algorithm, and measured the computational time required. I found that I could reduce this time by 40%, with no degradation in the assimilation. This result may be used by my host team for their research into short-range forecasts of extreme rainfall events.

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

I enjoyed travelling around different cities on the weekends, and would encourage future scholars to keep in contact with their fellow scholars, as they make useful travelling companions! I would also strongly advise scholars to learn as much Japanese as possible, while they are in the country. The country will open up for you, even if you know just a few words! My favourite aspect of Japan is certainly the food and drink, though, and I will miss being able to buy a delicious bowl of ramen for only £6.

9. Advisor's remarks (if any):

Sam Hatfield has made substantial progress during his stay in RIKEN on the unique subject of reduced precision computation of weather forecasting and data assimilation. The findings have a large potential for future applications and lead to further explorations in the follow-on researches. His cultural curiosities and interactions were also outstanding.

RESEARCH REPORT

1. Name: Peter George Martin （ID No. SP17107）

2. Current affiliation: University of Bristol, School of Physics, Tyndall Avenue, Bristol, BS8 1TL, UK.

3. Research fields and specialties:

Interdisciplinary and Frontier Sciences (Environmental)

4. Host institution: Kyoto University

5. Host researcher: Professor Yosuke YAMASHIKI

6. Description of your current research

In the aftermath of the 2011 Fukushima Daiichi Nuclear Power Plant (FDNPP) accident, a considerable amount of radioactivity was released into the Japanese environment. My current research activities have been directed into attaining a better understanding as to the physical and chemical forms of the widely-studies fission product cesium, but also the less well-studied actinide species such as uranium and plutonium.

Having previously conducted fieldwork within the contaminated Fukushima Prefecture, at locations such as Namie, Futaba and Iitate, we have obtained extensive data relating to the spread of the radionuclides. Within the laboratory, we have been conducting extensive analysis of physical samples, extracting the radioactive particles before subjecting them to a range of analytical methods – including synchrotron radiation analysis. Outside of the lab, we have been working extensively with simulation modelers, including those at the Graduate School of Advanced Integrated Studies in Human Survivability (GSAIS) to predict the flow and eventual fate of contaminant-containing material as it transits through the dynamic Fukushima environment.

With more and more people who were once displaced from their homes look to return, and as we now reach 6.5 years since the accident, it is now more important than ever to accurately determine how material is behaving in the dynamic Fukushima environment and what (if any) impacts to health it will pose.

The work, as part of my PhD - for the first time, has been able to locate and analyse fragments of uranium within the ejecta material. Having identified its existence, and determined its physical form, an accurate assessment of the mobility and eventual fate of the material is required. With modelling having been performed extensively on Cs-containing material, the focus is now turning to these other forms of contamination.

7. Research implementation and results under the program

Title of your research plan:

Understanding the evolution of Fukushima Daiichi Nuclear Power Plant contamination in the environment.

Description of the research activities:

The GSAIS at Kyoto University has extensive experience in the modelling of contamination migration and species behaviour within the environment. Following earlier work and results to date, my research during this JSPS Summer Program has been spent incorporating our latest results into their advanced hydrodynamic models. As a direct result of this we have been able to deduce valuable information relating to the rate of species migration from several of the waste stores than exist around Fukushima Prefecture in addition to the expected residence and fate of recently discovered actinide materials.

With these results, we have been able to discuss with those responsible for the construction and maintenance of such facilities better methods with which to safeguard again leakage through several design improvements that could be made. A subsequent trip to the same area is planned alongside a newly formed collaboration with the JAEA in October 2017.

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

Kyoto is such an amazing city, it truly does have everything – with the modern juxtaposed against the very traditional. It has been a great privilege to be taken around the area by both locals and fellow academics from the institute. Even though we worked hard and achieved a lot during the time at Kyoto University, I had plenty of time for many experiences. I cannot name them all, but the highlights must include; performing a tea ceremony, walking through the countless temples and shrines, watching Japanese baseball, visiting the Imperial Palace and Gardens as well as experiencing Kendo.

RESEARCH REPORT

1. Name: Gavin B. Robertson （ID No. SP17 108 ）

2. Current affiliation: School of Medicine, University of St. Andrews, UK

3. Research fields and specialties: Biological Sciences

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

5. Host researcher: Professor Hiroshi Takeshima

6. Description of your current research

In heart failure, damaging changes to Ca^{2+}-homeostasis occur as a result of increased spontaneous Ca^{2+}-spark frequency and dysregulated Ca^{2+}-handling within the cardiomyocyte. This leads to decreased systolic contraction, unwanted irregular contractile activity and cardiomyocyte death. Ischaemic heart disease is a major risk factor for heart failure. Accumulation of intracellular Ca^{2+} is a characteristic feature of ischaemia/reperfusion thought to result from spontaneous Ca^{2+} release from the sarcoplasmic reticulum (SR). Classically, diastolic SR Ca^{2+}-leak is thought to be governed by abnormal ryanodine receptor (RyR2) activity. There is evidence however, for a RyR2-independent mechanism of SR Ca^{2+} efflux, and that these ionic fluxes may be more strongly activated in disease states.

Mitsugumin 23 (MG23) is a newly identified sarcoplasmic reticulum (SR) ion-channel that displays Ca^{2+}-handling properties, challenging the idea that the cardiac ryanodine receptor is the only ion-channel responsible for SR Ca^{2+}-release. My current research suggests that MG23 plays a key role in diastolic Ca^{2+}-leak resulting in dysregulated Ca^{2+}-homeostasis (Reilly-O'Donnell et. Al 2017). These data represent a paradigm shift in our understanding of the molecular mechanisms which lead to SR Ca^{2+} leak in heart failure and the generation of fatal arrhythmias.

The major hypothesis underlying the proposed research was that MG23 plays a limited role in normal SR Ca^{2+}-release but during an ischaemic event, the function of MG23 is altered resulting in aberrant Ca^{2+}-dynamics, impaired contractility and cardiomyocyte death. This highlights a fundamental role for MG23 in chronic heart failure. To understand the role of MG23 in regulating cardiac function, the aim of the summer project was to establish the role of MG23 in shaping cellular Ca^{2+}-dynamics and cardiac contractility.

Reference: Reilly-O'Donnell et Al. (2017) JBC: M117.781708. [Epub ahead of print]

7. Research implementation and results under the program

Title of your research plan:

A role for Mitsugumin 23 in ischaemic heart failure

Description of the research activities:

Traditional techniques for isolation of cardiomyocytes from mouse heart are technically very difficult and require significant expertise. A recently reported novel approach was therefore employed in order to isolate cardiomyocytes from both wild-type (WT) and MG23 Knock-out (KO) mice. This technique provided a similar yield of calcium-tolerant mouse cardiomyocytes to that observed using traditional techniques. In order to investigate the role of MG23 in ischaemic responses, standard confocal imaging was used for measurement of intracellular Ca^{2+} and Zn^{2+}-dynamics in isolated cardiomyocytes exposed to an ischaemic buffer.

My preliminary data obtained during this programme suggest that both Ca^{2+} and Zn^{2+}-handling differ between WT and MG23-KO cardiomyocytes exposed to ischaemia. Therefore, MG23 may play an important role in sarcoplasmic reticulum Ca^{2+}-leak and cardiomyocyte cell death under ischaemic conditions. Future collaboration with Prof. Takeshima's Lab will aim to further understand the role of MG23 in these processes and may highlight MG23 as a potential therapeutic target in the treatment of ischaemic heart disease.

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

The JSPS summer programme has provided me with the wonderful opportunity to experience life in Japan. To work in the laboratory of Prof. Takeshima has been extremely valuable and inspiring, and I hope to continue this fruitful collaboration. I have taken the opportunity to visit many of the beautiful temples and sights around Kyoto, which has further added to my very enjoyable time in Japan.

9. Advisor's remarks (if any):

Although there were no technical skills for isolation of intact cardiomyocytes in my lab, surprisingly Mr. Robertson has established this in a short time. Furthermore, by means of fluorescence imaging, he is now finding the important role of MG23 in stressed cardiomyocytes. Perhaps his project already became promising, and we can expect fruitful results from our collaborative research now.

RESEARCH REPORT

1. Name: Helen SPRINGBETT （ID No. SP17109）

2. Current affiliation: University of Cambridge

3. Research fields and specialties:

Mathematical and Physical Sciences, Engineering Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Prof. Mark HOLMES and Prof. Yasuhiko ARAKAWA

6. Description of your current research

Semiconductor quantum dots (QDs) have shown much promise in recent years as potential single photon emitters. A single photon source provides the on-demand emission of one, and only one, photon at any given time, and is necessary for applications such as quantum cryptography, linear optical quantum computing, and true random number generation. Traditionally, single photons have been obtained by heavily attenuating laser pulses; however, as this is a statistical method, there is always a finite probability of emitting more than one photon. Therefore, the development of true single photon sources is required to achieve true reliability of the applications mentioned. Single quantum states, such as those in quantum dots, only allow one emission per relaxation process of the system- and are therefore ideal candidates for single photon sources. For production of visible wavelength quantum dot single photon sources, we have been working on the III-nitride material system, which shows many particular advantages such as the possibility of tuning in the blue, green or red by changing the alloying content of InGaN structures, and comparably high temperature emission.

My current research focuses on the structural characterization of such III-nitride QDs in order to create a comprehensive understanding of the quantum dot structures from growth through to their use in devices. I use Transmission Electron Microscopy and complementary techniques to investigate the structural and compositional profiles of the QD samples. This can be correlated with the growth conditions, and with the emission properties, in order to fully comprehend, and thereby improve, the structures grown.

7. Research implementation and results under the program

Title of your research plan:

Optical characterization of InGaN quantum dots using microphotoluminescence

Description of the research activities:

The work we have undertaken at The University of Tokyo has provided insight into the optical emission properties of the InGaN quantum dot samples grown in Cambridge through the use of microphotoluminescence (μPL) techniques, whereby laser sources are used to excite the quantum structures. In this manner we have recorded single photon emission. Furthermore, we have investigated methods in which to improve the purity of this single photon emission when exciting the quantum emitters in this way. In order to do this, we have excited the same single photon emitter with a range of continuous wave and pulsed laser sources at varying wavelengths and powers.

Furthermore, we have investigated the spectral diffusion of this, and similar, quantum emitters. This is a phenomenon by which the wavelength of the light emitted varies over time. We have observed and recorded this phenomenon over three different time scales, and a theoretical model to explain it is currently being developed.

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

Japan has provided me a wealth of wonderful experiences, for which I am very grateful. I have been lucky enough to experience a festival in Kyoto, see monkeys bathe in onsen, eat Michelin-starred ramen, stay in a Buddhist temple, watch the sunrise from the summit of Mount Fuji and generally enjoy the hospitality of this beautiful country.

9. Advisor's remarks (if any)

RESEARCH REPORT

1. Name: Melissa Walden （ID No. SP17110）

2. Current affiliation: Durham University, U.K.

3. Research fields and specialties:
Chemistry

4. Host institution: Kyushu University, OPERA.

5. Host researcher: Professor Chihaya Adachi

6. Description of your current research

The depletion of fossil fuel supplies and the increase in atmospheric carbon dioxide concentrations are making alternative energy sources an attractive way to alleviate the stress placed on our planet. In our modern day lives we demand energy to power homes, cars and businesses. A substantial amount of this energy is used on lighting and displays for computers and televisions. Thus, more environmentally friendly sources of energy, as well as a means of utilising this energy more efficiently, are urgently needed. Organic light emitting diodes (OLEDs) are being used in 'greener' energy-efficient lighting and display screens and work by converting electrical energy into light.

They have many advantages over other types of lighting device such as LEDs (light emitting diodes) and LCDs (liquid crystal displays). They are lighter, thinner and more flexible where they can be made from plastic as opposed to glass. They are also brighter with thinner organic layers than the corresponding inorganic crystal layers of an LED. Moreover, they do not require a backlight and thus can be 'on' only when required, resulting in a reduced energy consumption.

Phosphorescent metal complexes can be doped into these OLED devices in an emitting layer to give high efficiencies. My research focuses on the synthesis of these metal complexes to obtain complexes that emit efficiently in the red region of the visible spectrum. A variety of metal complex structures are investigated however Pt and Pd triazole complexes are at the heart of my research. These have potential for incorporation into OLED devices.

7. Research implementation and results under the program

Title of your research plan:

Investigation into Pt and Pd metal complexes for OLED device fabrication

Description of the research activities:

The synthesis of a series of compounds was performed at Durham University and these complexes were then investigated in Japan.

Initial purification by sublimation was performed of these metal complexes and thin films were then fabricated. Film compositions were chosen based on solubility and electronic properties of the metal complexes.

The optical properties of a series of Pt and Pd complex films prepared by both spin-coating and evaporation were measured.

From these optical property results, OLED devices of a Pt-triazole complex were fabricated. The device structure was optimized and its feasibility for OLED production was assessed.

Investigation into tetradentate Pd complexes for potential OLED application was also carried out and the synthesis of the precursor materials was achieved. Complexation of these ligands was attempted and future work will aim to successfully synthesize the resulting metal complexes.

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

I have experienced so much in Japan that it is hard to summarize. The people I have met have been some of the most outgoing and friendly that I have ever encountered. I have had so much support from my lab which has enabled me to learn so many new scientific techniques but also cultural Japanese things including Tanabata and Nagashi Somen!

The amount of new food I have tasted has been incredible and I feel particularly lucky to have been on Kyushu island for its abundance of fresh fish and vegetables. I particularly have enjoyed having matcha green tea on almost a daily basis!

I feel indebted to the people I have met here for taking me to so many new places and allowing me to experience the very best of Japan. It is such a beautiful place but it is even better to have local people advise on the best things to see and do and to experience it with them. I cannot wait to visit again!

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Sam Watson （ID No. SP17111 ）

2. Current affiliation: The University of Oxford

3. Research fields and specialties:

Biological Sciences

4. Host institution: The Institute of Plant Science and Resources (IPSR), Okayama University

5. Host researcher: Professor Wataru Sakamoto

6. Description of your current research

The chloroplast is a vital organelle that houses photosynthesis in all green plants and algae. The chloroplast has an unusual evolutionary history – it is the integrated descendant of a once free-living organism. Although the chloroplast still retains a miniature genome, most of its protein-encoding genes have been ceded to the nucleus; most proteins necessary for chloroplast function must therefore be imported into the organelle after synthesis in the cytosol. This import is dependent on the coordinate activity of two chloroplast membrane-bound machineries: the TOC and TIC complexes. Recently, it has emerged that the TOC complex, which faces the cytosol and has a critical role in the recognition and import of chloroplast-targeted proteins, is dynamically regulated by the Ubiquitin Proteasome System (UPS), a fundamental system of post-translational modification. The UPS controls the chloroplast's import activity, and thus its proteome, physiology, and behaviour. This regulation is crucial for chloroplast development and survival under challenging environmental conditions.

The aim of my PhD is to elucidate the mechanisms responsible for the regulation of UPS activity within the context of the TOC complex targeting. The UPS only targets TOC complex components under particular physiological or environmental conditions; how this selective activity is achieved is currently unclear. I tackling this question through both forward and reverse genetic approaches, alongside molecular and biochemical experiments.

7. Research implementation and results under the program

Title of your research plan:

Physiological and biochemical characterization of two chloroplast-localized ABC transporters

Description of the research activities:

ABC transporters form a diverse and highly conserved family of membrane transporters that are well-represented in plants. We are interested in a small group of currently undescribed ABC transporters that localize to the chloroplast inner membrane and share sequence homology with well-characterized human peptide transporters. A series of biochemical experiments have largely confirmed the peptide transporting ability of the three proteins. Beyond this, the function of the proteins remains unclear. Intriguingly, an *Arabidopsis* mutant of one of the transporters shows misregulation of a large number of nuclear genes, suggesting that the transporters function within a feedback pathway, reprogramming the nuclear transcriptome under certain physiological or environmental conditions. The key goal of my project has therefore been to determine the function of this hypothetical feedback pathway. To this aim, I have been attempting to assign phenotypes to mutants of two of the transporters (the analysis of the first is already well underway).

Through a series of physiological and biochemical experiments, robust phenotypes have been established for both mutants. Both mutants are sensitive to salt stress, and this effect is more severe in the double mutant. Evidence was also found of a reduced ability to tolerate growth on nitrogen-limited media in one of the mutants. Molecular phenotypes were also discovered – CN-PAGE experiments demonstrated that both mutants show enhanced accumulation of PSII-LHCII supercomplex, a core component of the photosynthetic machinery. This result was confirmed via a series of Western blotting experiments. We are now attempting to link the physiological and molecular phenotypes; our working model is that the activity of the three transporters is important for the suppression of photosynthesis under stressful conditions. This suppression may reduce the build-up of reactive oxygen species, harmful byproducts of photosynthesis that accumulate under stressful conditions and can cause major damage to the cell.

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

My time in Japan has been extremely useful and enjoyable. I have received a large amount of high quality training, and learned a number of new techniques. I have also had the chance to do a lot of sightseeing: I have visited Kyoto, traveled around Shikoku, and visited a number of islands within the Seto Inland Sea. I would very much encourage any interested students to apply.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Lotte Watts （ID No. SP17112）

2. Current affiliation: University of Aberdeen

3. Research fields and specialties:
Biological Sciences

4. Host institution: National Institute of Genetics, Mishima

5. Host researcher: Professor Masato Kanemaki

6. Description of your current research

Inability to replicate and repair DNA accurately can result in the mutation or loss of key regulators of cell proliferation, leading to cancer-causing events like activation of cellular oncogenes and loss of tumour suppressor function. It is therefore of paramount importance to understand the mechanisms that ensure chromosome stability. I am currently in Year 2 of a 4-year Cancer Research UK-funded PhD based in Anne Donaldson's lab at the Institute of Medical Sciences, University of Aberdeen. My PhD research investigates how the protein RIF1 ensures accurate chromosome maintenance.

My PhD research aims to understand the contribution of RIF1 to chromosome maintenance and ultimately, whether it can be exploited as a target for cancer therapy. As tested by the colony formation assay, I have shown that RIF1-depleted cells are highly sensitive to the replication inhibitor aphidicolin, suggesting an important role for RIF1 in recovery from replication stress. In addition, I have found that different RIF1 isoforms have different effects in protecting against aphidicolin, suggesting a functional difference between isoforms. This sensitivity to aphidicolin may result from the role for RIF1 in S phase during DNA replication e.g. in stabilizing replication forks. However RIF1 is also implicated during mitotic M phase. Cells lacking RIF1 can enter mitosis before completion of DNA replication, which can cause chromosome breakages during mitosis. RIF1 is implicated in resolving such chromosomal issues caused by previous replication inhibition, but the precise mechanism is unknown. Given these distinct roles for RIF1 during S phase and in M phase, the next critical question in my research is to understand at what point during the cell cycle RIF1 is important for cell survival after replication inhibition. This work has huge potential in the long-term to impact on cancer treatment and benefit patients.

7. Research implementation and results under the program

Title of your research plan:

When is RIF1 essential for cell recovery after replication stress?

Description of the research activities:

To elucidate at what point during the cell cycle RIF1 is important for cell survival after replication stress, it needs to be depleted accurately and timely during the cell cycle. The Kanemaki lab has developed methods for specific depletion of proteins from cell cultures synchronised at particular cell cycle stages, ideal to address this issue. This project was two-fold: to construct a cell line wherein RIF1 can be depleted (employing auxin-inducible degron technology) and to learn cell sychronisation methods and optimise them for my experiment. I have successful constructed the AID-RIF1 cell line, and once validated can start to use it in my experiments. I have also tested synchronization methods extensively and adjusted them accordingly. In addition, I have been able to perform some microscopy which has yielded exciting results. I have achieved what I wanted to and more from this programme and I am now in a strong position to return to Aberdeen and continue this work as ongoing collaboration.

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

I have thoroughly enjoyed immersing myself into the Japanese culture at every opportunity - initially through the homestay arranged by SOKENDAI and subsequently through weekend trips with other JSPS fellows including visits to Himeji Castle, Kyoto for Gion Matsuri and Yudanaka, Nagano. The JSPS Summer Porgramme has surpassed all of my expectations. Both professionally and personally it has been a life-changing opportunity and I am incredibly grateful to have been awarded this fellowship.

9. Advisor’s remarks (if any): N/A

RESEARCH REPORT

1. Name: Magnus M Woods (ID No. SP17113)

2. Current affiliation: Mullard Space Science Laboratory, Department of Space and Climate Physics, University College London

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Institute for Space Earth Environment, University of Nagoya

5. Host researcher: Professor Kanya Kusano

6. Description of your current research

My research at my home institution in the UK involves the use of space based imaging spectrometers to investigate the solar atmosphere in the hours prior to the occurrence of solar flares (rapid, largescale releases of magnetic energy in the solar atmosphere). The aim of this work is to determine whether there are spectral signatures that can be reliably determined to occur prior to flaring, and how these signatures relate to models of flare triggering.

7. Research implementation and results under the program

Title of your research plan:

Investigations of a pre-flare flux rope, studied through magnetic field extrapolations.

Description of the research activities:

Whilst in Nagoya I have analysed the results of magnetic field extrapolations prepared by Dr Inoue of ISSE Nagoya University. Magnetic field extrapolations are a mathematical representation of the 3D magnetic structure of the solar atmosphere, produced by combining theoretical models with measurements of the magnetic field at the solar surface. I learned how to interpret these data sets and to visualize them using the software VAPOR. I then proceeded to use these data in combination with

observational data of the active region of the sun under study taken by several satellites. The active region under study had formed part of a previous project that I had undertaken (See; Woods et al. 2017), but this previous study had many outstanding questions. Through the work that I have done at ISEE Nagoya University, combining the results obtained from the Magnetic field extrapolations with observational imaging and spectral data, we have been able to answer some of the outstanding questions relating to this active region and the spectral signatures that we first observed. We believe that we have found clear evidence that the emergence of magnetic flux from below the solar surface and its interaction with the existing magnetic field is the driver of the spectral signatures that we have observed. I also had the opportunity to travel to the Tokyo area to visit the National Astronomical Observatory of Japan (NAOJ) and Japanese Aerospace Exploration Agency's (JAXA) ISAS campus. Whilst visiting these institutions I presented a seminar at each and held many productive discussions with the researchers working there that will hopefully lead to further collaborations in the future. The experience of the JSPS summer program has been incredibly enjoyable and intellectually valuable endeavor!

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

During my stay, I have had many enjoyable and interesting cultural experiences. Members of my research group have taken me to many Japanese restaurants (Izakaya, rooftop BBQ restaurants etc.). As well they took me on a visit to Inouyama city to visit the original wooden castle there which was a very special experience. Outside of the work environment I have had the chance to travel at weekend with other JSPS summer program students. Through this I have gone to watch Sumo wrestling, as well as experiencing the Gion Matsuri festival in Kyoto.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Laure GILLOT-ASSAYAG （ID No. SP17201）

2. Current affiliation: Paris 1 Panthéon-Sorbonne/ ENS-Ulm

3. Research fields and specialties:

Humanities Social Sciences

4. Host institution: Toyo University, Tokyo

5. Host researcher: Prof. Shin NAGAI

6. Description of your current research

My current research seeks to elaborate criteria for an ethic of compromise, especially in Paul Ricœur's thought. No study to date has been published on compromise in the philosophy of Paul Ricœur, yet a key concept to understand the architecture of his political and moral philosophy.

Indeed, he develops the notion of a political paradox ("Paradoxe politique"), a compromise between rationality and violence at the very heart of politics and democracy, which serves as a common thread in my reflections. I investigate the configuration of compromise (its circumstances, modalities), its implementation (deliberation), and the instances of mediation (justice, language) that institutionalize the use of compromise.

7. Research implementation and results under the program

Title of your research plan:

"ETHICS OF COMPROMISE: FRENCH-JAPANESE PERSPECTIVES"

Description of the research activities:

The purpose of my stay was to explore the controversial concept of 'compromise' in its transnational dimension, little addressed by present philosophical studies.

I have analyzed thoroughly how the Kyoto school helps us to distinguish compromise from compromise of principles, in the thought and the commitment of its philosophers. My research director has been a tremendous help for putting me in contact with other Japanese philosophers both in Kyoto, Tokyo and in the United States. Moreover, I have attended several workshops on Nishida Kitaro and Japanese phenomenology at Tokyo University.

The second part of my research has consisted in studying compromise in business and working relationships, its actors and its legitimacy, in a dialogue between sociology, economics, and philosophy. I have examined how one could built a philosophy of "kyosei" as a means of conceptualizing the need for a dialogue between shareholders, entrepreneurs, employees in order to balance the interests of

shareholders and society at large. In Japanese big firms (mostly “keiretsu”), I have found out that forms of negotiation such as consensus are preferred, though post-war "social compromise" is now weakened for several substantive and circumstantial reasons.

A final part has addressed intergenerational compromise. The ageing of the population, both in France and Japan, implies to implement policies for social solidarity. I have investigated how social relationships develop between generations through cohabitation and at what respective costs.

During my stay, I had the opportunity to give a 1.30 hour conference on “Ethics of Compromise in Paul Ricoeur’s thought” to researchers and PhD students in Toyo University Faculty of Philosophy. It took the form of a group discussion and challenging questions and comments were made on my research.

For purposes of future collaborations, I have started to make an arrangement to invite my supervisor to give a talk on his research at my university next year.

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

I would like to thank Professor Shin Nagai for his insightful advices that open up prospects for future research and collaborations. I consider this program as a great discovery both on a professional and personal level.

Among other cultural experiences, I had the opportunity to go to Hiroshima during the commemorations with a group of JSPS fellows. At this occasion, we attended several speeches and visited the memorial. We also went to various matsuri, had a night in a capsule hotel before visiting the lavish and splendid city of Nikko.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Beauprez Sophie-Anne （ID No. SP17202）

2. Current affiliation: PhD Student, CeRCA, University of Poitiers, France

3. Research fields and specialties:

Social Sciences

4. Host institution: University of Tokyo

5. Host researcher: Hiraki Kazuo

6. Description of your current research

The aim of my thesis is to investigate the link between action observation and language processing. In the first study of my thesis, we showed that observing an action can affect language processing. The participants in our experiment viewed an action and then had to perform lexical decision tasks on verbs. The analysis of the data showed a facilitation effect on language processing when the verb and the action that were previously seen were congruent, whereas no facilitation effect was observed for an incongruent verb. These findings were interpreted as evidence that action perception and action word processing share common representations.

7. Research implementation and results under the program

Title of your research plan:

Influence of human and robot observation on the action-language relationship.

Description of the research activities:

The aim of this study was to assess whether observing a robot performing an action will produce the same facilitation effect as observing a human.

To realize this study, I was trained to use and program “Nao” (the robot from

Aldebaran http://www.aldebaran.com/en). Then, I recorded short videos of Nao and of a human performing different actions.

During the experiment, the participants saw these videos before seeing an action verb. These action verb could be congruent or incongruent with the video (e.g. congruent trial: seeing the video of a robot or a human acquiescing and then the word “acquiesce” appears; e.g. incongruent trial: seeing the video of a robot or a human acquiescing and then the word “applaud” appears).

We recorded the response times and the accuracy of 21 participants. Moreover, we decided to record the electrophysiological activity of their brain (EEG) during the experiment (but EEG data will be analyzed as a second step).

Concerning the behavioral data, contrary to what was expected, a facilitation effect was found in the human condition and in the robot condition. However, this effect was significantly more important for human than for robots.

Thus, to a lesser extent than human observation, it seems that the observation of a robot is able to influence the language processing. As Japanese are more used to see robots in their daily life, it would be interesting to replicate this study in France to see if this facilitation effect would still be present.

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

In addition to the great opportunity to learn new techniques and to work with robots in a Japanese laboratory, it was also a chance to enjoy many experiences and to discover a different culture.

I am coming back home with my head full of memories and the wish to visit Japan again!

RESEARCH REPORT

1. Name: Patricia BOLLE （ID No. SP17203）

2. Current affiliation: Institut des Matériaux Jean Rouxel – Université de Nantes - France

3. Research fields and specialties: Chemistry

4. Host institution: Laboratory for Photonic Molecular Science
Nara Institute of Science and Technology (NAIST) – Japan

5. Host researcher: Pr. Tsuyoshi Kawai

6. Description of your current research

The research topic of my PhD in Materials Chemistry is part of the HYbrid Polyoxometalates for Optical Data Storage (HYPODS) project. The aim is to elaborate a new class of photoresponsive molecular hybrid materials for potential applications as reversible memory photodevices. These hybrid systems are built upon polyoxometalates (POMs), defined as discrete anionic metal-oxygen clusters, associated with photochromic and/or photoluminescent organic molecules. These innovating couplings constitute an attractive opportunity to drastically tune or improve the solid-state performances of photoactive organic molecules which to date strongly limits their incorporation into efficient photoadressable devices. After the elaboration of new materials, the main objectives are the characterization of their photophysical properties in the solid-state and the establishment of pertinent structure/solid-state optical property relationships. One part of my work is to study the coupling of a cationic photochromic diarylethene (DTE^+), actually part of the most promising class of photoswitchable molecules for high-density optical data storage, with POMs to evidence if this coupling could improve the DTE^+ photoisomerization performance in the solid-state. This combination has never been achieve to date. Very recently, we succeeded in obtaining two new supramolecular assemblies DTE^+/POMs. These two assemblies exhibit remarkable solid-state photoresponses. By comparing their coloration and fading kinetics with those of the triflate salt of DTE^+ (reference materials in our studies), we have shown that both supramolecular hybrid assemblies exhibit more complete fading kinetics than those of the reference, quite evidencing that we succeeded in exalting the photoswitching of the cationic DTE^+ with POM. The optical properties of these two new hybrid assemblies are very interesting and promising. Now one of our challenge is to understand the phenomena concerning the exaltation of the photoisomerization of DTE^+.

7. Research implementation and results under the program

Title of your research plan:

New Diarylethenes/Polyoxometalates (POMs) photochromic assemblies

Description of the research activities:

I spent my research activities in Pr. Kawai's laboratory, internationally recognized in the field of DTE chemistry, in order to increase my knowledge about DTE and to understand my previous results that I obtained in France. I divided my research activities in two different targets. The first one was to study more in detail my reference without POM: the photochromic triflate salt of DTE. In fact, my host laboratory works mostly in solution in contrast to my laboratory in France where I always work in solid-state. It was for me a good opportunity to increase my knowledge about this family of photochromic molecules. I studied my compound by NMR and UV in solution. I have determined the photostationnary state and the quantum yield of my compound. DTE^+ in solution shows nice properties: fast coloration speed with high photoconversion to colored form, almost 100% after 5 mins under UV which is roughly twice larger than usual DTEs. My second target was to obtain the structure after UV of my two hybrid compounds that combine POM and DTE^+. In fact, I already get the structure by XRD of my two assemblies in France but only with the DTE^+ open form (colorless crystal) and we were interested to obtain after UV irradiation the structure with the DTE^+ colored form (colored crystal). This part was difficult and I tried different ways to get it, and finally we succeed for one of my hybrid assemblies. The obtained structure is a mix of 30% DTE^+ close form and 70% DTE^+ open form. Now, I need to understand and compare structures before and after UV irradiation and try to determine structure-property relationships to explain the exaltation of the photoisomerization of DTE^+ with POM.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): This experience was incredible! I would like to thanks Pr. Kawai to receive me in his laboratory and for our discussions about science (and others). Professionally I learn a lot about diarylethenes and academic research in Japan. I also had the chance to travel a lot and meet nice people. I have so many beautiful memories in Okinawa, Hiroshima, Osaka, Tokyo, Nara and Kyoto.

9. Advisor’s remarks (if any): This student indicated high attention for research and for getting information on DTE chemistry. As she delivered very interesting sample from France, she has succeeded to get exciting results, which is much more than I expected upon discussion in France. She also indicated very nice adaptability to the laboratory and Japanese culture. Many of us expect her to back in near future.

RESEARCH REPORT

1. Name: Guillaume BRETEL （ID No. SP17204 ）

2. Current affiliation: University of Nantes, Nantes, France

3. Research fields and specialties:

Chemistry

4. Host institution: Department of Synthetic Chemistry and Biological Chemistry, Graduate School of Engineering Kyoto University, Katsura, Nishikyo-ku, Kyoto 615-8510, Japan

5. Host researcher: Professor Kenji Matsuda

6. Description of your current research

Started in 2016 at the CEISAM laboratory, (University of Nantes, France), under the supervision of Prof. François-Xavier Felpin and Dr. Erwan Le Grognec in the CORAIL team (Catalysis, ORganometallic chemistry And synthesIs of Ligands), my PhD project is at the interface between organic synthesis and material chemistry.

The main topic is the synthesis of different molecules and the grafting onto cellulose by a covalent bond. Currently, we are doing synthesis of hydrophobic molecule and their fixation at the surface of the cellulose by photochemistry with a disulfide bond cleavage. The cellulose was previously prepared by an esterification of dithioglycolic acid to permit the fixation of the hydrophobic compound at the surface of the cellulose. Then, the paper was analyzed by IR, elementary analysis, solid NMR and measure of the contact angle to evaluate the hydrophobicity of the paper.

7. Research implementation and results under the program

Title of your research plan: Synthesis of diarylethene compounds for a fixation at the surface of the cellulose.

Description of the research activities: The kind of reaction that we want to try is the grafting of photochromic compounds at the surface of the cellulose, not by an adsorption of the molecule but with the formation of a covalent bond. The interest is to contend against falsification of bills, with an UV-irradiation of the paper, the photochromic compound will switch and have a specific coloration. Then, the molecule turns back into a colorless product to give the paper its original appearance. Such systems exist but with specific inks, not with a covalent modification of the paper. During my stay, I have made the synthesis of 2 diarylethenes and started the synthesis of another. The analysis by spectrophotometry, NMR and mass spectroscopy showed that the good products were obtained.

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

This was an incredible research experience, the collaboration with the professor Kenji Matsuda and his team was a real pleasure. I learned a lot about the behavior and synthesis of photochromic compounds. I also had the opportunity to visit the laboratory of the professor Tsuyoshi Kawai in Nara and Osaka.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Amandine DAVRE （ID No. SP17205 ）

2. Current affiliation: University of Montreal

3. Research fields and specialties:
Humanities

4. Host institution: Kyoto University of Art and Design

5. Host researcher: Prof. Mariko TAKEUCHI

6. Description of your current research

Since Japan's Triple Disaster, on March 11, 2011, a new kind of trend in contemporary Japanese art has emerged: the post-Fukushima art. Far away from the idealized imagery of "Cool Japan" (based on Japanese popular culture), the post-Fukushima art shows the consequences of 3/11. My research focuses on the visualization of everyday life, reconstruction, and radioactivity in the post-Fukushima Japanese photography, as well as on its diffusion and reception, both in and outside Japan. I work on photographs taken by Arai Takashi, Kagaya Masamichi and Takeda Shimpei in the aftermath of the Fukushima Daiichi nuclear disaster. The photographic prints of these photographers are distinctive on account of the anachronistic techniques used by them to make visible invisible radiation in the environment: daguerreotype, autoradiography and photograms.

The research examines the following aspects:

1) The specific techniques and the aesthetic features by means of which those three photographers attempt to capture the mute tragedy of devastated landscapes as well as the uncanny aura of reconstruction and decontamination projects.

2) The (im)materiality of the radiation and of the photographed subject/object/scene.

3) The history and the procedure of the three technologies used by these artists (daguerreotype, autoradiography and photograms), the role of these technologies in the imagery of disasters, and their place in the history of Japanese photography.

4) The diffusion of my corpus in the art world and its reception by photography experts.

7. Research implementation and results under the program

Title of your research plan:

Exposure Aesthetics in the Post-Fukushima Japanese Photography

Description of the research activities:

During my stay in Japan, I tried to achieve most of the goals I set before coming but new opportunities, greater than I could imagine, came out. With great thanks to many researchers, professors, curators and artists I have met and built a strong professional relationship with. They gave me the opportunity to present my research in Japan: I gave two courses at the Meiji Gakuin University as an invited researcher and a lecture at one of my artist's workshop. They introduce me to many people working in my field of study that I interviewed too and I can feel that it is the beginning of a great collaboration with some of them.

The main objective of my research was to study all the photographic technic used by the photographers who try to show the radioactive exposure. I followed some of them during all their photographic process: collecting data, research of the object/scene/subject to photograph, the development of each photograph and also the exhibition of some of their photographs. I also went to the Fukushima area to see with my own eyes abandoned or destroyed houses, nuclear waste along roads and how people deal with the radioactive contamination. It was an important moment for me and I will never forget what I saw or felt during this trip to the Fukushima area. It gave me the strength to continue my research on this subject.

The second objective of my research was to study the Japanese art market and the cultural sector to see what is the actual art trend in Japan. To do that, I visited many art museums and art galleries in various areas, such as Kyoto, Osaka, Nagoya, Tokyo or Fukushima. It was important for my research that I investigate these forums to better understand the presence of these kind of photographs in the Japanese art market and the cultural sector.

This summer fellowship opened so many doors for me and I feel that I need to come back to Japan to continue my research here and work on new projects with all the people that I met.

RESEARCH REPORT

1. Name: Lucas Drumetz （ID No. SP17206）

2. Current affiliation: Grenoble Institute of Technology, Grenoble, France

Department of Mathematics, University of California, Los Angeles, CA, USA

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Tokyo

5. Host researcher: Prof. Akira Iwasaki

6. Description of your current research

Hyperspectral images are multivariate images which comprise the information on an observed scene in many contiguous and narrow wavelength bands of the electromagnetic spectrum, usually in the visible and near infrared domains. Such images then contain much more information than conventional gray-level or color images, sinc each pixel is a full intensity spectrum. For a remote sensing application (satellite, airborne or drone imaging), the interest is that hyperspectral images allow an accurate identification of the materials present in the observed scene. However, the spatial resolution is usually relatively low, and it is frequent that the field of view corresponding to a single pixel contains more that one material to detect, and the observations are then a mixture of the contributions of each material. The spectral unmixing problem aims at automatically identify the materials (called endmembers) present in the scene, and to quantify their proportions (called fractional abundances) in each pixel.

Many algorithms have been developed in the last two decades to solve this problem, but they suffer from two main limitations: i)the complexity of physical mixture process, which makes real data more complex than the linear model usually assumed by existing approaches (i.e. the contributions of each material in a pixel add up in a linear way). ii) the fact that all materials have a significant intraclass variability because of many different physical causes, and cannot be represented by a single spectrum, as is classically done.

I have developed a model to adapt the existing algorithms to the latter problem, which outperforms other approaches dealing with intra-class variability related to locally changing illumination conditions. This model has proven useful, but suffers from a few drawbacks: i)The materials identified by the algorithm are dependent on the output of a classical algorithm of the literature used as an initialization. In complex cases, such as images with shadowed areas, or no pure pixels (i.e. pixels containing only one material of interest), this initalization is very poor, because spurious endmembers are selected. ii)Some complex unmixing scenarios may have several endmembers which are very correlated (different types of vegetation), along with some completely which are spectrally far away (man made materials).

7. Research implementation and results under the program

Title of your research plan:

Hyperspectral image unmixing with spectral variability for the characterization of tree species.

Description of the research activities:

The goal of this project was to design new algorithms to overcome the limitations explicited above, and to apply them to a complex dataset acquired by the University of Tokyo over the Tama Garden Forest, in the western area of Tokyo. This scene contains many different types of vegetation: grass, different species of conifer and broadleaf trees. It also comes with many pixels which are affected by tree shadow, making standard algorithms fail in such a complex setting.

I have proposed a new fast unmixing algorithm which refines my previous model, by allowing it to refine the abundance estimation, but also to iteratively update the reference endmembers used, in accordance with the physics of the problem, and the associated mathematical constraints. The proposed formulation takes into account endmember variability, and constrains the reference endmembers to be spectrally close to one another (vegetation), while not penalizing those with very different spectral characteristics (man made materials).

Preliminary results show that the proposed approach is able to distinguish between three types of vegetation in the image: grass, conifer and broadleaf trees, which have very similare signatures, but can still be separated. The shadowed areas are also well explained and handled by the variability model used, preventing these shadow to hamper the global unmixing results. Promising results have been obtained on another urban dataset, and now need to be confirmed by experiments on simulated data.

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

This research and cultural experience in Japan was invaluable to me, both professionally with exciting research opportunities which are going to be pursued after I leave, but also personally. I feel very lucky to have been able to live in Tokyo for more than two months and getting to explore this incredible city. I was also lucky enough to travel in a field work trip to Shiojiri and to visit the city of Mastumoto. I also enjoyed a lot all my travel experiences here, from Nikko to Okinawa, but also Hiroshima and Kamakura. The japanese gastronomy was also a constant delight during these 10 weeks.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Amandine Duchaussoy （ID No. SP17 207）

2. Current affiliation: Normandie Univ, UNIROUEN, INSA Rouen, CNRS, Groupe de Physique des Matériaux, 76000 Rouen, France

3. Research fields and specialties:

Physical Sciences

4. Host institution: Department of Materials Science and Engineering, Faculty of Engineering, Kyushu University, Fukuoka 819-0395, Japan

5. Host researcher: Prof. Zenji HORITA

6. Description of your current research

In recent years, bulk nanostructured Al alloys, processed by severe plastic deformation (SPD) have attracted a large amount of interest due to their exceptional mechanical and physical properties which are often superior in comparison with their coarse-grained counterparts. Nowadays in industry, there is a strong demand for Al alloys with high strength. This demand is driven by the idea of designing low weight structures for energy savings and low CO_2 emissions. To get Al alloys with high strength, the challenge is to combine the classical strengthening mechanism by fine precipitation and the grain-size strengthening mechanism by nanostructuring. However, this combination is extremely challenging to control because of grain growth during precipitation treatment.

The aim of my PhD study is to produce small grain sizes in light-weight high-strength aluminum alloys by an SPD process known as high-pressure torsion (HPT) and combine with classical precipitation hardening for extra strengthening. In the alloys, iron is intentionally added to stabilize the small grain sizes. It is known that iron makes intermetallic particles but they are normally large in size and thus harmful to reduce the ductility. In this study, the HPT process is used not only for grain refinement but also for fine dispersion of the iron-based intermetallics through fragmentation and precipitation so that the fine particles can act as pinning points for inhibition of grain growth.

In my study, I work on high-strength aluminum alloy (AA7449) with iron addition. This alloy is processed by HPT to achieve small grain sizes and fragmentation of intermetallic particles. Then ageing treatments are carried out for fine precipitation in the fine grain structure.

I study the influence of the shear strain on the microstructure evolution using analytical techniques such as Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM) and Atom Probe Tomography (APT). I also try to link the obtained

microstructures with the thermal stability using *in-situ* TEM experiments.

Although the microstructure analysis will be soon near completion in Rouen, France, I establish the relationship between these specific structures and their mechanical properties which is obtained in Kyushu under the JSPS summer program.

7. Research implementation and results under the program

Title of your research plan:

"Designing new material by intense plastic deformation and ageing for enhanced mechanical properties"

Description of the research activities:

Professor Horita's group at Kyushu University is one of the leading groups in the world in the field of mechanical behavior of bulk nanostructured materials. So the new material, containing iron intermetallic particles, was processed by HPT. The aim is to fragment intermetallic particles in very small particles and to decrease the grain size to improve the mechanical properties and the thermal stability. Microhardness measurements and tensile tests have been conducted to determinate if the mechanical properties is increased, and ageing treatment is performed to determinate the properties at the peak-aged conditions and their thermal stability. The results show that the microhardness increases to the HPT-processed state (~250 Hv) which is more than twice the initial state (~110Hv), and this increase can be the result of the grain refinement, the solid solution and the particles fragmentation. Natural ageing lead to increase the microhardness around 275 Hv for the most deformed alloy and 255 Hv for the less deformed. Other alloys with different proportions of iron, and be subjected to rapid cooling, was also investigate by HPT. The best found mechanical properties are for the alloy with 0.8% of iron, deformed by 10 revolutions by HPT. The next step is to observe the microstructures of all these states with TEM, SEM and APT to make the link between the properties and the microstructures of these new designed alloy systems.

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

I think this program is an experience not to be missed as it is incredible has many points of view. It allowed me to open myself to a culture totally different from mine. I was able to visit cities such as Fukuoka, Kyoto, Nara, Okinawa and Hiroshima where I enjoyed summer festivals, local foods, but also where I could visit temples and attend the commemoration of the A-bomb in Hiroshima which was a very important moment.

I would like to thank all the people in the laboratory for their warm welcome. They have always been there to help me and give me advices. Finally I would like to thank Prof. Horita for having welcome me for two months in his laboratory and for all he did for me.

9. Advisor’s remarks :

It was my great pleasure to carry out this JSPS summer program with Amandine Duchaussoy, a PhD candidate, from France. In a very warm weather in Fukuoka, she worked hard to develop the research collaboration ongoing with her supervisor, Prof. Sauvage of Normandie University in France. Her activity was also extended to exploring Japanese culture. I am sure that she has learned many from this summer program, and I do hope that this will help us build a strong relationship between France and Japan.

French advisor’s remarks :

Thank you so much to the JSPS and CNRS for giving the opportunity to Amandine to discover Japan and spend few months in one of the leading group of the world in our research field. This visiting program already gives a strong boost to our collaboration with our Japanese partners and this collaborating work and research experience will be a strong asset for the future carrier of Amandine.

RESEARCH REPORT

1. Name: **Tanguy FARDET**	（ID No. SP17**208**）
2. Current affiliation: **Université Paris Diderot, UMR 7057**	
3. Research fields and specialties:	
Interdisciplinary and Frontier Sciences: Neurophysics	
4. Host institution: **RIKEN Brain Science Institute**	
5. Host researcher: **Taro TOYOIZUMI**	

6. Description of your current research

My PhD project is centered on the growth and activity of neuronal cultures from a physical perspective. In that context, I use analytical and simulation tools to propose minimal models that discriminate between biological mechanisms that should be involved in shaping the activity observed experimentally.

I recently demonstrated that coupled excitatory neurons exhibiting adaptation and periodic oscillations are sufficient to generate bursting, and I am now investigating whether such simple models are indeed sufficient to reproduce the detailed spatiotemporal organization of the bursting activities observed experimentally.

The second part of my PhD project involves detailed simulations of the growing processes involved in the formation of coupled neuronal networks from an initial population of immature dissociated neurons. I use simple models, based on the random walk formalism to describe the mechanisms underlying the elongation of neurites and the progressive evolution of the network. This leads to fast simulation of potential networks stemming from these growth mechanisms, which we can then analyze using graph theoretical measurements to characterize their properties and evolution in time.

Coupling the two projects by simulating neuronal activity on these 'grown' networks could then allow us to compare and correlate the functional connectivity with the real spatial topology to investigate how network structure can facilitate or hinder synchronization phenomena.

7. Research implementation and results under the program

Long-term evolution of synchronous bursting in neuronal cultures

The objective of this project was to understand more precisely the origin of the bursting behavior observed in cultures.
Therefore, we designed a simulation setup to reproduce the evolution of bursting activity at different stages of a culture's aging process. We took into account the changes in the connectivity structure, as the network matures over the first few weeks, by providing a complete description of the network in space, also including realistic distance-related delays in the dynamics.

We studied how bursts were initiated by a varying fraction of pacemaker neurons or by synaptic noise alone. Noise and network parameters were gathered from several experimental studies, such that only the neuronal parameters had to be fitted to reproduce standard behavior of known neuronal groups.

This allowed us to reproduce not only the correct timescales, as observed in experiments, but also similar nucleation dynamics. We showed that, because the connectivity is more local in young cultures, several regions of the graph contribute to the initiation of the network bursts. On the other hand, more mature cultures are globally connected, which leads to the emergence of only one nucleation center as the central driver of the bursting activity.

The simulations revealed that, though pacemaker-driven bursting seems more robust than pure noise-driven activity, the latter can be sufficient to trigger network bursts with easily excitable neurons displaying a lognormal distribution for the synaptic strength.

We now have a functional simulator that can reproduce biologically-plausible bursts and we will now push the analysis of the results further to try to understand in more details how the nucleation points we obtain are related to the network structure. We hope to find qualitative changes in the dynamical properties when the fraction of pacemakers increases which would allow us to propose ways of assessing experimentally the relative importance between noise and pacemakers.

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

I would like to thank Taro and the whole NCA team in RIKEN, which was really welcoming and good-natured. I spent some very interesting weeks with them, including some nice barbecue, boat and karaoke parties! Since the team was very international, we also exchanged a lot on the differences between our various cultures and the way we try to approach Japanese way of life.

This internship was also a great occasion for me to discover Tokyo and Kanto in more details and I really enjoyed visiting the city, the museums, shrines and temples, as well as other cities around, such as Nikko and Yokohama.

I think my funniest experience was the visit of the Watermill Farmhouse, on the Nogawa river in Mitaka. I ended there all alone with the old Japanese people taking care of the site. They gave me a tour in Japanese and managed to explain pretty much everything about the watermill and the way people used to live there, though the visit probably lasted twice longer than the usual tour… I recommend! (for people with basic Japanese understanding)

9. Advisor's remarks (if any):

Tanguy has been an extremely important member in my lab and everybody appreciate his stay. He is a very clear thinker and very strong with his programing skills. Tanguy has mathematically modeled how network of neurons produce bursting dynamics in a very well-controlled experimental setup. Hence, he has been studying the most fundamental issue in neuroscience in a tractable manner – how neural circuits autonomously generate structured neural dynamics. This was stimulating for us. I hope Tanguy and I can continue collaborating to reveal the key mechanism behind autonomous neural dynamics and how learning is involved in its development. His research may shed light on how the brain recall and stabilize memory patterns and how the brain's default activity patterns are produced. We thank JSPS for providing us this wonderful opportunity.

RESEARCH REPORT

1. Name: GARCIN （ID No. SP17209）

2. Current affiliation: The University of Strasbourg

3. Research fields and specialties:

Humanities

4. Host institution: Kindai University 近畿大学

5. Host researcher: Pr. Hideaki Satô 佐藤秀明教授

6. Description of your current research

I am currently conducting a comparative reading of Mishima Yukio (1925-1970) and Takahashi Kazumi (1931-1971). Both novelists could be considered as some of the very last ideological writers in Japan. The former advocated a return to the ultranationalists' ideals of Pre-war Japan, while the latter was viewed as the literary voice of Maoist students at the end of the 1960s. However, in their fictions, they both promoted a paradoxical view of political action, suggesting that commitment was closely related to simulacrum and nihilism.

Though the kinship between Mishima Yukio and Takahashi Kazumi has already been discussed, no comparative literary study of both writers has been published until now. I wish to fill this gap by engaging in a close reading of Mishima Yukio and Takahashi Kazumi's ideological novels, with the aim of publishing an article on the subject. I believe that the inherent ambiguity of their works offers new insights into the notion of ideology in Postwar Japan, as well as sheds new light on ideological novels as a genre.

7. Research implementation and results under the program

Title of your research plan:

Commitment and Literature: A Comparative Reading of Mishima Yukio and Takahashi Kazumi

Description of the research activities:

The three objectives of my stay in Japan were to meet Japanese scholars, to read academic research on Takahashi Kazumi and to define the body of texts I wish to work on. I have been warmly welcomed by professor Satô Hideaki who introduced me to his students and to various specialists of Mishima. I had the opportunity to present my work during his seminar and to visit the Mishima Yukio Literary Museum in Yamanashi, an institution with whom I intend to collaborate closely in the near future. We plan to organize an exhibition on Mishima in Strabourg next year and I could meet people from this museum who are willing to help and collaborate with the University of Strasbourg. I have also participated in various symposium and seminars, in Osaka, Kyôto and Tôkyô.

I spent most of my spare time in Kindai University's library reading some of Takahashi Kazumi and Mishima Yukio's works. With the guidance help of Professor Satô I have acquired several books on Takahashi Kazumi that are not available abroad. My readings and my talks with professor Satô, as well as other scholars, enabled me to define precisely the 4 novels I intend to work on.

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

I had a wonderful trip to Ise Jingû. I had long wished to go there and it was great to fulfill my vow.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Joy LACHAT （ID No. SP17210）

2. Current affiliation: Institute for Integrative Biology of the Cell, UMR9198, CNRS, Université Paris-Sud, Gif-sur-Yvette, FRANCE

3. Research fields and specialties:

Biological Sciences

4. Host institution: Bioproduction Research Institute, National Institute of Advanced Industrial Science and Technology (AIST), Hokkaido Center, Sapporo

5. Host researcher: Yoshitomo Kikuchi, Ph.D

6. Description of your current research

Symbiosis with microorganisms is well known among all species, including insects. The phytophagous insect *Riptortus pedestris* is an important crop pest in Japan which feeds preferentially on soybean plants. This beanbug is associated with a bacterial symbiont, a specific *Burkholderia* species, located in a portion of the insect's midgut constituting the symbiotic organ. This interaction promotes the growth and the development of the beanbug. Since this bacterium is acquired from the environment, non-symbiotic insects can be reared and the bacterium can be isolated *in vitro*, rendering this model suitable for studying symbiotic interactions. Recently, it has been found that *Riptortus* produces antimicrobial peptides in the midgut called crypt-specific cysteine-rich peptides (CCR) for which the bacterial symbiont demonstrates a high resistance profile. During my thesis, it has been hypothesized that these CCR peptides can participate to the specific colonization of the symbiotic organ by *Burkholderia insecticola*. In order to decipher which bacterial factors are involved in this specific colonization, we are conducting a candidate gene approach based on the implication of the bacterial membrane components, targeted by the CCR peptides. With helpful insects experiments and advices from our Japanese collaborators, we would like to know if these mutants previously constructed in our lab could still colonize the insect's midgut.

7. Research implementation and results under the program

Title of your research plan:

Identification and characterization of bacterial colonization functions in the beanbug *Riptortus pedestris-Burkholderia insecticola* symbiosis

Description of the research activities:

To start my experiments, I brought five different bacterial mutants from France, each of them deleted for one specific bacterial membrane component. These components were chosen because they demonstrated a high sensitivity profile towards antimicrobial peptides once they were mutated. As they lost their resistance towards antimicrobial peptides, we hypothesized that they could also lose their ability to colonize the insect's midgut. For that purpose, I needed to train myself and mastered the insect dissections procedure. This insect goes through five different larval stages and I had to dissect the second (5-6 mm) and the fifth (1-1.5 cm) larval stages through the binocular microscope. This training took me two to three weeks, in order to master the procedure correctly. After this was done, I could infect the insects by feeding them with contaminated water containing my bacterial strains. As my mutants were labelled with GFP (Green Fluorescence Protein), I can visualize them by fluorescence microscopy. Surprisingly, they were all able to colonize the insect's midgut. In parallel, I also performed competition experiments by feeding insects with a mix of one mutant and the wild-type symbiont (non-mutated strain) at the same ratios. The wild-type was labelled in red with RFP (Red Fluorescence Protein) and the mutant was labelled in green, so we could differentiate them under fluorescence microscopy. As a result, I found that all the mutants are not able to colonize the crypts of the symbiotic organ and stayed in the upstream midgut regions, while the wild-type strain colonized the symbiotic organ. By isolating the symbiotic organ and making in vitro cultures, I also quantified the number of bacteria present in this organ. Surprisingly, we found that the wild-type and the mutant are present in the same amount in the symbiotic organ.
As a conclusion, I found that my mutants are clearly outcompeted by the wild-type strain and are not able to colonize the midgut crypts anymore. However, even if there is a spatial segregation, their fitness or their survival rate is not impacted because the wild-type strain and the mutant strain amounts are identical.

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

During my stay, I participated to the O-bon traditions in mid-August with my supervisor's family and that was really interesting. The cultural traditions are clearly different between Japan and my country, so I was happy to have the opportunity to share this experience with my advisor's family.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Constance LECOURT （ID No. SP17212）

2. Current affiliation: University Claude Bernard Lyon 1, France

3. Research fields and specialties:
Chemistry

4. Host institution: Hiroshima University

5. Host researcher: Prof. Katsuya INOUE

6. Description of your current research

My PhD research project deals with molecule-based magnets which are magnetic entities at a molecular level. The synthesis set-up is based on a metal-radical strategy, alternating metal centers and organic radicals, which are spin carriers. I am currently working on 2D Mn^{II} - Nitronyl-nitroxide free radical systems, where manganese (II) (Mn^{II}) is the metal center and Nitronyl nitroxide is the organic free radical, which has a good stability due to delocalization of the unpaired electron on two NO groups. They crystallize as layered compounds upon addition of anions (X: ClO_4^-, PF_6^-) which are inserted between the coordination polymer layers.

The ferrimagnet compound $\{[Mn^{II}_2(NITIm)_3](ClO_4)\}_n$ presents interesting properties, that are not found in other systems with different substituents and anions. There is a switch-off of the ferrimagnet behavior close to ambient temperature, due to thermo-induced valence tautomerism VT (redox isomerism) and along with cooling, Mn^{2+} is oxidized to Mn^{3+} while part (2/3) of the radical is reduced. On reheating, this electron transfer process is reversed with a hysteresis**.** Moreover, all compounds $\{[Mn^{II}_2(NITIm)_3]X\}_n$ crystallize in chiral space groups. They show second harmonic generation signal and are expected to have dielectric properties which opens perspectives for multiferroic materials.

Valence tautomerism is accompanied by changes in magnetic properties. These changes may be triggered most generally by temperature but also by other external stimuli such as the application of pressure. One specific objective of my summer internship in Japan has been to study the effect of pressure which was expected to change the domain of temperature of the transition in $\{[MnII_2(NITIm)_3]ClO_4\}_n$.

7. Research implementation and results under the program

Title of your research plan:

Magnetic and dielectric properties of Layered Two-Dimensional Manganese (II) – Radical Coordination Framework

Description of the research activities:

My main goal during these two months of research was to realize different types of characterization on my 2D - {$[Mn^{II}_2(NITIm)_3](ClO_4)$} compound. Two types of properties have been investigated. First magnetic measurements under pressure were carried out using a SQUID magnetometer and a hydrostatic high-pressure micro cell. This comprises measurement of the temperature dependence of the magnetic susceptibility and of the magnetization versus the magnetic field from atmospheric pressure to 3 MPa. As was expected, VT hysteresis was shifted to higher temperatures when pressure was applied on the sample and width of the loop was reduced. We obtained a pressure sensor compound, even if a higher sensitivity was anticipated, regarded to crystalline structure. Moreover, AC susceptibility measurements were carried out at different frequencies by Prof. Masaki MITO from Kyushu Institute of Technology in order to obtain information about non-linear susceptibility and influence of field frequency on the hysteresis. This characterization is ongoing.

Secondly, we were interested in electric properties. Unfortunately, conductivity measurement was impossible due to the high resistivity of the compound. Instead dielectric measurement will be realized on my last day. Many interesting questions have been raised about the electric behavior of this compound and different characterizations should be investigated to understand more fundamentally electrons behavior at low temperature.

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

First, I would like to thank Prof. Katsuya Inoue for the opportunity to spend two months in his lab, where I occurred productive researches. I also want to thank Nishihara-sensei and Maryunina-san, the two assistant professors who took time to help me with my measurements. And finally, thanks to Mito-sensei, from Kyushu Institute of Technology, who got involved in this project. Japan is a wonderful country and Japanese people are amazing. I had the opportunity to travel a lot and discovered many different places (Okinawa, Chugoku, Kyoto, Yakushima, ...), I tried many kind of food (shabu shabu, fried octopus, etc), took part in different Japanese events (firework, typical dance) and met so many great people that I will not forget. I am excited to come back again in Japan, hopefully for a post-doc!

9. Advisor's remarks (if any):

Constance was very enthusiastically devoted to research and study in this lab. It seems that she also enjoyed her research life with a familiar feeling with lab members. It seemed to have been bothered by a high temperature and humidity, but this is maybe become one good memory for her.

RESEARCH REPORT

1. Name: Caroline ROSSI-GENDRON （ID No. SP17213）

2. Current affiliation: Ecole Normale Supérieure / UPMC Paris (FRANCE)

3. Research fields and specialties:

Chemistry

4. Host institution: Department of Chemistry, Graduate School of Science Kyoto University

5. Host researcher: Prof. Hiroshi SUGIYAMA

6. Description of your current research

The recent technological progresses have been supported by the miniaturization of systems and machines to sizes up to 100.000 times smaller than the diameter of a single hair. The importance of those nanotechnologies was emphasized by the 2016 Chemistry Nobel Prize for the fabrication of molecular machines and opened the way for new applications in various fields such as medicine or renewable energies.

My research focusses on building molecular machines by …weaving DNA! This revolutionary technique called “DNA Origami” was invented in the USA 10 years ago and is extremely powerful. Versatile, fast and biocompatible, it gives access to molecular assemblies of any shape, of controlled size and with unprecedented precision. One problem however remains: those « high definition » objects are intrinsically static.

My objective is therefore to transform those DNA structures into working molecular machines by making them dynamics and remote-controllable by an external signal. For that purpose, I use a molecule created by my team, which is activated by light and unweaves DNA with UV light but helps weaving it back with blue light. I therefore use this new reversible weaving principle to obtain the first DNA-bases molecular machines that are both mobile and remote-controlled by light.

I also got interested in understanding the weaving mechanism more specifically. At the molecular level, there are no needles or hands to do the work, and the weaving occurs by itself when the temperature goes progressively from typically 90°C to 20°C. I however discovered a way to make the weaving happen at constant room temperature. This allows to have a new insight for the understanding of the weaving process

7. Research implementation and results under the program

Title of your research plan:

Direct observation of a DNA origami's isothermal folding process

Description of the research activities:

The kinetics and thermodynamics of origami folding are rarely addressed topics and only a few studies have been published in the matter. A probable reason of this lack of knowledge lies in the paucity of methods to directly observe origami's melting and folding processes. The direct observation of the folding and melting mechanisms is inhibited by the observation methods themselves. As a matter of fact, DNA origamis are usually observed on a mica plate on which they are adsorbed. This adsorption freezes the system in a certain way and makes the observation of the dynamic processes impossible. Furthermore, the necessary temperature control used to fold the origamis requires an adapted experimental setup involving a temperature-controlled sample-holder for the microscope (called AFM for Atomic Force Microscopy). However, those experimental barriers are no longer a problem when using a system that folds isothermally and that is adsorbed on a flexible surface. Such a surface was developed by Prof. Sugiyama's team.

During my research stay in Japan, I investigated the isothermal folding of various DNA origami shapes such as a 7-tiles motif, a rectangle and a triangle. I also characterized the feasibility of an isothermal partial folding of the objects, going for example from a 6-tiles motif to a 7-tiles motif. As expected the temperature used for the isothermal folding has a strong effect on the feasibility of the process and on its rapidity. Furthermore, I succeeded to adsorb the partially formed origamis on a mobile surface and then to observe directly for the very first time the "weaving" of DNA on the surface to create a fully formed origami!

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

The JSPS Summer Program was the most amazing and exciting foreign research experience for me, and it was also the perfect opportunity to discover the wonderful country that is Japan. Thanks to the very high academic level and the state-of-the-art technologies available, I could successfully complete my research project with very important results that will be a great assess to my PhD work. I also had the chance to visit many places such as Kyoto (of course, a lot…), Osaka, Nara, Kobe, Okinawa, Hiroshima, … It was a perfect summer!

9. Advisor's remarks (if any)

RESEARCH REPORT

1. Name: Damir Francois Damien Pinek （ID No. SP17214 ）

2. Current affiliation: Grenoble-INP, LMGP

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution:Nagoya University

5. Host researcher: Assoc. Prof. Takahiro ITO

6. Description of your current research

MAX phases are nano-lamellar compounds which combine the good properties of metals (large electrical conductivity) to those of ceramics (high resistance to thermal shocks and extreme temperatures, chemical stability). The general formula of MAX phases is $M_{n+1}AX_n$, where M is a transition metal, A is an element of groups 13 to 16, and X is either carbon or nitrogen.

As a PhD student at LMGP, I'm focusing on:

1: The growth of MAX phase single crystals

2: The determination of their overall electronic properties.

About 1, I've been working on an improvement of the growth process of Cr_2AlC, V_2AlC, Ti_3SiC_2 and Ti_2SnC single crystals. For Ti_2SnC, we went from crystal of about 100 um to centimeter size crystals.

Concerning 2, I've been simulating the Fermi surface and the band structure of MAX phases using Wien2K DFT code. Those two geometrical objects are intrinsic to a given crystalline material and nearly all of its properties are given by the topology of its Fermi surface and/or by its band structure.

7. Research implementation and results under the program

Title of your research plan:

Experimental determination of Ti_2SnC and V_2AlC electronic structure through ARPES measurements at Aichi synchrotron radiation center

Description of the research activities:

During my stay at Nagoya university, I could improve my overall understanding of angle resolved photoemission spectroscopy (ARPES) technique through discussions with Assoc. Prof. Takahiro Ito and his students. Thanks to Assoc. Prof Ito, I have had 3 full days beam time access to perform ARPES experiments on V_2AlC and Ti_2SnC sample I've brought from France. I learned how to analyze ARPES data by using an ensemble of Igor procedures provided by Assoc. Prof. Ito. I also gave a group seminar about DFT calculation to Assoc. Prof. Ito's group members.

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

9. Advisor's remarks (if any): Mr. Damir Pinek has familiarized with our laboratory members as exciting senior researcher. His short stay as the present JSPS summer program participant makes good friendship, competitive mind as researcher, and international/global perspective for each other. I believe his active research mind will grow the new field of research on MAX phases with further collaborations in near future.

RESEARCH REPORT

1. Name: Sarah J. Berkemer	（ID No. SP17301 ）

2. Current affiliation:

a) Bioinformatics Group, Department of Computer Science, and Interdisciplinary Center for Bioinformatics, University of Leipzig, Härtelstraße 16-18, D-04107 Leipzig, Germany

b) Max Planck Institute for Mathematics in the Sciences, Inselstraße 22, D-04103 Leipzig

3. Research fields and specialties:

Bioinformatics

4. Host institution:

Earth-Life Science Institute (ELSI), Tokyo Institute of Technology

5. Host researcher:

Shawn McGlynn

6. Description of your current research

Being a bioinformatician, I am working on the computational analysis of biological data collaborating with wet labs in the fields of Biology, Microbiology or Genetics. My current research focuses on the analyses of RNA sequencing data. This data sets show the current active genes of a cell and their level of activity, called transcriptome of a cell. Hence, RNA sequencing is considered to reveal more detailed insights into the way of how a cell's molecular processes are working. This includes the regulation of gene activity, processing steps of single molecules and their digestion. At the same time, molecules show a high amount of mutual interactions which needs specific binding sites, molecule structures or other chemical traits. Analyzing the set of RNA molecules being present in the cell at specific time points helps to gain new information about the processes in a cell even though it needs more investigations to get a plausible theory describing the complex situation.

Among others, there are several ways on how to set up an RNA sequencing protocol and also different protocols depending on species and tissues.

I am currently analyzing an RNA sequencing data set of an archaeal species for gaining further insights into the molecular processes in the cell. For a large amount of archaeal species not much is known about how the cell's molecules are processed. Archaea live in many different kinds of environments and thus, there are not many general assumptions that can be made about all of them. Each archaeal subspecies shows different traits and characteristics regarding transcriptome and further cellular processes. The fact that some Archaea are able to live in extreme environments such as very hot, acidic, saline or sulfurous make them a very interesting and exciting field to study as environmental conditions influence a cell's processes.

7. Research implementation and results under the program

Title of your research plan:

Archaea and their viruses: Resource partitioning between life forms

Description of the research activities:

The research plan for the project at ELSI included several phases.

During first phase, we infected an archaeal species with a virus and at different time points after the infection we took samples. Using PCR and qPCR, relative amounts of viruses and host cells could be retrieved which can be used to calculate time and rate of growth of virus and host cell.

The second phase includes the isolation of the host cells' transcriptome to perform an RNA sequencing run. The results of the RNA sequencing are expected to show which genes of virus and host cell are active and also their level of activity. Given the set of samples taken from distinct time points, we expected to see which genes are active in which phase of the virus' life cycle. At the same time, we were asking if it is possible to see a defensive reaction by the host cell in order to protect itsself from the virus.

Unfortunately, the first phase of the research plan took longer than expected such that the RNA sequencing data set could not created before I had to leave Japan. Hence, I will continue the project in my home country and stay in close contact with my advisor and coworkers in Japan. Currently, we are planning to meet again next year, so I will probably come back to the institute in order to evaluate the project's results and maybe writing a publication.

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

I really enjoyed the stay in Japan and I am very thankful for the opportunity to take part in the JSPS summer program. I also want to thank my host researcher, Shawn McGlynn, to welcome me in Japan and for the interesting discussions we had about many different topics. I got to know many new and interesting people and I learned a lot of new things while staying in Japan regarding research but also referring to culture, language and everyday life in another country.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Björn BÜKER （ID No. SP17302）

2. Current affiliation:

University of Bielefeld

3. Research fields and specialties:

Mathematical and Physical Sciences

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

5. Host researcher: Dr. Kazuhiro HONO, Dr. Yuya SAKURABA

6. Description of your current research

For my Master thesis I am researching magnetoresistive metallic thin film systems based on the so-called Heusler alloys. The crystal lattice of these materials has a specific superstructure that leads to interesting material properties such as a high spin polarization in the ferromagnetic phase or even half-metallicity. For this reason, devices using either the tunnelmagnetoresistive effect (TMR) or the giant magnetoresistive effect (GMR) based on Heusler alloys show a much larger signal than similar structures employing conventional 3d-ferromagnets. Therefore sensors with a high signal to noise ratio and good scalability, that can be produced with these materials are of high interest to the hard disk industry in order to accomplish ever higher data densities.

Based on recent publications of Dr. Hono's research group in NIMS, modification of the interfaces through thin layers in the order of atomic monolayers of NiAl has shown to drastically increase the GMR ratio in the current-perpendicular-to-plane (CPP) configuration. By varying the fabrication process as well as the material used for the inserted layer, I hope to gain insight on the mechanism of the enhanced magnetoresistive properties caused by the thin interlayers. The semi-classical theory of GMR cannot fully describe this new interface effect. Moreover, since it is an interfacial effect, the experimental results are extremely sensitive to the microstructure of the device. In other words, optimizing the deposition process of the thin layers in order to achieve almost atomically flat interfaces is of great importance. Otherwise it is impossible to clearly determine if the changed properties of the device truly originate from the inserted layers.

The project was established in collaboration with Dr. Hono and Dr. Sakuraba and will be continued after the end of the JSPS summer program 2017, to reach a satisfying conclusion.

7. Research implementation and results under the program

Title of your research plan: Improvement of the magnetoresistive properties in Heusler based tri-layer structures through interface modification

Description of the research activities: In order to have a good basis for the effect of adding insertion layers, we started by producing the standard system without any added layers. At that time, analysis by atomic force microscope (AFM) and x-ray diffraction determined that there was a problem with the microstructure of the film. This was at first thought to be an interdiffusion problem caused by thermal treatment after the deposition process. However, I was able to determine after variation of different production parameters, that the system is very stable against thermal effects after the deposition. We found out that systems like these are very sensitive to heightened substrate temperatures in this stage, as some colleagues were experiencing similar issues with different materials.

Ultimately, we were able to produce GMR devices with a very stable electrical resistance and a low spread of signal strength across the substrate, which assesses both the quality of the film and the microfabrication.

In order to investigate insertion layers, samples with NiAl interlayers of 0.21 nm were fabricated. These will serve as a reference to past publications of Jung *et. al.* and other materials such as CoGa in the future.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): This was a great experience in terms of both research and cultural exchange. The Japanese lab culture and work ethics, combined with the vast resources of the institute made working interesting and efficient. Everyone was involved in the discussion and helping out when it came to troubleshooting.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Franz, Jan-Niklas （ID No. SP17303）

2. Current affiliation: Goethe University, Frankfurt/Main, Germany

3. Research fields and specialties:

Medical, Dental and Pharmaceutical Sciences

4. Host institution: Mie University

5. Host researcher: Prof. Yoshiyuki TAKEI, Dr. Akiko EGUCHI

6. Description of your current research

Trauma is the leading cause of mortality in young patients worldwide. Alcohol-misuse plays here a significant role because alcohol-related deaths are preventable. Not only as relevant injury cause, alcohol-misuse is associated with nearly 50% of all admission to emergency department, but also as potent immuno-modulator alcohol impacts patients` clinical course significantly. While chronic-alcohol-misuse correlates with infectious complications resulting in organ failure and mortality after trauma, studies in acutely-alcohol-intoxicated trauma patients (TP) are conflictive. Currently, TP are treated according to equal standardized therapeutic approaches. That makes it actually impossible for the clinician to use adequate preventive individual interventions in alcohol-intoxicated TP, and to individually address the patient`s inflammatory state.

Circulating microvesicles play an important role in susceptibility to complications, which frequently occur after trauma. Extracellular vesicles (EVs) are nanosized lipid bilayer-surrounded vesicles (30-1000nm) released by possibly all cell types. Dr. Eguchi is extensively studying the crosstalk between hepatocytes and non-parenchymal cells, and has discovered EV`s usefulness as novel diagnostic tool for liver diseases, which are related to pathological inflammatory processes, similar to those observed after trauma.

Therefore, we wanted to study the potential of EVs to indicate alcohol-intoxicated TP at risk for severe inflammatory complications and/or organ dysfunction or mortality after trauma.

7. Research implementation and results under the program

Title of your research plan:

Microvesicles as a predictor of trauma complications

Description of the research activities:

Following first results from research in japan, we found blood EV levels to be related to patient health and immune status after trauma. Therefore, we further investigated whether EV content can be used to distinguish trauma status.

37 patient blood samples were randomly selected from a collective of 140 samples; 15 samples for each nonalcoholic and acute intoxicated groups, 7 for chronic alcoholic group.

EVs were isolated from blood and encapsulated RNAs were extracted using kit according to manufacture's protocol. cDNA templates were generated and miRNA levels, such let7f, miR-29a, and miR-340, were quantified via TacMan microRNA assay by following the user guides.

Results were analysed using GraphPad Prism Software.

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

RESEARCH REPORT

1. Name: Stefanie Ingrid Griesbeck	（ID No. SP17304）
2. Current affiliation: PhD candidate	
3. Research fields and specialties: Chemistry	
4. Host institution: Nagoya University	
5. Host researcher: Prof. Dr. Shigehiro Yamaguchi	

6. Description of your current research

In context of my PhD project, I investigate chromophores based on triarylboranes for cell imaging. Due to the electron poor nature of the element boron and its empty p-orbital in a three-coordinate environment, triarylboranes are good electron acceptors. Investigation of their optical and electronic properties is of increasing interest, as those chromophores can be used as anion sensors (*e.g.* fluoride and cyanide) and organic light-emitting diodes (as electron-transporting, light-emitting and hole-blocking materials). Because of the great non-linear optical properties, triarylboranes are also excellent components for compounds that undergo two-photon absorption. Due to the simultaneous absorption of two photons, the fluorescence has a very high resolution, resulting in many different applications as 3D optical data storage, microfabrication and biological imaging. To utilize the chromophores for biological imaging, the compounds need to be water-solubilized. Which was recently achieved by the introduction of ammonium groups at the chromophore. These positive charged substituents are not just promising, due to their hydrophilic character, but enhance also the accumulation in the mitochondria. The synthesis of water-soluble triarylborane dyes for mitochondrial imaging is the focus of my research under the supervision of Prof. Todd B. Marder. Our group and the group of Prof. Shigehiro Yamaguchi have published plenty scientific articles based on my research topic. Furthermore, the Yamaguchi group is expert in the field of biological imaging for main group element based dyes. We now aim to improve our water-soluble mitochondrial imaging agent towards NIR chromophores and applications beyond chemistry.

RESEARCH REPORT

1. Name: Hamm, Maximilian （ID No. SP17305 ）

2. Current affiliation:

German Aerospace Center (DLR), Institute for Planetary Research

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Chiba Institute of Technology, Planetary Exploration Research Center (PERC)

5. Host researcher: Hiroki Senshu

6. Description of your current research

At the DLR in Berlin, Germany, I investigate the thermal properties of the Near-Earth Asteroid Ryugu. Ryugu is the target of the Japanese JAXA mission “Hayabusa-2”, a probe that was launched towards Ryugu in 2014 to collect sample from the surface and return them to Earth. In that frame the DLR provides a lander to that mission. I investigate the thermal properties of the asteroid by modelling the material properties and using the infrared Radiometer MARA onboard the DLR lander. The data of the MARA instrument will allow the estimation of the asteroid’s surface temperatures as it heats up during the day and cools down at night. By matching the observed rate of temperature change with thermal models, we can derive the material properties governing the thermal behavior of Ryugu, most importantly the thermal inertia. The thermal inertia is closely linked with the structure and evolution of the Asteroid.

The Hayabusa-2 spacecraft features a more complex infrared radiometer, TIR. It is an imaging instrument that will provide a temperature map of the asteroid as well as a map of the thermal inertia. We want to bring together the results of MARA (in-situ) and TIR (global) to provide multi-scale science. To do so it is essential to understand each other’s models and methods.

7. Research implementation and results under the program

Title of your research plan:

Thermal Modelling of Surface Roughness on Near-Earth Asteroid Ryugu

Description of the research activities:

In order to investigate the influence of surface roughness on the data analysis, it was essential to understand each other's models and methods. We compared our numerical codes and investigated in detail how the methodic differences influence the outcome of the analysis. Furthermore we developed a new tool to provide a thermal inertia map of Ryugu. This included understanding a new programming language "SPICE". During our work on a reference paper on the so-far known properties of asteroid Ryugu, we came across an unexpected effect linking the erosion of the surface material to the latitude on the asteroid. We are currently developing a theory on this effect, which will hopefully result in a research letter soon. Unfortunately we didn't have the time include the effect of surface roughness to our models. However we successfully lay the foundation to do so, while we continue to work on this and more topics for the next months.

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

The cultural experience in the Chiba Institute of Technology was mind-blowing. The colleagues were extremely kind and open, and did so much to make my life here convenient and exciting. I found Japanese friends here at the CIT and also outside of work. I could travel to other institutes in Kobe and Sagamihara to learn even more about the Japanese Space research. I could enjoy and see much of the Kanto area (Tokyo National museum, Skytree, Tokyo Sea Life Park, Ryokan in Hakone, BBQ). I loved my stay here and I will try to come back as soon as possible to do more research.

9. Advisor's remarks (if any):

He, Maximilian Hamm, is enthusiastic student and we had fruitful discussion during his summer program. During this program we found some interesting topics to be investigated.
So we'll keep in touch even after this program and proceed collaborative studies.
Hiroki Senshu

RESEARCH REPORT

1. Name: Alexander Hofmann （ID No. SP17306）

2. Current affiliation: Institute of Physics, University of Augsburg, Germany

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Center for Frontier Science, Chiba University

5. Host researcher: Prof. Hisao Ishii

6. Description of your current research

My current research during my PhD program is focused on the charge carrier dynamics in organic electronic devices. I'm working on a program that aims at the development of numerical models and their experimental validation describing the transient electrical response of organic semiconducting devices. One specific subgoal of the project is the study of polar organic materials with a permanent dipole moment and their impact on carrier dynamics and device performance, as well as the fundamental physics involved.

My contribution to the project covers mainly experimental studies using transient measurements like CELIV (charge extraction by linearly increasing voltage) as well as impedance spectroscopy (IS) on various device architectures and material systems. We recently developed a model to apply the CELIV technique to two-layer polar organic OLEDs (organic light emitting diodes). Due to the fact that one of the two layers is processed from polar molecules and shows a so called giant surface potential, charge carriers of one type only can accumulate at the organic-organic interface, enabling measurements which would otherwise require a thick non-polar insulating layer being processed on the device.

Using this technique, by comparing temperature dependent CELIV extraction transients and impedance spectroscopy measurements, the activation energy for the hopping transport in organic semiconductors as well as the energy barrier can be independently determined. This investigation is then applied to devices with varying molecular structure of non-polar guest and polar host materials and different ratios of doping or dilution to study the impact of the magnitude of the permanent dipole moment and the growth kinetics during layer deposition.

7. Research implementation and results under the program

Title of your research plan:

Spontaneous orientation polarization and charge carrier dynamics with polar organic materials

Description of the research activities:

We chose at first to focus on the well-known prototypical materials NPB (N,N'-Bis(naphthalen-1-yl)-N,N' -bis(phenyl)-benzidine), which is almost non-polar and Alq_3 (tris(8-hydroxyquinoline)aluminium). Previous measurements showed some distinct features in the activation energies dependent on the doping ratio of the two materials, we therefore conducted layer-by-layer ultraviolet photoemission spectroscopy (UPS) to record the energetic landscape of the materials.

Four different ratios of dilution could be investigated; the measurements include low-energy UPS measurements to observe the density of states up until the bandgap. All samples show a slight band bending within the first few nanometers almost independent of the doping ratio. The injection barrier between the contact fermi level and the highest occupied molecular orbital (HOMO), however, is dependent on the ratio in a specific manner. This result correlates with the features we saw using impedance spectroscopy.

The measured width of the density of states is currently being compared with calculations from molecular orbital simulations to further investigate the interfacial properties. Furthermore, all films show a different intensity dependence as expected, which will need additional investigation.

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

The JSPS Summer Program provides an exceptionally welcoming atmosphere for foreign researchers in Japan. The Homestay experience allowed a very close look into Japanese culture and together with the further activities, partially organized by my very nice and helpful colleagues, the three months make up very valuable memories.

9. Advisor's remarks (if any):

Mr. Hofmann has made much efforts to proceed our joint experiment. By collaborating my students, he measured a tons of UPS spectra of NPD films doped by dipolar molecule. The detailed analysis has been not yet completed, but I am sure that we have got interesting data to understand the electronic structure and carrier dynamics of dipolar doping system. His stay at our lab has also greatly stimulated my students to get international atmosphere. I'd like to appreciate JSPS summer program for giving this valuable opportunity.

RESEARCH REPORT

1. Name: Karina Iwe （ID No. SP17307）

2. Current affiliation: University of Kiel

3. Research fields and specialties: Humanities

4. Host institution: Niigata Prefectural Museum of History

5. Host researcher: Dr. Yastami Nishida

6. Description of your current research

My research is linked to museology and archaeology. I am interested in forms of presentation of interdisciplinary knowledge.

7. Research implementation and results under the program

Title of your research plan:

Knowledge transfer at museums

Description of the research activities:

I highly enjoyed my stay at the *Niigata Prefectural Museum of History* in Nagaoka (Niigata Prefecture). The museum opened in 2000, and deals with the organization and display of special exhibitions, preservation and storage of cultural remains, offers a broad spectrum of an educational programs and conducts research. It introduces visitors to the archaeology, history and folklore of the Niigata prefecture in a very appealing way.

I would like to highlight a few professional activities and results from the duration of the research period. On various occasions I was introduced to colleagues from institutions such as the Ancient Orient Museum in Tokyo and the Niigata Prefecture Archaeological Research Center.

Due to the exchange of ideas, I wrote an article about the latest UNESCO nominations of Japan's cultural heritage („Das kulturelle Erbe Japans und die UNESCO") for the online newsletter of the German Society for Pre- and Protohistory, which was published in August 2017.

On another occasion I had the chance to talk about the function and tasks of monument preservation and monument protection in Germany in order to encourage an ongoing discussion of Japan's efforts to preserve traditional Japanese buildings (Kominkas).

Aside from my scientific work at the museum, I was also able to join and contribute to the educational program of the museum. Furthermore, I translated the audio program into German, edited the German version of the official museum website, and was involved into preparation of a special exhibition ("Tools before the modernization"), including a quiz for children.

In addition to my stay at the museum in Nagaoka, I also took the opportunity to travel to many other museums across the country in order to analyze their concept of knowledge transfer and to make a comparison. Being interested in cultural landscapes, I also documented my observations on my website, which highlights the cultural heritage of many areas of the world. I was very pleased to add the rich cultural heritage of Japan to this project.

I highly enjoyed my stay at the museum in Japan. It was a great pleasure to explore the cultural landscape of Japan.

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

I was a frequent visitor of temples and shrines. I enjoyed observing several activities such as Yabusame at Kimpu Shrine, yoga sessions at Johukuji temple, and I was invited to drink tea with priests and took the opportunity to ask them about their temples.

RESEARCH REPORT

1. Name: Anna Marie Kruspe （ID No.: SP17308 ）

2. Current affiliation: Fraunhofer IDMT, Ehrenbergstr. 31, 98693 Ilmenau, Germany

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: National Institute of Advanced Industrial Science and Technology (AIST)

5. Host researcher: Prof. Masataka Goto

6. Description of your current research

Personal and professional music collections have been growing massively since the advent of digital music formats, such as MP3. These collections now make new, automatic organization strategies necessary. In the field of Music Information Retrieval (MIR), many such approaches have been developed over the past 15 years. They allow the classification of music by such characteristics as genre, mood, instrumentation etc.
One factor that has not received much attention yet is the lyrical content of songs. For my PhD, I have been researching the application of Automatic Speech Recognition (ASR) technologies to singing. Applications have so far included Phoneme Recognition, Language Identification, Keyword Spotting, and Lyrics-to-singing alignment.

Another approach that I developed last year deals with the retrieval of textual lyrics from sung inputs. This system was based on Dynamic Time Warping between the recognized phoneme posteriorgrams of song recordings, and binary templates of the expected phonemes. It yields good results for recordings of whole songs without accompaniment. However, short segments of songs are not sufficient for good retrieval results, and the system is not able to handle live input. In addition, it is not efficient for large databases of lyrics.

7. Research implementation and results under the program

Title of your research plan:

Retrieval of sung lyrics from sung inputs

Description of the research activities:

During my research stay, I further developed the system for lyrics retrieval. I designed an algorithm to generate relatively plausible phoneme strings from the recognized phoneme posteriorgrams. Then, I employed a modified Levenshtein distance to retrieve the most likely song from a large database. This algorithm was also adapted in detail for this purpose.

The resulting system is able to retrieve lyrics on the basis of sung inputs of a few seconds duration with good accuracy. In a small evaluation on a database of 300 songs, the approach achieved a retrieval rate between 70 and 100% for the top result (depending on the set of sung inputs).

In addition, the switch from Dynamic Time Warping to Levenshtein distance speeds up the search process by several orders of magnitude. Further optimizations for speed were also included.

I then integrated the developed system into a chat bot for the Telegram mobile messenger. This bot allows a user to sing a song snippet to the messenger, and will then return the top 10 best guesses of the system. It also displays the record cover for the best result, and allows the user to play back the appropriate snippets from the original recordings.

The same approach was also adapted to facilitate a new approach for lyrics-to-singing alignment.

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

Cultural experiences:

- Traveling to Nagaoka, Niigata, and Nagano
- Traveling to a Sumo tournament in Nagoya
- Exploring various parts of Tokyo and Yokohama

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Sophie Lange （ID No. SP17　309　）

2. Current affiliation:

Fraunhofer Heinrich Hertz Institute

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Tokyo University

5. Host researcher: Dr. Takuo TANEMURA

6. Description of your current research

The ongoing growth of intra- and inter-data center traffic pushes the development of up to 400 Gbit/s optical communication links. A typical optical communication link from the electrical data source to the sink consists of transmitter (TX) and receiver (RX) electronics and optics. A low power consumption and low cost are crucial for the link design.

Photonic integration is one of the key technologies to improve the cost, power consumption and size of the optical components. Monolithic laser and modulator integration gives negligible coupling loss and reduces the transmitter size, packaging time and effort. InP allows for monolithic integration, making InP transmitters cost and power efficient. My work includes the design, fabrication and characterization of high-speed optical transmitters chips on InP with integrated laser and modulator. With the laser modulator transmitter, I achieved data transmission at up to 200 Gb/s, making the device suitable for two lane 400 Gbit/s optical communication links.

7. Research implementation and results under the program

Title of your research plan:

Test and optimization of an optical polarization modulator for quantum confined Stark effect (QCSE)

Description of the research activities:

In short reach optical networks, the data traffic is steadily increasing. When choosing from the technology options, different trade-offs exist. A high lane rate benefits from avoiding a high number of lanes, but increases the bandwidth requirements for the link electronics and optics. By increasing the spectral efficiency, the bandwidth requirements for a given lane rate are reduced. For short reach applications, intensity modulation and direct detection schemes are very promising, utilizing simple and cost-efficient photodiodes. One solution is to modulate the state-of-polarization, or the Stokes vector, which is compatible with direct detection and improves the spectral efficiency. The proof-of-concept of the first monolithic InP-based polarization modulator was already demonstrated to show static operation by using the electro-optic Pockels effect inside a bulk InGaAsP core layer or carrier based effects in a multi quantum well (MQW) core.

During my fellowship I investigated the polarization modulator applicability for the QCSE electro-optic effect in an MQW core, which has a higher efficiency than the Pockels effect and is suitable for high-speed operation. I used a commercial simulation software to model the device structure and test its operation for the QCSE effect. The simulations showed that the QCSE effect is present in the device and that it can be optimized for polarization modulation by choosing the optimum bias conditions or changing the MQW structure. I also conducted a measurement of the polarization modulator, showing the presence of an electro-optic effect when applying a reverse bias voltage which might be related to the QCSE effect. Overall, the results are helpful for the group to optimize their next device for the QCSE effect.

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

I really enjoyed the stay in Japan, while doing research at the Tokyo University. Everyone in my research group is really open and friendly and we often went out to an Izakaya after work enjoying Japanese food and drinks. The group consists of Japanese and international students and it was interesting to share different cultures and opinions. Tokyo is an amazing place with many different facets from traditional to modern places, where there is always something to see and do.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Damian PEIKERT （ID No. SP17 310）

2. Current affiliation: Center for Psychosocial Medicine University Clinic Heidelberg

3. Research fields and specialties:

Humanities Social Sciences Interdisciplinary Sciences

4. Host institution: Graduate School of Medicine and Faculty of Medicine Kyoto University

5. Host researcher: Professor MD Toshiya MURAI, MD Shun'ichi NOMA

6. Description of your current research

Keywords: Clinical Philosophy, Interculturality, Interdisciplinary Research

In his later works, psychiatrist Kimura Bin (Kyoto) is presenting the idea of a "Clinical Philosophy". Inspired by the insights of Viktor von Weizsäcker and Nishida Kitaro he assumes an inseparability of philosophy and psychiatry which leads to a philosophy of life. This approach can be defined as both psychopathology and medical anthropology. In each and every case Kimura provides psychiatric groundwork for a contemporary psychopathology especially as it enables a focus on cultural variability. Beside this, phenomenologists are developing readings of Clinical Philosophy as intellectual movement, e.g. Hamauzu Shinji (Osaka), or as a specialized type of phenomenology (Clinical Phenomenology), e.g. Sakakibara Tetsuya (Tokyo). The basic assumption of these approaches is that phenomenology provides a much-needed, deepened understanding of clinical phenomena (nursing, care, depression, anxiety, and so on). In the light of these diverse interpretations, can we still define Clinical Philosophy? Does Clinical Philosophy present a concise psychopathological method, or can it be read as one? How can we grasp a concept raised from the intermediate area between two methodological contexts?

Until now, my studies were primarily inspired by the occupation with Intercultural Philosophy. Growing up in the field of cross-cultural research, I have mostly been concerned with questions of cultural and psychological identity. To approach these questions, I promote the concept of phenomenology. Phenomenology is the learning of structures of consciousness as experienced from the first-person point of view.

As it was useful for current intercultural philosophy and cross-cultural research, I am currently identifying what exactly "phenomenological psychopathology" stands for. Finally, I am arguing that Phenomenological Psychopathology confluences into a concise method,

which improves the interdisciplinary exchange between medicine and philosophy and causes a positive backlash to the individual sciences. As to deepen my understanding of what phenomenology can contribute to current interdisciplinary discourses, I strove to get in touch with the work of Japanese researchers. Clinical Philosophy, as it is congeneric with Phenomenological Psychopathology, is much more elaborated in Japan than elsewhere and is focusing on communicability in a pathbreaking way. This is the junction where Clinical Philosophy becomes fruitful for intercultural research. Since the experiences I made in intercultural philosophy greatly benefitted my studies, I got motivated to complement cross-cultural issues with psychopathological research. Strictly speaking, my ambition is to approach psychopathological questions from an intercultural perspective while paying special attention to everyday experience in medical care.

7. Research implementation and results under the program

A Conceptual Clarification of Clinical Philosophy. Some Remarks on the Betweenness of Research(ers).

Beside constituting the main interests of my own research, this research project can contribute to bringing several readings of Clinical Philosophy to the attention of the German discourse. Of specifically promising character is the idea to make available respective works in German language by scholarly reviewed and annotated translations. Furthermore, the cooperation of interviewees and advisors could strengthen the exchange between German and Japanese physicians, what has been confirmed as being desirable by all parties. In the same sense, an intensification of the collaboration between several interdisciplinary societies is now conceivable.

Description of the research activities:

Thanks to the mediation and great support by MD NOMA Shun'ichi of the University Hospital Kyoto, intense interviews with psychiatrists and philosophers formed the main part of my research stay. The main aim of these interviews was the conceptual clarification of what precisely Clinical Philosophy stands for, presumably revealing its many directions of development and implementation. In this regard the research stay was successful. I could deepen my understanding of Clinical Philosophy and got a deep insight in the day-to-day work of the researchers. Visiting several conferences as well as scientific and clinical institutes constituted the framework of this research.

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

It is highly worth mentioning that hierarchy and majority principle is still an essential part of Japanese culture. It turned out that these principles of interpersonal dealings highly affect all areas of research. This means both the day-to-day work and the theoretical framework. As foreign researcher, we are facing a culture of research which is very different from our own. It is a great challenge for foreign students to face up to a very different understanding of rights and duties of students and researcher. Strictly speaking, critical thinking and freedom of expression are still great challenges for Japanese society. It is necessary for foreign students to deeply understand the structures of living together in Japan (Omote 表/Ura 裏), because these highly implicit structures may cause great frustrations and misunderstandings. Considering this, we can conclude two aspects. On the one hand, it is highly necessary for foreign researcher to behave in a modest and respectful way. On the other hand, it is highly necessary for the Japanese society to rethink their openness and affection to their own people as well as to foreign people. An international, intercultural and interdisciplinary exchange is based on an open mind, openness and an attitude of sincerity.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Maximilian Sommer	(ID No. SP17311)
2. Current affiliation: Institute of Space Systems, University of Stuttgart	
3. Research fields and specialties:	
Engineering Sciences	
4. Host institution: Institute of Space and Astronautical Sciences, Japan Aerospace Exploration Agency	
5. Host researcher: Makoto YOSHIKAWA, Hajime YANO	

6. Description of your current research

At the University of Stuttgart, I am involved with the cosmic dust research group at the Institute of Space Systems, which is in part concerned with the modelling of meteoroid streams throughout the inner solar system, to help define the impact hazard to spacecraft and to study the presence of meteor showers at locations away from the Earth. This is important because hypervelocity impacts of micro-meteoroids (<100 micrometer) can damage or destroy spacecraft or their subsystems through physical damage or electromagnetic effects. Natural meteoroids are particularly dangerous because of their high impact speeds of 20-70 km/s. However, micro-meteoroids can also be purposely collected and analysed, as they transport information about the composition of distant worlds through space and time. This way it is possible to sample the material of the origin of the dust grain without acutally having to go there.

Micro-meteoroids largely originate from comets and asteroids. The model I've been working recently on ejects particles from more than 400 comets and integrates their trajectories through the solar system to track their evolution under gravity, solar radiation and relativistic effects. The result is a database containing information on young meteoroid streams (<1000 years) that are spatially confined and high in particle density. An examplary animation of one of those streams (comet 67P) can be watched here: http://sci.esa.int/rosetta/58304-tracing-the-dust-trails-of-comet-67p/ . Starting with the JSPS Summer Project we wan't to implement another model to gain more insight into the distribution of particles that are much older. Due to perturbations, these particles have moved away from their parent body's orbit and form a smoother, more stationary distribution. We want to analyse the structure of this distribution, in light of the measurements of the IKAROS mission as well as the planned EQUULEUS mission.

EQUULEUS is a cubesat designed by the Japan Aerospace Exploration Agency (JAXA) and the University of Tokyo that will explore the Earth-Moon-Lagrange-Point 2 (EML2). It is going to be launched aboard NASA's Space Launch System which is scheduled for 2019. One of its main objectives will be the detection of micro-meteoroids in the outer region of the Earth-Moon system and possibly interplanetary space at 1 AU. To that end, EQUULEUS is carrying an instrument called Cis-Lunar Object Detector in Thermal Insulation (CLOTH), which is a combination of a particle impact sensor and the thermal protection system of the spacecraft. Because of CLOTH's integration into the thermal protection system it utilizes about 50% of the spacecraft's surface as detection area. This is critical as the total flux of particles in the observed size range is very low.

7. Research implementation and results under the program

Title of your research plan:

Modelling of meteoroid flux at Earth-Moon L2 to be verified by dust impact detectors onboard the EQUULEUS spacecraft

Description of the research activities:

During this research project a numerical model was devoloped that specifically models the motion of old dust particles troughout the solar system. Unlike previous research, we include the effects of all eight planets and the Earth's moon, which should allow us to simulate dust evolution anywhere in the solar system as well as dust captured in the Earth-Moon system. The model's backbone is the N-body Hybrid Mercury integration algorithm developed by Chambers(1999). To account for solar radiation pressure and Poynting-Robertson drag, the effects were added to the force model of the integrator. The model was implemented to utilize multiple CPU-cores to work in parallel and is running on a workstation with high multicore capabilities. Specifically, we studied the presence and stability of mean-motion-resonances, which cause dust particles to be trapped in certain orbits due to periodic gravitational influences from the planets. This causes the formation of regions in the sporadic meteroid cloud with higher density (accumulations) or lower density (gaps). Preliminary results of our working model show that these features are very pronaunced for the vicinity of Earth and therefore possibly measurable during an interplanetary mission phase of EQUULEUS. Next, we want to analyse the simulation data further for particles temporarily captured in the Earth-Moon system to investigate possible accumulation in the EML2 region (the destination of EQUULEUS). However, the initial simulations also show that the formation of these structures is almost not apparent in the vicinity of Venus. We could not yet determine the cause for the absence of these structures, although their presence has been indicated by space missions in the past. To investiage this, we ran simulations that didn't consider Earth's gravity that indeed showed strong formation of structure also at Venus, indicating that Earth causes the absence of a ring at Venus in our model. This could be due to gravitaional perturbations of Earth, as they might decrease the stability of external mean-motion-resonances with Venus. Another reason might be that the formation is not possible for the modelled grain size (beta value). Further simulations and analysis of this are required to rule out artifacts or other limitations of the model.

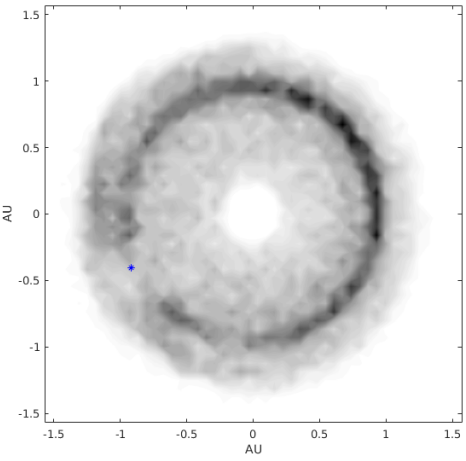


Illustration of conducted simulation showing dust ring and gap at 1 AU. The blue dot is the Earth

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

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Katharina Strohrmann （ID No.: SP17312 ）

2. Current affiliation:

Institute of Helicopter Technology, Technical University of Munich, Germany

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Institute of Advanced Fibro Science, Kyoto Institute of Technology

5. Host researcher: Prof. Hiroyuki Hamada

6. Description of your current research

My current research is about the introduction of natural fibers as reinforcement in aerospace structures. The idea is to reduce the environmental impact of a helicopter structure by the use of ecologically sustainable materials. Due to low density and high stiffness of flax fibers, we chose these fibers for further work. The approach is to substitute carbon reinforced plastics partly and hybridize the structure for best weight, CO2-impact and strength efficiency.

Therefore I did studies on impact resistance and plan to investigate on vibrational damping properties of hybrid laminates in ongoing work. Within this summer term project we did tests on crash energy absorption. It is expected, that these preliminary tests result in a neat field of beneficial applications for hybrid carbon and flax, which should be part of further work.

Within the whole project we will build an ultralight weight helicopter door and tail plane out of flax and carbon hybrids, which should act as an experimental study on the applicability in semi-structural parts. The results of the crash, impact and damping tests will be incorporated in the design of the mentioned parts. If the results of the hybrid flax-carbon tubes in the crash tests are remarkably good, we will do further research in this field.

7. Research implementation and results under the program

Title of your research plan:

Crashworthiness of hybrid carbon and flax tubes for aerospace applications

Description of the research activities:

The potential of hybrid flax and carbon fiber reinforced plastics (FFRP and CFRP) as structural composite materials used in crashworthy helicopter and other aerospace structures should be investigated within this work.

For this investigation different specimen of flax and carbon laminates were fabricated before the program. Within the summer school section cuts of the laminates were analyzed with a microscopic inspection. Thereby the hybrid interface and the quality of impregnation could be assessed, as well as a view of the fiber volume content and the sizes of fibers.

Additionally the weight of the specimen was measured several times, while the specimen were dehumidified. As flax fibers show hydrophilic behavior, it was interesting how the consolidated tubes and the different hybrid stack-ups act.

Then a static compression test (at a speed of 5 mm/min) was conducted with one specimen of each lay-up. Crash and material failure behavior were observed and documented by a video camera. Quantitative characteristics (Force-Displacement curve) of this test were recorded and thereby the absorbed energy efficiency, the stroke efficiency, the mean crushing stress and the crush force efficiency were calculated and compared. Also the total absorbed energy is needed for the dynamic compression (crash) test set-up. Parameters for the dynamic testing could be assessed. Additionally the crashed specimen were embedded and cured in an epoxy resin to analyze the failure mode and fracture mechanisms in detail.

The hybrid specimen did well, but could not beat the pure carbon specimen in terms of specific crash absorption. Though the hybrid specimens' weight was lower than the calculated and expected values.

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

Japanese people showed a great hospitality. I also joined the university's Lacrosse team, which was a great experience. KIT offers a great accommodation for international students, Marikoji Kaikan, which is besides very fair pricing also good for activities with other exchange students. We did Karaoke singing and cooking together.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Dianne L. WELDIN （ ID No. SP17313 ）

2. Current affiliation: University of Stuttgart, GERMANY

3. Research fields and specialties:

Chemistry

4. Host institution:

Department of Synthetic Chemistry and Biological Chemistry, Kyoto University

5. Host researcher: Prof. Jun-ichi YOSHIDA

6. Description of your current research

My PhD research is being conducted under Prof. Michael R. Buchmeiser, Institute of Polymer Chemistry MSF, University of Stuttgart, Germany. My work deals with the development of new polyionic electrolytes for use in lithium-sulfur batteries. The molecules are designed with a special shape to address issues such as dissolution of lithium poly(sulfide)s, electrolyte depletion along with Li_2S layer formation.

The first stage of the project is the synthesis and purification of the desired electrolytes. Once isolated, the compounds are characterized using standard techniques such as nuclear magnetic resonance spectroscopy, mass spectrometry, and elemental analysis. It is important that the electrolytes are isolated in high purity to ensure optimal performance in the cell. The batteries themselves are also constructed under an argon atmosphere to ensure that no air or moisture is present inside the cell.

The second part of the project is the electrochemical testing of the new electrolytes to assess their suitability in lithium-sulfur batteries. Measurements such as charge/discharge rates, cyclic voltammetry, and impedance spectroscopy allow the effectiveness and stability of the electrolytes to be determined.

Using this procedure we have succeeded in creating a new system that possesses high initial capacities and is stable over hundreds of cycles.

7. Research implementation and results under the program

Title of your research plan:

Development of active organic materials for redox flow batteries using non-aqueous electrolytes

Description of the research activities:

1) Synthesis of new functionalized naphthoquinone compounds. Products were characterized using nuclear magnetic resonance spectroscopy and mass spectrometry. Purification and separation was achieved using column chromatography and preparative gel permeation chromatography.

2) Cyclic voltammetry of synthesized naphthoquinone compounds. This was important to study the redox behavior of the compounds and to assess if they are stable during electrochemical measurements, and subsequently, in redox flow batteries.

3) Electrochemical measurements. A redox flow cell was constructed under an argon atmosphere to ensure no moisture or air could enter the system and lead to decomposition. Charge and discharge measurements were recorded with the constructed redox flow batteries.

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

The opportunity to join JSPS summer program, to live and to work in Japan was one of the best experiences of my life. It was a big honor to work at Kyoto University and it was really interesting to see the laboratory work and also to meet and spend time with Japanese colleagues. I was able to visit a lot of amazing temples and shrines, hiked on mount Fuji (amazing view!), watched a baseball game and a Japanese concert in a shrine, conversed with a maiko, watched a sumo tournament in Nagoya, experienced “purikura”, lived with a Japanese host family, wore a yukata, experienced Gion Matsuri and Mitarashi festivals, and ate the most delicious food. What an amazing country!

7. Research implementation and results under the program

Title of your research plan:

Water-Soluble Triarylborane Chromophores for One- and Two-Photon Excited Fluorescence Imaging of Mitochondria in Cells

Description of the research activities:

My research activities were mainly based on organometallic synthesis under the exclusion of air and moisture. The key step of the synthesis was a C-C coupling reaction with a cationic triarylborane. Unfortunately, this synthetic route was not as successful as expected. But with some additional protection groups and a reverse order of the synthetic steps the synthesis of the target molecule is heading now in the right direction. This work will be a good start of the collaboration between my PhD supervisor and my host professor.

Furthermore, I could learn to do DFT calculations on my own and could run many calculations to understand the photophysical properties of previously synthesized compounds.

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

I am very grateful for the wonderful time I could spend in this lovely country. The beautiful landscapes, the impressive culture and the very welcoming people was overwhelming every day. I had the chance to visit many places during the weekends (Tokyo, Kyoto, Mt. Fuji) and enjoy awesome fireworks. I got to know a research lab with hard working and very talented chemists. I was impressed by their well-conceived research plans and the group discussions. I hope to continue my collaborations with my host researcher and to come back for the remaining measurements.

9. Advisor’s remarks (if any):

We all have enjoyed working together with Ms. Griesbeck these two months. She has gotten used to the life in our laboratory smoothly. She is a very smart student, always worked hard, and showed a good example of a high-level international students. She also talked a lot with the students in the laboratory and stimulated them. I would like to thank for her participation, which brought international atmosphere to our laboratory. I hope that this stay has indeed been a valuable time for her academic life.

RESEARCH REPORT

1. Name: Jason S. AU （ID No. SP17401）

2. Current affiliation: McMaster University (Hamilton, Canada)

3. Research fields and specialties:

Biological Sciences

Medical, Dental and Pharmaceutical Sciences

4. Host institution: Wakayama Medical University

5. Host researcher: Dr. Fumihiro Tajima, Dr. Yoshi-ichiro Kamijo

6. Description of your current research

Exercise can be challenging for many individuals with spinal cord injuries (SCI) due to the motor and nervous impairments that are unique to each individual. Injuries can be classified by the injury level of the spinal cord (e.g., cervical spine injuries = tetraplegia, thoracic/lumbar spine injuries = paraplegia), as well as the completeness of the injury. While these classifications can broadly suggest an individual's physical capacity to exercise, they do not accurately measure the function of the autonomic nervous system. For example, nerves to the heart branch from the T1-T6 spinal segments, which control heart rate during exercise. However, the degree of dysfunction for injuries between these levels is highly variable, leading to large differences in heart rate responses even for individuals with the same injury classification. In our lab in McMaster, we have previously used specific tests of autonomic nervous system function to further classify individuals who have altered cardiovascular function at rest and during exercise.

In Wakayama, our team will be extending these findings by examining whether temperature responses to exercise in individuals with SCI are related to specific tests of nervous system function. In able-bodied individuals, sweating is controlled by the nervous system as a way to restore heat balance in the body; muscles generate heat when they work, which needs to be dispersed from the body to prevent overheating. However, in individuals with SCI, some of these nervous pathways are impaired, which limit the sweating response to exercise. As a proof-of-principle study, we will examine whether clinical tests of autonomic nervous system health are related to altered temperature and sweating responses in individuals with SCI.

7. Research implementation and results under the program

Title of your research plan: **Autonomic dysfunction and thermoregulation during exercise in individuals with spinal cord injuries**

Description of the research activities:

During this fellowship, our research team at Wakayama Medical University has surpassed our data collection goals, and have completed testing on 12 individuals with SCI and 7 able-bodied controls. Individuals came to the lab on two separate visits: Visit 1 consisted of measurements of blood volume, sympathetic skin responses, sit up test for orthostatic hypotension and a cardiopulmonary maximal exercise test; Visit 2 consisted of a 30 min arm cycling bout to measure skin temperature, core temperature with ingestible capsules, blood volume and urine output. Our team consisted of medical doctors, physiotherapists and researchers. At this time, data analysis is ongoing and will be completed within the next few months.

As an interim analysis, all individuals with tetraplegia presented with some degree of autonomic dysfunction as indicated by the clinical autonomic tests, which resulted in reduced exercise capacity and low core temperature at rest and during exercise. Regional skin temperature responses during exercise indicated that individuals with autonomic dysfunction did not elevate arm temperature to the same degree as those with intact nervous function, likely due to either absent control of upper limb microvascular constriction and dilation, or low active muscle mass during exercise.

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

The Summer Program has been a wonderful experience both working with our Japanese colleagues, as well as exploring Japanese culture. Outside the lab, I was able to travel to Shirahama, Osaka, Kyoto, and Tokyo on weekends to experience the local culture and visit with the other JSPS fellows that I met during orientation week. The highlights included the Arashiyama monkey park and Fushimi Inari shrine in Kyoto, the great beaches in the Wakayama region, and of course, all the Japanese food! I'm definitely looking forward to visiting Japan again outside of research time

9. Advisor's remarks (if any): n/a

RESEARCH REPORT

1. Name: Tanor BONIN （ID No. SP17402 ）

2. Current affiliation: McGill University

3. Research fields and specialties:
Interdisciplinary and Frontier Sciences

4. Host institution: Kanagawa University

5. Host researcher: Prof. Rie MATSUNAGA

6. Description of your current research

Music perception research provides a unique insight into the auditory system and the mental processing of sound. Musicians manipulate alter the scales, orchestration, and temporal development of musical sounds to elicit different emotions, ideas, and auditory images of space and time in the audience. These manipulations are informed and constrained by the musical traditions of the prevailing culture and genre. A fascinating psychological question is the extent to which the sounds of different musical traditions rely on shared mental processes.

The Japanese and Western musical traditions derive from notably distinct cultural and philosophical influences. For example, the philosophies of East and West entail alternative interpretations of the nature of time, the relationships between objects and their surroundings, and thus of causality. One expects that the difference in these cultures' metaphysical delineations of reality might be reflected in signature acoustic and theoretical structures of their musical traditions. Indeed, previous research has demonstrated that Japanese listeners process the musical scales of the Japanese or Western traditions using distinct neural networks and perceptual schemata. The present research was intended to evaluate whether and to what extent such differential processing might apply to the orchestration and temporal development of Western and Japanese musics.

7. Research implementation and results under the program

In this program, we evaluated the *melodic contour* of Japanese and Western musical excerpts as an empirical index of their temporal development. The melodic contour of a musical sound is the rate at which the pitch height changes over time. Experientially, it is the "trajectory" of the melody; the wave-like patterns of musical rising and falling throughout the piece. Our results indicate that this temporal development is perceptually

relevant to music listeners, contributing to the categorical uniqueness of a musical style above and beyond the effects of the selection of notes determined by its musical scale.

Title of your research plan:

Time, Timbre, and Tonality in the Cross-Cultural Perception of Japanese and Western Musics

Description of the research activities:

The stimuli were developed by first transcribing 18 classic melodies from traditional Japanese folk songs; these initial stimuli were coded as possessing Japanese scale structure and Japanese contour structure. Second, the melodic contours of these stimuli were extracted and transposed onto the scale structure of traditional Western music; these stimuli were coded as possessing Western scale structure and Japanese contour structure. Third, the Western scale stimuli were transposed to traditional Western contours; these stimuli were coded as possessing Western scale structure and Western contour structure. Finally, the Western contours were extracted and transposed onto the scale structure of traditional Japanese music; these stimuli were coded as possessing Japanese scale structure and Western contour structure. Thus the stimulus preparations constituted a 2x2 design with a total of seventy-two musical excerpts that allowed us to investigate the scale structure and contour structure of the Western and Japanese musical traditions independently.

These stimuli were then randomly presented in sequential order to our participants (n=122), who were asked to evaluate the extent to which each piece of music reflected the Western or Japanese musical tradition on a 7-point Likert scale semantically anchored between Strongly Western at one extreme, Strongly Japanese at the other, and Equally Japanese and Western in the center. Statistical analyses of participants' responses confirmed that participants are sensitive to the scale structure *and* contour structure of Japanese and Western musics; melodies whose scale and contour structures were derived from the same musical tradition elicited stronger perceptual images in the listener than did those melodies whose scale and contour structures were derived from alternative musical traditions.

A technical malfunction precluded our investigation of the neural processing of Japanese and Western orchestrations. However, a pilot study similar to that described above for the investigation of musical temporal development indicated that participants were indeed perceptually sensitive to whether the music was performed in traditional Japanese or Western orchestrations. A complete research program will need to be conducted in the future to affirm these findings.

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

I received the invaluable opportunity to study traditional Japanese koto music with sensei ANDO Masateru during my stay in Japan. This experience provided me an exposure to Japanese music, culture, and perspective that cannot be captured in the scientific laboratory. For ANDO-sensei's kindness and expertise I am inspired and deeply grateful.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Kaila J. HAMILTON （ID No. SP17403）

2. Current affiliation:
Department of Plant Sciences
College of Agriculture and Bioresources
University of Saskatchewan
51 Campus Drive, Saskatoon, Saskatchewan
S7N 5A8, Canada

3. Research fields and specialties:
Biological Sciences Agricultural Sciences

4. Host institution:
Cryobiofrontier Research Center
Department of Plant-bioscience
Iwate University, Faculty of Agriculture
020-8550 3-18-8 Ueda, Morioka, Iwate
5. Host researcher: Professor Matsuo UEMURA

6. Description of your current research

Global warming is predicted to increase chilling and frost injury in crops. In corn, chilling injury is an ongoing constraint for global production and expansion which affects food, feed and fuel supplies. Corn is an important model system as it is the largest crop (tonnage based) produced in the world. The project is focused around developing a predictive model through investigation of physiological mechanisms induced by chilling treatment to rapidly assess pre-existing germplasm banks of hybrid corn that perform well under cold conditions. Metrics of performance are based around ability to avoid lethal freezing injury following initial fall frost event (chilling treatment). Previous experiments have included techniques such as: thermal imaging, hydrophobicity, confocal laser scanning microscopy, Fourier transform mid-infrared spectroscopy and gas chromatography/mass spectrometry to evaluate lipid modifications following chilling treatment. Plant material included four contrasting chilling resistant genotypes of hybrid grain corn. The lipid layer, or epicuticular wax on the surface of the leaf is known to act as an effective physiological barrier against lethal ice nucleation into the plant. The intended outcome of the JSPS Summer Program was to incorporate protein contribution to the model with results from the previous experiments. Protein inclusion would improve its predictive power increasing its versatility for a variety of academic and industry applications. Protein analysis was performed in Prof. Matsuo Uemura lab's using protocols of Takahaski (2013) for shotgun proteomics under the supervision of Ph.D. candidate Hiroyuki Imai and Dr. Watanabe.

7. Research implementation and results under the program

Title of your research plan:
Investigation of proteomic changes following chilling treatment in Zea Mays

Specific objectives of the project were to evaluate soluble proteins using a non-targeted approach to measure differences between genotype and treatment effect from greenhouse and field produced mature hybrid grain corn plants of four contrasting chilling resistant genotypes.

Preliminary results identify a number of proteins associated with cold response. In the initial test 20 proteins of significance were found. In subsequent testing (in-progress) we expect a large increase in number of proteins identified. Sample preparation is complete, LC-MS/MS Analysis is underway and data analysis is ongoing at this stage.

Description of the research activities:

1.) Extraction and Isolation of the soluble proteins from corn leaf (CANADA)
2.) Lab Meeting and Orientation
3.) Bradford Assay for Protein concentration following transport
4.) SDS-PAGE for visualization of proteins
5.) Digestion and Purification of Proteins (Protocols of Takahashi et al. 2013)
6.) Quantification of Proteins using Nano-LC-MS/MS
7.) Analysis of Protein Results

OTHER

Lab Meetings about other student's research projects, Journal Club on plant physiology related papers, English club member - For young researchers

8. Please add your comments, including any cultural experience during your stay in Japan (if any): JSPS was a well-rounded program of cultural experiences and time spent in the lab. (A) Private tour by city official of 2011 tsunami damage caused by Great East Japan earthquake at Rikuzentakata, Iwate. Tour included access to private construction re-build area, tour of temporary city hall and of previous Takata-matsubara pine forest with remaining miracle pine. Trip also included Pacific coast tour along Ofunato and Sumita (B) Local traditional and Wanko Soba Experiences (C) Farmer led tour of Fruit orchard specializing in Cherry (Sunfarm) who is a collaborator of my home university (D) Geibikei Gorge and Yugendo cave (E) Weekly local farmers market (F) Met Second Secretary (Public Affairs), Cael Husband Embassy of Canada.

9. Advisor's remarks (if any): The proteomics project Kaila proposed went well although data need to be analyzed after she comes back to Canada. In addition, she participated in various programs with students in Iwate University, which contributed to establishment of human networks for future.

RESEARCH REPORT

1. Name: Benjamin Keeshan （ID No. SP17404 ）

2. Current affiliation: Carleton University

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Osaka University

5. Host researcher: Prof. Shinya Kanemura

6. Description of your current research

My research involves the investigation and constraining of models which attempt to extend the Standard Model of particle physics (SM). The SM, the gold standard of particle physics, is a theory which treats fundamental particles as quantum fields, a special type of mathematical object, and relates interactions between fields to internal gauge symmetries under which the physics must be invariant. The forces of the SM are mediated by gauge bosons (the massless photon and gluon and the massive W and Z). Massive particles, which appears to break the gauge symmetry of the SM, are generated via a process called electro-weak symmetry breaking (EWSB). In the SM, EWSB occurs in the simplest way possible but it is possible that there are other 'exotic' sources of EWSB. Indeed, for all the successes of the SM, it is known to be incomplete. It must be extended in some way by positing new fields and/or gauge symmetries without breaking the SM's agreement with known experimental results. My research involves examining the Georgi-Machacek model (GM) which extends the SM by adding 'exotic' scalar fields which contribute to the masses of the W and Z bosons. To agree with the experimental measurement of the rho parameter, a measure of the relative strengths of the two weak currents, the GM needs to require a symmetry, called custodial symmetry, in the Higgs sector which exists 'accidentally' in the SM. This symmetry cannot be exact at all energy scales because of one of the great peculiarities of quantum field theory; the physical value of the parameters are all functions of energy. This 'running' of the parameters means that symmetry of the GM can only be true at one energy scale. My research involves investigating how this symmetry violation manifests, the allowed scales where symmetry could be exact and the impact of the predictions of the GM of the symmetry violation. These impacts can then be used to constrain the GM model which is a benchmark model for electroweak symmetry breaking from exotic sources.

7. Research implementation and results under the program

Title of your research plan:

Constraining exotic sources of electroweak symmetry breaking

Description of the research activities:

During my research in Japan, I improved the numerical method for determining how the choice of the symmetric energy scale effects the parameters and observables of the GM. I also developed an algorithm to incorporate two important measured values, the mass of the discovered Higgs boson and the Fermi constant, into the custodial symmetry violating GM. I also calculated the effect of the custodial symmetry violation on some of the couplings in the GM which otherwise would be zero. These other custodial violating predictions may be useful when trying to reconcile an approach to the GM which relies on the running of parameters and the current procedure for renormalizing the GM model. In my approach, the rho parameter is an output of the model while in the renormalization approach it is an input which needs to be fixed. If these approaches can be reconciled, it will be possible to place novel constraints on the GM.

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

I have really enjoyed my time at Osaka University. My research experience was fantastic. Everyone in the department was very kind and welcoming. I have many interesting and informative discussions about my research with both the students and faculty and even as a visitor at Kanazawa and Kogakuin Universities. I was also able to do a lot of sightseeing in many different cities including: Osaka, Kyoto, Kobe, Nara, Kanzawa, Tokyo, Yokohama, and Hiroshima.

9. Advisor’s remarks (if any):

We have had discussions on our research project one or two times per every week during his stay. We have made lots of progress. We will continue discussion to finalize the project after he returns to Canada. I believe that Ben's stay was a positive influence for the young graduate students in Osaka. They were enthusiast to communicate with him both in research and private.

RESEARCH REPORT

1. Name: Felix Lapointe （ ID No. SP17405）

2. Current affiliation : École Polytechnique de Montréal

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Gifu University

5. Host researcher: Asami Nakai

6. Description of your current research

Fiber reinforced thermoplastics (FRTP) are materials that presents interesting properties for the aerospace and automotive industry. Their high specific strength and stiffness, good chemical resistance, make them good candidate for structural applications where weight reduction is important.

The pultrusion is a manufacturing technique that allows to produce constant cross sections beams of FRPs. This manufacturing technique has been used successfully with thermosets resin for the past 50 years. Its usage with thermoplastics resin has still not yet reached an industrial state, the high viscosity of molten thermoplastics hinders the impregnations. To overcome this challenge the technique being studied involves multiple stage impregnation and a vacuum chamber to help the impregnation.

A pultrusion line has been designed and manufactured to test the effect of using multiple dies and vacuum as impregnation enhancement techniques. Parts were manufactured with different manufacturing parameters (die temperature, pulling speed, number of die and usage of vacuum). Shear tests and cross section microscopy are then used to compare the quality of impregnation present in the different parts manufactured.

Reducing the weight of structures in the transport industry is often associated with fuel economy and reduction of emission of greenhouse gasses. Demonstrating the efficiency and low cost of pultrusion for manufacturing thermoplastic composites could help the transport industry move towards cleaner products.

7. Research implementation and results under the program

Title of your research plan:

Impregnation model for the thermoplastic pultrusion of commingled yarns.

Description of the research activities:

The manufacturing of pultrusion molds are expensive and time consuming. Being able to have a modelling tool and optimize the geometry of the dies before manufacturing them would allow to increase the quality of the parts pultruded and reduce the cost associated with manufacturing dies to test different geometries. The goal of this project is to produce an impregnation model that could assist in the design of future pultrusion dies.

The model was made using Ansys Fluent. The model was separated in 3 different zones, a resin region, a fiber region and an intra-yarn resin region. Two fluids were used to visualize the impregnation, at the beginning of the simulation, the fibers are filled with air, during impregnation, resin takes the air place in the fibers. The fiber region was modelled using porous media and a velocity source term. An equivalent permeability was used to represent the shorter impregnation distance in commingled yarns. The resin region was modelled using only non-slip wall conditions on the die wall and a pressure output at the die entrance. The intra-yarn resin region was sized to represent the fiber volume fraction in the commingled yarns. This region was also modelled as a porous media with an inter-yarn permeability.

The results for impregnation were representative of the experimental results, the motion of the resin represented the observations made during the experiments. The model found maximum pressure to be around 80 kPa, the experiments conducted in Japan on a pultrusion line equipped with pressure sensors showed maximal pressure of 1 MPa. It is believed that this difference is caused by the model not including the fiber compaction that would reduce the distance between the fibers and the die wall and therefore increase the pressure at the cone base.

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

My experience in Japan was a very rewarding. Nakai-sensei and all the students in her lab were all very inclusive and helpful. From the first day to the last they made sure I was part of their team and that I had everything I needed to conduct my research and enjoy my experience in Japan. I am very grateful that I have met them and I'm looking forward to meeting or work with them again in the future. I will also remember all my week-end trips, the people I met playing ultimate Frisbee, the Sumo tournament, hiking mount Fuji and many other great experience Japan has to offer. I would like to thank JSPS and Mitacs for this opportunity.

9. Advisor's remarks (if any)

RESEARCH REPORT

1. Name: Steven Meas （ID No. SP17406）

2. Current affiliation: Department of Laboratory Medicine and Pathobiology, University of Toronto

3. Research fields and specialties:

Biological Sciences

4. Host institution: Department of Otolaryngology – Head and Neck Surgery, Kyoto University

5. Host researcher: Prof. Koichi Omori and Dr. Koji Nishimura

6. Description of your current research

The auditory system works by converting sound waves into neural signals. Primary auditory neurons (PAN) receive input from mechanosensory hair cells in the cochlea and relay these messages to the auditory centres of the brain. Primary degeneration of PANs is one of the leading causes of age-related hearing loss. New technologies, such as hearing aids and cochlear implants, have emerged that can help reduce the impact of hearing loss and improve a patient's quality of life. However, these aids often do not resemble natural hearing and cannot be used by patients without PANs. Alternative biological strategies that use stem cells grafts and/or gene therapies to restore the connection between the cochlear hair cells and the brainstem offer a potential solution to relieve hearing impairment, an issue that is expected to double within the next quarter-century. One promising strategy for the regeneration of PANs is the direct reprogramming of cells within the spiral ganglion, the location of neuron cell bodies in the peripheral auditory system, such as spiral ganglion glial cells (SGGC), into PANs. Current work in our lab indicates that we can create induced PAN-like neurons (iPAN) *in vitro* from neonatal and adult SGGCs. At Kyoto University, I have been using an adeno-associated virus to deliver a neurogenic transcription factor to the spiral ganglion to test the feasibility of reprogramming SGGCs into iPANs using a preclinical model of hearing loss *in vivo*. This evidence is necessary to evaluate our strategy as a viable solution for hearing loss and its potential as a candidate method for future clinical trials

7. Research implementation and results under the program

Title of your research plan:

***In Vivo* Reprogramming of Spiral Ganglion Glial Cells into Primary Auditory Neurons**

Description of the research activities:

The experimental outline of our study involved: (1) the induction of auditory neuropathy, (2) infection with the virus, (3) functional testing via auditory brainstem response (ABR) testing and (4) histological analysis of cochlea from sacrificed mice. Induction of auditory neuropathy included surgical delivery of the chemical ouabain, a Na^+/K^+-ATPase inhibitor, to the surface of the left round window, a membrane between the middle ear and scala tympani of the cochlea. Within 24-hours ouabain-treated animals were observed to have vestibular defects when lifted by their tails, abnormal right-ward spinning, which recovered 1-2 weeks after ouabain exposure. After 1 week of ouabain exposure, the virus carrying our neurogenic transcription factor was surgically delivered through the perilymph of the posterior semicircular canal. Mice were sacrificed 4 weeks after canalostomy surgery. There appeared to be no difference in ABR thresholds between ouabain and saline treated controls, however suprathreshold amplitude and latency values need to be examined further. Based on histological analysis, ouabain caused almost complete ablation of TuJ1-positive neurons compared to saline-treated controls, which were unaffected. There was some evidence to indicate that some cells were infected with virus and could convert into neurons, however there appeared to be no difference in auditory function.

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

9. Advisor's remarks (if any):

Steven has been working hard and he shows his ability to perform research on his own. Despite his short stay in my lab, he gathered comprehensive data including electrophysiology and histology, and criticized those data constructively. He contributed a lot to our collaborative project between Kyoto University and the University of Toronto.

RESEARCH REPORT

1. Name: Kyle Rauch （ID No. SP17407 ）

2. Current affiliation: Dalhousie University

3. Research fields and specialties:

Engineering Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Dr. Kumiko Oguma

6. Description of your current research

Advancements in light emitting diode technology have allowed for the development of germicidal UV LEDs (UVC-LED). These new UVC-LEDs offer increased design flexibility due to being compact, durable, and allowing for monochromatic wavelength specification. However, before UVC-LEDs should be implemented in any real-world application, a better understanding of the underlying mechanisms needs to be explored to ensure new reactors take full advantage of the unique advantages UVC-LEDs offer. My studies at Dalhousie University examine the effect that different peak wavelengths and combinations, have on the disinfection rate of Escherichia coli (*E.coli*) in a batch setting. Early results may show that specific combinations of UVC-LEDs may produce synergistic effects. Overall, peak wavelength selection is an important design parameter for new reactors, and using the right combination of wavelengths may allow designers to take advantage of potential synergistic effects.

7. Research implementation and results under the program

Title of your research plan: Optimization of a Novel UV-LED Disinfection Reactor

Description of the research activities: The objectives of the study at the University of Tokyo were to design, build and test a continuous flow UV-LED disinfection reactor. The goal of the testing was to examine how the Reynolds number, or a measure of the hydraulic conditions, influences disinfection. To do so, we chose a low, medium, and high flowrate that corresponded to Reynold's numbers of 1000, 2000, and 3000. These are significant values as they correspond to the laminar, transitional, and turbulent hydraulic regimes, respectively.

The final design of the reactor used a quartz tube with an inner diameter of 22 mm and a length of 400 mm, with a single 280 nm UV-LED placed 300 mm from the tube entrance. The final design specifications were determined based on the hydrodynamics of the system as determined by the Computational Fluid Dynamics (CFD) software OpenFOAM. Additionally, the diameter of the reactor tube was determined by ensuring that light from one UV-LED fully penetrated the water column, and that the flowrates required to achieve a Reynolds number of 3000 in the system were not unrealistic. Once the design was finalized, the parts were ordered from a local company, and when they arrived I was tasked with setting up the reactor in two arrangements: the first for a single pass flow through; the second a closed loop.

Once the system was built, chemical actinometry was used to determine the intensity of the LED at a forward voltage of 5 V and current of 300 mA. Using this calculated intensity, a kinetics study was done on a strain of the bacteriophage MS2. A biodosimetry technique was then used to determine the strength of the UV dose in the reactor. The biodosimetry study was done for the single pass arrangement as well as the closed loop system. For the single pass system, only the dose for the low flowrate could be determined, but doses for all flowrates were found using the closed system. Overall, the results show that the Reynolds number may influence UV dose, and that there may benefits to running a system in a transitional or turbulent regime versus a laminar regime.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): My experiences during this program have been nothing short of life changing. Those gained in the lab working in with Dr. Oguma, and rest of the Takizawa Lab group at the University of Tokyo will, without any doubt, act as a catalyst propelling my research at my home institute faster and further then I could have hoped for. My experiences gained outside the lab were just as influential, and the numerous fond memories I have of Japan (the kind people, rich culture, beautiful geography, delicious food) will be with me forever. I look forward to the next opportunity I have to visit Japan.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Sean C. Smithson （ID No. SP17408）

2. Current affiliation: McGill University

3. Research fields and specialties:

Engineering Sciences

4. Host institution: 東北 大学 (Tohoku University)

5. Host researcher: 教授 羽生 貴弘 (Prof. Takahiro Hanyu)

6. Description of your current research:

Digital logic circuits function on the premise that for each input combination there exists but one corresponding out configuration. However, the reverse does not hold true; for any given output value, there may exist many different valid input combinations which result in the same output. As such, traditional digital logic circuits are non-invertible; one cannot feed a value into a circuits output terminals expecting the corresponding input to appear at the input terminals. However, classes of Boolean logic circuits that are invertible have been theorized; where input and output values are not represented by fixed voltage levels, but instead by probability distributions thereof. Existing theoretical works on the subject have relied upon crucial properties of ideal semiconductor devices which have been theorized of, but which no one has been able to manufacture.

Our research instead leverages stochastic computing techniques, where values are represented by the probability of a stochastic bitstream being either ‘0’ or ‘1’, to perform computations on said probabilities using circuits which can be built using existing manufacturing processes. As such, our research uses stochastic computing as the foundation for spiking neural networks which, when properly configured, can be designed to implement invertible analogues of any arbitrary logic circuit. By taking advantage of the unique properties inherent to stochastic computing, the resulting circuits not only have low power requirements, but are also remarkably resilient to sources of error. Properties which are of critical importance as transistors are further miniaturized and device reliability degrades while power densities increase.

7. Research implementation and results under the program:

Title of your research plan:

Stochastic Computing based Spiking Neural Networks as a Foundation for Invertible Logic Circuits

Description of the research activities:

My research project began at Tohoku University by first reviewing existing works on theoretical circuit families for implementing invertible logic. Once determining that my existing work on stochastic computing spiking neural network circuits were extremely well suited for real-world hardware implementations, I began performing algorithm-level simulations. Such experiments involved software implementations in order to develop and automate the design flow for several circuit families (various computing functions) and as a means of evaluating the scalability of the approach. Once invertible logic circuits for adders, subtractors, multipliers, dividers, and factorizers (of variable bit widths) were completed at the algorithmic level, I began designing the resulting hardware architectures (at the register-transfer level); which was then followed by analysis and design verification. Ultimately, an initial design passed all verification tests and has preliminarily been evaluated to be compatible with the manufacturing toolchain used at Tohoku University. Currently all is on track for the manufacturing of actual silicon integrated circuit during their coming production run. This is a fantastic result of the project as we will not only have introduced the first invertible logic circuit family to be realizable using existing manufacturing processes, but also physically demonstrated so. I sincerely thank Tohoku University for extending me the great privilege of having the results of my research manufactured; a rare opportunity I may not have otherwise had.

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

I would like to express my gratitude to both the staff and the students at Tohoku University for the overwhelming hospitality they showed me during my stay. At no point did I ever feel out of place and everyone did their best to help me with daily life in Japan, all while putting up with my very rudimentary Japanese. I would also like to thank JSPS for allowing me such an opportunity; I have developed a great fondness and respect for Japan, a country as beautiful as its people are kind, and forever will I cherish my time spent here.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Kyle STOKES （ID No. SP17409）

2. Current affiliation: University of Windsor

3. Research fields and specialties:
Biological Sciences

4. Host institution: Keio University

5. Host researcher: Dr. Toshiro SATO

6. Description of your current research

The overall aim of my project is to better understand how the circadian clock (a genetic cellular timing mechanism) contributes to or prevented the growth of intestinal cancer cells and the assistance in healing processes. In previous research, I have shown that the circadian clock is able to coordinate the healing of intestinal tissue after irradiation damage. We wondered whether the coordination of cell division in the intestinal epithelium (only stem cells divide in this tissue) was related to cancer development. To test this I had to come to Japan to work with Dr. Sato a leader in organoid cell culture and gene editing on these cells.

7. Research implementation and results under the program

Title of your research plan: Times are Changing: Editing the Circadian Clock

Description of the research activities:

this I had to learn the CRISPR-Cas9 technique. While in Japan I set out to learn how to perform the CRISPR-Cas9 genome editing technique on 3-dimensional intestinal stem cell culture (organoids). I had hoped to effectively knockout genes that a part of the core circadian clock (a cell autonomous timing mechanism). I was successful in learning this technique over the past 2 months but was unable to successfully edit out the genes CRY1 and CRY2 in viable organoids. The protocol was developed and optimized to transfect genes into human intestinal organoids. Initially we thought this would work just as well for mouse organoids as, generally speaking, mouse cells are more resistant to stress. This however, was not the case. We attempted several different variations of the protocol to optimize the protocol for mouse cells with little success. Another, member of the lab was able to successfully transfect these cells with the CRY1/2 genes but with minimal efficiency. The benefit of this failure was that I was able to perform the protocol multiple times so that I gained proficiency in the technique. Additionally, having to tweak the protocol to suit my needs allowed me to better understand how this protocol works. Finally, since this protocol still needs to be reworked to enhance the efficiency it will be possible that if we can obtain a higher efficiency that we can get submit this work for publication. Additionally, once efficiency is obtained we will be able to continue the original research aim and another publication will be possible.

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

In addition to the excursions that JSPS provide, I had the change to explore Kyoto and all of its shrines and temples. I saw many iconic places in Tokyo and was able to go to Tokyo Disney. I will be traveling to Nikko for one last trip on August 19th. Japan is a truly beautiful country and I hope to return in the future.

9. Advisor's remarks (if any):

None

RESEARCH REPORT

1. Name: Jacob Stolle

（ID No. SP17410）

2. Current affiliation: University of Ottawa

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Waseda University

5. Host researcher: Prof. Tomoya Shibayama

6. Description of your current research

The current project was initiated through an ongoing international multidisciplinary collaboration focused on the study of tsunami loads and effects. The project was initiated as a collaboration between the University of Ottawa (Canada) and Waseda University (Japan). Based on field surveys of the 2004 Indian Ocean, 2010 Chilean, and 2011 Tohoku Tsunamis, a series of experimental and numerical studies have been performed examining the various types of loading conditions within a tsunami-like events.

A subproject of this larger endeavor focuses on the assessment of the risk of extreme debris loading in tsunami-like events. From the field survey performed on tsunami-stricken communities, impacts from large debris, such as shipping containers and shipping vessels, were noted to cause severe damage to structures within the vicinity of the debris source. Due to the relative rarity of tsunami-like events and the reduced likelihood of these extreme impacts, the design of structures for these extreme loads cannot be performed for all structures. The objective of this subproject is to provide a framework for assessing the risk of these extreme debris loading. As field data regarding debris motion in tsunami-like events is limited, the research focuses predominantly on experimental and numerical modelling to provide an estimation of debris motion within the inundating flows.

7. Research implementation and results under the program

Title of your research plan:

Examining the influence of local topography on debris entrainment and transport dynamics.

Description of the research activities:

The objective of the experiments performed at Waseda University was an investigation into the influence of local friction and topography on the transport of debris within a tsunami-like wave. The physical model will provide high-quality comprehensive data for the calibration and validation data sets to be used in future numerical modelling projects.

Waseda University has a unique wave basin facility (4 m wide x 9 m long), that allows for the study of elongated solitary waves. Elongated solitary waves have been shown to well-represent the incipient motion of a tsunami wave on-land. The experiments were performed using scaled-down shipping containers (1:50 geometric scale). Two topographical conditions were examined through this study: 1:10 slope (to model a coastal plain) and a flat, horizontal bed (to model a harbor). The local friction was varied by adding roughness elements (sandpaper) to the surface of the shipping containers. The overall friction was varied by performing the tests on either a stainless steel or carpeted bed. The debris trajectory was analyzed using a camera-based tracking algorithm.

The different categories were compared to determine the influence of the local conditions on debris transport. Using ANOVA analysis, the maximum displacement in the flow direction and the lateral displacement will be examined to discern any significant influence of local topography on debris transport characteristics.

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

During my stay in Japan, I visited Sendai and Onagawa (Miyagi Prefecture) to observe the rebuilding efforts in the area after the 2011 Tohoku Tsunami. Additionally, as one must do in Japan, I hiked up Mt. Fuji in early July. Unfortunately, also learned a lesson about how fast the weather can change at such altitudes and was not able to summit as a result.

9. Advisor's remarks:

Mr. Stolle performed an excellent academic works in our laboratory. He co-operated with our Japanese students and gave good academic influence to them. He is always a hard-working researcher and shows us the Canadian academic spirit. I would like to appreciate his contribution to our university and to his colleague students in Waseda University.

RESEARCH REPORT

1. Name: Jason TAM （ID No. SP17411）

2. Current affiliation: University of Toronto

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Hokkaido University

5. Host researcher: Professor Hiromichi OHTA

6. Description of your current research

Superhydrophobic surfaces were first observed in natural species, with the lotus leaf being the most well-known example. Superhydrophobic surfaces are highly water repelling with a water contact angle greater than 150°. When water comes in contact with these surfaces, it forms nearly spherical droplets and they roll off the surface easily. Furthermore, these surfaces have self-cleaning properties; when water droplets roll off the surface, dirt and contaminants are carried away. The mechanism of superhydrophobicity is controlled by specific surface roughness and low surface energy materials. Currently, most engineered superhydrophobic surfaces are soft polymer based materials and lacks the mechanical and thermal robustness required for most industrial applications. My research is focused on the development of robust non-wetting surfaces. We have recently developed a simple, low cost electrochemical technique to produce novel superhydrophobic coating with a hard nanocrystalline nickel matrix and embedded hydrophobic polytetrafluoroethylene (PTFE) particles. To further improve the mechanical robustness and wear resistance of the non-wetting coating, the soft polymeric PTFE particles were replaced with hard, hydrophobic rare earth oxide (REO) ceramic particles, such as cerium oxide (CeO_2). Rare earth oxides are known to be hydrophobic due to their unique electronic structure. Indeed, highly non-wetting properties of nickel – cerium oxide composite coatings were observed. However, the origin of hydrophobicity of REO is still not well understood today. This topic remains in active debate in the literature as there are mixed reports of the intrinsic wetting properties. Currently, my research work has shifted towards to the fundamental investigation of the intrinsic wetting behaviour of rare earth oxide ceramics.

7. Research implementation and results under the program

Title of your research plan:

Wetting Properties of Cerium Oxide Epitaxial Films with Different Crystallographic Orientations

Description of the research activities:

Unlike polymers, CeO_2 is a crystalline material; the arrangement of cerium and oxygen atoms are different between crystal orientations. Based on this knowledge, we hypothesize that wetting properties vary between different orientations. Previous studies were performed on randomly oriented polycrystalline CeO_2 and the influence of crystal orientation on the wetting properties is not known. The main objective of this project at Hokkaido University is to experimentally determine the influence of crystallographic orientation of CeO_2 on the wetting properties, specifically the water contact angle (WCA). Pristine, atomically flat CeO_2 epitaxial thin films were deposited on (001), (110), and (111) oriented single crystal yttria stabilized zirconia (YSZ) substrates by a novel pulsed laser deposition technique. Although the as-prepared samples were hydrophilic, the orientation-wetting property relationship was observed; (111) CeO_2 film has the highest WCA while the (001) film has the lowest WCA. The results are consistent with theoretical studies on the surface energy of CeO_2; (111) has the lowest surface energy while (001) has the highest surface energy.

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

The JSPS summer program was an eye opener for me. I had an amazing experience in both academic research and Japanese culture. I would definitely consider future research collaborations with Japanese institution and perhaps returning to Japan in the near future for post-doctoral research.

9. Advisor's remarks (if any):

It was our great pleasure to study with Mr. Jason Tam for two months. If possible we would like to invite him to our laboratory again near future.

RESEARCH REPORT

1. Name: Alexa TANNER （ID No. SP17 412）

2. Current affiliation: University of British Columbia

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

4. Host institution: Kumamoto University

5. Host researcher: Prof. Toshio FUJIMI

6. Description of your current research

My research this summer has focused on studying how people perceive multi-natural hazard risks. Kumamoto Prefecture has both recent and direct experience with a M7.0 earthquake in 2016, destructive flooding in 2012 and 2016, and localized landslides.

Due to the frequency and recentness of natural disasters in the Kumamoto Prefecture, a multi-hazard perspective has been taken to understand how experience with multiple natural hazards influences perceptions of future natural hazards and the role experience has on perceived impact. This research examines whether experience with flooding, earthquakes, both events, or neither, influence risk perceptions.

My current research is creating an online survey that assesses Kumamoto residence risk perceptions of earthquakes and floods. We will be testing if a cross-over effect of risk perceptions is present, that is if experience with one hazard influence perceptions of other natural hazards. Additionally, we will be testing to see how perceptions relate to mitigation actions and if levels of support differ based on personal experience and the nature of earthquakes and flooding (wide-spread and uncertain vs. localized and seasonal).

7. Research implementation and results under the program

   Title of your research plan:

   The influence of experience with multi-natural hazard risks: Risk perceptions of residence in Kumamoto, Japan

Description of the research activities:

This summer I have furthered my knowledge of risk perceptions related to natural hazards by focusing on multi-natural hazard environments. Along side Dr. Fujimi, a survey instrument is being created that will be sent to Kumamoto residence to understand how recent experience with natural hazards influence perceptions to see if cross-over effects exist.

Results from this survey will be analyzed with the aim of understanding how risks are perceived and the implications this may have for mitigation preferences. Though this work is just beginning and no firm results can be reported yet, we hope that this research will aid Kumamoto and other communities faced with multi-natural hazards in the form of an article in a international journal.

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

My time in Japan has been very fulfilling. It has been enriching to experience Japan from the perspective of a student, to learn about the local education system, and generally experience how other grad students live and do research.

I've had several opportunities to venture to regions outside of Kumamoto and experience the regional differences within Japan.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Ian R. WILLICK （ID No. SP17413）

2. Current affiliation: University of Saskatchewan

3. Research fields and specialties:
Agricultural Sciences

4. Host institution: Iwate University

5. Host researcher: Prof. Matsuo UEMURA

6. Description of your current research

When developing crops for temperate climates, breeders must choose between high yield potential and yield stability. Environmental stress due to freezing results in significant yield losses and prevents crop extension into new regions. An example of this is winter wheat where average Canadian commercial yields (bushels/acre) were 31% greater than spring wheat varieties but comprise only 12% of the total wheat production in Canada. Even though winter wheat has become Western Canada's third largest wheat class, extreme winter temperatures (< -30°C) resulting in winterkill has limited Western Canadian winter wheat production outside of Southern Alberta.

The crown is the critical organ for winter survival in cereals. Our previous research on freezing within the crown identified the vascular transition zone as the initial site of injury under slow cooling rates (2°C h^{-1}). The primary objective of my PhD thesis is to produce a working model identifying how both winter cereal crown tissues avoid and tolerate freezing. A better model defining regions of ice nucleation, propagation and injury are integral to developing a holistic understanding of cold hardiness within winter cereals. Advancements in our understanding of tissue specific crown acclimation strategies may assist in the identification of new physiological and protein markers for freezing resistance breeding programs. 'Norstar' winter wheat and 'Puma' winter rye crowns were used as model winter cereal systems since the represent current levels of winter hardiness in winter wheat ('Norstar') and the target level of winter hardiness ('Puma').

One of the mechanisms of freezing tolerance cold acclimated winter cereals employ is the secretion of antifreeze proteins into the apoplast to inhibit damage caused by ice propagation within this space. My previous research has identified tissue specific differences in antifreeze protein accumulation in chamber acclimated 'Norstar' winter wheat. However, additional research is required to identify the role of antifreeze proteins in field acclimated samples, and identify whether they can explain the increased field survival of field acclimated plants as opposed to chamber acclimated plants.

7. Research implementation and results under the program

Title of your research plan:

Proteomic analysis of field cold acclimated and sub-zero acclimated winter wheat and rye crown tissues

Description of the research activities:

In Western Canada, winter survival is the critical environmental issue facing winter wheat expansion. To survive freezing, plants must avoid lethal injury to the crown's vascular transition zone, the tissue required for root regrowth. Winter cereals exposed to 4 to 12°C accumulate cryo-protectants, such as dehydrins and anti-freeze proteins, during a process known as cold acclimation. Cold acclimated plants acquire additional freezing resistance when exposed to non-lethal sub-zero temperatures (-3 to -5°C). Using the current superior freeze resistant winter wheat 'Norstar' and more winter hardy 'Puma' rye as a model, physiological responses of plants to freezing were contrasted with proteome analysis. The vascular transition zone was identified as the site of injury using vital staining and recovery tests. This supports previous research from our group. We also identified a series of protein markers with anti-freeze and sugar hydrolyzing function that accumulated to a greater degree in the vascular tissues of rye as opposed to wheat. Additional research will need to be conducted to determine whether winter wheat overexpressing one or more of these candidates will enhance freezing tolerance.

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

During my time in Morioka I have had the opportunity to visit many of the local cultural sites including Geibieki gorge in Ichinoseki, Yugendo cave in Higashiyama town as well as participate in Morioka's Sansa Odori festival. I also had the opportunity to visit Rikuzentakata to see the effects of the recent Tsunami as well as the re-construction efforts. More important than the sights were the friendships I've made in Uemura-Sensei's lab that I hope will continue for many years to come.

9. Advisor's remarks (if any):

The proteomics project Ian proposed went well and the data will give us foundation for further experiments to determine function of some proteins in cold acclimation and freezing tolerance mechanism. In addition, Ian participated in various programs with students in and out Iwate University. I believe that this contributes to his establishing human networks that will help him and Iwate University students to communicate further in future.

RESEARCH REPORT

1. Name: Ruben Asensio-Torres （ID No. SP17501 ）

2. Current affiliation: Department of Astronomy, Stockholm University, Stockholm, Sweden

3. Research fields and specialties: Mathematical and Physical Sciences

4. Host institution: Department of Astronomy, The University of Tokyo, Hongo, Tokyo

5. Host researcher: Dr. Motohide Tamura (Dr. Masayuki Kuzuhara, whose affiliation is Astrobiology Center of NINS and NAOJ, also closely collaborated with this research plan)

6. Description of your current research

Extrasolar planets are planetary-mass objects similar to the ones in our Solar System, but orbiting other stars than the Sun. My research focuses on the direct imaging of these objects and the gas-poor circumstellar disks around stars, the so-called debris disks, where terrestrial planet formation might be ongoing. Direct imaging aims at detecting very faint companions over a much brighter stellar background. That is, the starlight must be efficiently removed to directly observe planets or circumstellar disks around stars. This has to be done at very high resolutions to unveil very close distances to the star, and therefore, telescopes with large apertures are needed. The efforts in this field are thus focused on attaining high resolutions and removing all the stellar photons efficiently, while leaving those coming from the faint companions (planets and disks) unaffected.

If a planet is detected, direct imaging permits us to follow its movement along its orbit around the star, constraining the orbital evolution in such a way that even a transit event can be ruled out. Direct high-resolution spectroscopy of exoplanetary atmospheres reveals fundamental parameters as atmospheric composition or temperature of the planet, and even its spin. In the case of a non-detection, the presence of planets can also be inferred from the gravitational perturbations caused on the circumstellar disk, such as warps or offsets.

The newly-established Japanese Extreme Adaptive Optics Systems at the Subaru telescope (SCExAO) corrects extremely well the aberrations caused by the atmosphere and provides world-leading high-contrast images. This implies that smaller and dimmer planets might be revealed under the stellar halo, or that circumstellar material may be found closer to the star. In particular, CHARIS is an Integral Field Unit (IFU) that will permit us to discover and study the atmospheres of extrasolar planets through their spectra, providing important constraints on their composition and formation processes. In my research, such state-of-the-art instruments are used to explore the planet formation and evolution.

7. Research implementation and results under the program

Title of your research plan:

Development of the CHARIS data analysis for the HIP 79124 system

Description of the research activities:

A very close, faint companion to the intermediate-mass star HIP 79124 was identified by Hinkley et al. 2015 with a technique called Aperture Masking Spectroscopy. The 100–200 Jupiter masses object has been recently imaged at only 20 times the distance of the Earth to the Sun and the physical association with HIP 79124 has been confirmed (Serabyn et al. 2017).

The goal of this project is to use the powerful SCExAO+CHARIS high-contrast imaging capabilities at close separations to the star to image this companion and perform a spectroscopic study at near-infrared wavelengths. This work will shed light on the mass, temperature and atmospheric composition and properties of this apparently low-mass star. Furthermore, these observations will also probe larger separations, which may reveal new companions forming a triple (or a higher order) system. This all will help to constrain the star and planet formation process.

During my stay in Japan I have developed the pipelines that will be used to reduce and analyse the CHARIS data. For that I used a test dataset that I obtained from the team, and have been working on that with my host researchers. After this, the next step is to use this pipeline to reduce and study the HIP 79124 data that I recently got, which will be carried out once I am back to Stockholm, and so our collaboration will continue in the future. Finally, I also had the chance to give a presentation for the exoplanet group at Tokyo University and meet the people there, while this collaborations has given me the opportunity to be part of one of the leading high-contrast imaging teams, such as the CHARIS group.

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

The NAOJ and University of Tokyo have a great working environment and very convenient housing for visitors. The location allowed me to visit Tokyo almost every week and get to know different and special wards, including an onsen and karaoke experience. I also took a few days to visit more traditional sites like Kyoto, Hiroshima and Nikko. I really enjoyed these trips, which allowed me to get to know the Japanese culture and their great food.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Sahar Dalahmeh （ID No. SP17 502）

2. Current affiliation:

PhD, Researcher at Department of Energy and Technology, the Swedish University of Agricultural Sciences.

3. Research fields and specialties:

Engineering

4. Host institution: Hokkaido University, Graduate school of engineering

5. Host researcher: Professor Naoyuki Funamizu

6. Description of your current research

Rejection of micro-pollutants using forward osmosis membranes is governed by physicochemical properties of pharmaceuticals (molecular size, charge, hydrophobicity and polarity), membrane characteristics (material, surface charge and porosity) and feed solution chemistry (pH and ionic composition).

The hypothesis of the research was Membrane surface charge and pharmaceutical properties (including hydrophobicity (log D) and ionization) vary with pH, thus pharmaceutical rejection in FO will be pH dependent.

The objectives of my research during JSPS summer program were to:

1- Investigate efficiency of cellulose triacetate (CTA) –forward osmosis membrane in rejection of selected pharmaceuticals from two solutions (deionized water and synthetic urine) under different pH conditions.
2- Investigate the rejection/diffusion patterns of pharmaceuticals in relation to pH.

7. Research implementation and results under the program

Title of your research plan: Rejection of pharmaceuticals using forward osmosis process.

Description of the research activities:

To achieve the objectives of this research, the following activities were implemented:

1. A series of forward osmosis experiments were performed to test the rejection of pharmaceuticals thorough CTA membrane. Seven pharmaceuticals were tested: carbamazepine, ibuprofen, salicylic acid, acetaminophen, omeprazole, salbutamol and tamoxifen.

2. Additional forward osmosis experiments were performed to investigate the rejection of the pharmaceuticals from fresh synthetic Urine (pH = 5.7), hydrolyzed synthetic urine (pH = 9.5) and filtered hydrolyzed synthetic urine (pH = 9.5).

3. The following measurements were performed for the samples collected from the feed solution: pH, electrical conductivity, water volume, water flux. For the urine samples, NH_3-N and Total ions (Na, Ca, Mg, NH_4, K, Cl, PO_4) were analyzed.

4. No HPLC method was previously prepared to measure pharmaceuticals in the host group. Thus, I worked on developing instrumental method to identify the compounds using 4000 Qtrap HPLC MS/MS instrument. The activities included: identifications of the peak and fragments of the compounds, optimization of the LC/MS conditions for compounds. Researcher in the host group promised to test the methods, analyze the pharmaceuticals in the samples collected from the forward osmosis experiments and send the results to the guest researcher.

The results showed that the volume of water and urine decreased by five folders after 4 hours of forward osmosis. The concentrations of NH_3-N in the hydrolyzed urine were concentrated from 10g/L to 33 g/L after forward osmosis, showing 33% concentration. The concentrations of the pharmaceuticals in the samples were not determined during the stay of the guest researcher at the host institute. The time was not enough to develop, test and use the MS/MS HPLC method. However, the collaborating researchers in the host institute promised to determine the concentrations of the pharmaceuticals and send the data to the guest researcher to analyze them.

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

The guest researcher participated in the open day activities performed in the Research Center for Humanity and Nature. She took the task of explaining the forward osmosis process and distribute stickers about sanitation to children and parents.

9. Advisor's remarks (if any):

Nothing to mention.

RESEARCH REPORT

1. Name: Sara Fernandez Leon （ID No. SP17　503　）

2. Current affiliation:

Karolinska Institutet

3. Research fields and specialties:

Biological Sciences

4. Host institution:

Institute of Development, Aging and Cancer. Tohoku University, Sendai.

5. Host researcher:

Prof. Tanaka Kozo

6. Description of your current research

I have been working in different projects at my home university, one of them was focused in the role of IL1-alpha in initiating BCG responses to Bacille Calmette-Guèrin, (the vaccine against Tuberculosis). My second project, was about investigation of proteasome inhibitors as a potential anticancer therapy and evaluation of its toxicity. Since I am planning to do a PhD in molecular oncology in the future, I search for a group at the department of Molecular Oncology in Tohoku University, where I started something different to what I was doing back home, I believe that will contribute to my future PhD project to continue developing myself in the field of molecular oncology.

7. Research implementation and results under the program

Title of your research plan:

Investigation of Rod1 in Kinetochore-microtubule attachment in different cell types.

Description of the research activities:

During my research experience in Japan, I have been working with cultures of tumour cells, fluorescence microscopy, western blot and immunoprecipitation techniques.

I first investigated the expression of Rod1 protein (which is involved in kinetochore-microtubule attachment) in different tumor cell lines. I found Rod1 expression level was lower in tumor cells compared normal cells, this can lead to chromosomal instability increasing the risk of uncontrolled cell division. After that, I investigated the expression of this protein in tumor cell lines with different depletion of proteins involved in kinetochore-microtubule attachment. I found the expression of Rod1 was not always significantly higher in the control cells compared to depleted cells, suggesting these tumor cells could have a mutation in protein binding Rod1.

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

I think it was very interesting to live for two months in a country and culture very different to mine. I learnt a lot not only in the laboratory but also outside, I met nice friends, I tried food I never tried before and I did some tourism.

9. Advisor's remarks (if any):

I felt the communication was very difficult because of their English.

RESEARCH REPORT

1. Name: Giulia Gaudenzi （ID No. SP17 504 ）

2. Current affiliation: Department of Neuroscience, Karolinska Institutet - Stockholm, Sweden

3. Research fields and specialties:

Medical, Dental and Pharmaceutical Sciences

4. Host institution: Institute of Tropical Medicine, Nagasaki University (NEKKEN)

5. Host researcher: Prof. Taro Yamamoto, MD, PhD - Head of Department of International Health, Institute of Tropical Medicine, Nagasaki University

6. Description of your current research

My doctoral thesis focuses on the molecular mechanisms behind neural stem cells (NSCs) and their contribution to the generation of cells in all cortical layers of the cerebral cortex. Specific transcription factors such as Pax6, Ngn2, Tbr2 together with an orchestrated noise of multiple signaling pathways, are directing the making of the cortex in a largely unknown fashion. Additionally, transcription factors act together with chromatin modifiers to provide gene expression control at the epigenetic level, without altering the genetic code. These modifications control the chromatin state to make it less/more accessible to transcription factor by DNA and histone modifications. Epigenetic modifications have been shown to regulate cell fate determination by repressing developmental genes and the functional significance of these epigenetic mechanisms is sadly established in many neurodevelopmental disorders. Because of its critical role in corticogenesis, mutations in the human transcription factor Tbr2 gene has been linked to pathologies like microcephaly and polymicrogyria, clinical syndromes manifested by mental retardation, epilepsy and impaired speech function (Baala et al., 2007) and more recently altered in Zika's congenital syndrome (Li et al., 2016). Additionally other tropical diseases from parasitic infection such as cerebral malaria and CNS Toxoplasmosis, have been shown to cause strong neurological phenotypes and even death.

7. Research implementation and results under the program

Title of your research plan: **International health research: a cross-disciplinary collaboration from molecular neuroscience to epidemiology.**

Description of the research activities:

Because of my strong interest in infectious disease, neurobiology and global health I had the opportunity to follow the research work of Prof. Taro Yamamoto's team at the department of International Health. I've mainly contributed to 3 projects:

1. International health's field research expedition in Nepal

During this research expedition our team travelled to Nepal for collecting samples of the Tibetan population of Upper Mustang district, an isolated region of the Nepalese Himalayas and one of the last hidden kingdom. The research aim of the project was to investigate the prevalence of non-communicable diseases such as diabetes and hypertension in relation to high altitude adaptation. During this project I've got acquainted and I've observed: how to prepare for a field research work in minimal and rural settings; how to strengthen relationship with the local community and local scientists for mutual benefit; how to adapt our work in basic laboratory conditions.

2. Establishment of molecular tools for telomere's length detection in various sample

In this project we have troubleshoot and optimized a telomere length assay by RT-qPCR to be used with samples collected in the Upper Mustang district of Nepal. My role has been to test the protocol in Japan and extract DNA from the samples collected in the field.

3. Infectious disease research experience: TB, Zika & Malaria

Part of this project was conducted at NEKKEN and partly at Juntendo University. At the international health department I've followed the setting up of a portable sequencing device (MinION) to be used to sample Mycobacterium Tuberculosis transmitted from elephants to humans in rural settings of South East Asia. At the virology department of NEKKEN I've observed how to prepare Zika Virus plaque assay. Finally, at Juntendo University´s I've joined Prof. Toshihiro Mita's research group to learn about Malaria research and tools. Overall, this gave me a broad overview on how I can apply my skills to these research questions.

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

I had a superb time in Japan with my fellow colleagues at the NEKKEN laboratory and from JSPS summer program. We've visited museums, art exhibitions - including Ghibli Studio's itinerary exhibit, beautiful temples and shrines. I've learnt about Japanese culture by interacting with local people, by superb culinary experiences, summer traditional fireworks festivals. During weekends I've extensively visited Kyushu hotspots and I've enjoyed the beautiful nature and seaside around Nagasaki's prefecture. I've also had the chance to spend few days in Okinawa and a week in Tokyo at Juntendo University. JSPS summer program has been a truly memorable time, not only for the strong scientific value of it but because it was embedded in the wonderful Japanese cultural experience.

RESEARCH REPORT

1. Name: Jakob Helander （ID No. SP17505）

2. Current affiliation: Lund University

3. Research fields and specialties: Engineering Sciences

4. Host institution: Tokyo Institute of Technology, Department of Electrical and Electronic Engineering

5. Host researcher: Prof. Jiro Hirokawa

6. Description of your current research

As a Ph.D. student in electromagnetic theory, the research activities in our group at Lund University deal mainly with generation and propagation of electromagnetic fields and these fields' interaction with devices and different material media. A main branch in this topic is the design, evaluation and improvement of different antennas that are used in a variety of wireless applications.

My research has primarily been focused within two areas; large antenna arrays (multiple antennas arranged together acting as a single antenna) and millimeter wave frequency antennas. In airborne radar systems, large antenna arrays can be utilized in order to realize long-range detection of aircrafts within a large angular sector by controlling the direction of radiation. In one of my research projects, I have been studying how to improve the performance of such large antenna arrays by optimizing the transmit power distribution.

Additionally, I have been participating in a multitude of research projects concerning millimeter wave frequency antennas for future wireless communication systems. The short wavelengths at these frequencies enable antenna arrays to be efficiently integrated in handheld devices. Consequently, this would enable users to experience much higher data rates than what is possible today. Within this research area, I have been involved in developing novel antenna designs, and evaluating their performance with respect to various quality metrics.

7. Research implementation and results under the program

Title of your research plan:

Application Prospects of Millimeter Wave Antennas and Large Arrays

Description of the research activities:

During my stay, I have been conducting a small study on the performance of a certain design of a large millimeter wave antenna array. Closely connected to some of my prior work, the end goal can be described as to increase the coverage area where the user can experience higher data rates. Using machine learning algorithms and some simplified models for electromagnetic wave propagation, time efficient simulations can be conducted that take into consideration several factors of the excitation of the antenna. That way, different excitations can be evaluated and much insight can be gained into what characteristics the aperture field distribution have. Since the project was launched two months ago, only initial conclusions have been drawn so far. All results to date have therefore been summarized in a written report that will function as a foundation for future work on the topic.

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

One of my first weekends in Japan, I experienced some beautiful views while biking the 70 km long Shimanami Kaido Bikeway running from Imabari to Onomichi. During the summer I have also had the chance to witness the Bon Odori in Shibuya, and the Sumidagawa Hanabi festival.

9. Advisor's remarks (if any):

"Mr. Helander has studied sufficiently for a short two-month stay to increase the transmission volume for non-far region communication using a large array antenna."

Prof. Hirokawa

RESEARCH REPORT

1. Name: Ricardo Ramalho dos Santos （ID No. SP17506 ）

2. Current affiliation: Karlstad University

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Gia Khanh Tran

6. Description of your current research

The mobile network requirements (e.g. bandwidth and latency) are increasing every year, due to the growth of the number of mobile devices and the needs of the content required by the used applications, such as high-definition video streaming or self-driven cars. In order to fulfil these demands, the next mobile network standard, often known as 5G, will have to use infrastructures and technologies that can cope with the network needs. One of the introduced solutions uses wireless millimeter-wave (mmWave) transceivers, i.e. within the 60GHz band, to handle the communications between the network provider and the end-user equipment, as it supports several Gbps of throughput, while fulfilling the low-latency requirements and reducing capital expenditure. My research work is focused in controlling this type of infrastructures, through a computer networking paradigm called Software-Defined Networking (SDN), which allows the management of the network through a software controller entity. In Tokyo Institute of Technology, I will focus my research on deploying a SDN controller in an environment with physical mmWave transceivers, building communication mechanisms among these two entities.

7. Research implementation and results under the program

Title of your research plan:

Millimeter-wave mesh network controller using Software-Defined Networking

Description of the research activities:

Initially, my research was focused in establishing basic connectivity between a 4 node mmWave testbed (with each node having 2 IEEE 802.11ad network interfaces) and an additional node running a OpenDaylight (ODL) as a SDN controller. The controller would then have basic flow management capabilities, forwarding traffic among the testbed nodes. A web-based demonstration was prepared, in order to present the dynamic configuration of the network through ODL, by having 2 paths available and allowing the user to select which one to use. In additional, fast-failover (monitoring the link status of different paths and using the first available one) was also presented, showing how the used path can be changed upon temporary link failure (in this case, demonstrated by blocking one of the links).

The research continued with an intensive evaluation of fast-failover within mmWave networks, by tweaking its configurable parameters under different network traffic configurations and measuring its impact, through different network performance metrics. This evaluation resulted in a submission to the "5G Test-Beds & Trials – Learnings from implementing 5G" workshop, to be held in Globecom 2017.

In addition, further work was made regarding the management of virtual users in the existing testbed, allowing inter-node traffic generation between multiple source and destinations, without requiring additional physical machines.

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

I vastly enjoyed my stay in Japan, as it allowed me to obtain good knowledge regarding its working and everyday life culture. I was well welcomed in my laboratory, which often lead to additional activities after work. The work pace was intense, but at the same time challenging, which resulted in very satisfactory outcomes.
While in Japan, I was able to travel inside and outside Tokyo, either for leisure or work (e.g. meeting other research labs in other universities). Such experiences increased my enjoyment and understanding of Japan and its culture. I will look forward to return to Japan in the near future.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Saad Sheikh （ID No. SP17507）

2. Current affiliation:

Department of Industrial and Materials Science, Chalmers University of Technology, Sweden

3. Research fields and specialties:

Engineering Sciences

4. Host institution:

National Institute for Materials Science (NIMS), Tsukuba, Japan

5. Host researcher:

Dr. Hideyuki Murakami

6. Description of your current research

My ongoing PhD project is devoted to studying the alloy development and mechanical properties of high-entropy alloys (HEAs), which are based upon a unique physical metallurgy concept, where solid solution phase stabilization takes place by the significantly higher configurational entropy of mixing in comparison to the conventional alloys. HEAs consists of at least five principal metallic elements with concentrations between 5 at% to 35 at% and usually form simple solid solutions such as face-centered-cubic (FCC) and body-centered-cubic (BCC) structures rather than complex phases. The mechanical behavior is highly dependent upon the phase constitutions and to optimize both high strength and high tensile ductility is a great challenge in the field at both room temperature and elevated temperature while keeping the density lower. In addition, the oxidation resistance of these alloys have not been seriously studied, which is however a known problem for high-entropy alloys based upon refractory metals known as refractory high-entropy alloys (RHEAs). In view of the unique advantages of both refractory elements and HEAs as high-temperature alloys (HTAs), and our very recent article of ductilizing RHEAs (Sheikh et al., J Appl Phys, 120, 2016: 164902), developing RHEAs as novel ultrahigh temperature materials becomes a timely and important research direction**.** The key challenge to be addressed now is how to enhance the oxidation resistance of RHEAs without sacrificing the hard-fought room-temperature ductility. Based on what have been learned from conventional refractory alloys, the oxidation resistance of RHEAs shall get improved by doping or coating them with elements like Aluminum, Chromium and Silicon.

7. Research implementation and results under the program

Title of your research plan:

Improving the oxidation resistance of refractory high-entropy alloys

Description of the research activities:

The oxidation resistance of RHEAs shall get improved through Aluminizing pack cementation process and this has been the focus of my work during the JSPS summer program. Aluminizing pack cementation process is a surface modification technique which is carried out by applying protective layers on components (substrate) so that the expected high-temperature oxidation resistance may be achieved. Usually, by the formation of a dense oxide layer on the coating surface, the coating and the oxide layer become a diffusion barrier for oxygen ions and, hence lowers the oxidation rate significantly. The formation of a protective and continuous Al_2O_3 layer is the most effective way for providing an excellent diffusion barrier to resist oxidation at high temperatures. In this regard, phase constitutions of the specimens were identified by an X-ray diffractometer (XRD) after pack cementation. Microstructural characterization, surface and cross-sectional images and local element concentrations were analyzed by a scanning electron microscope (SEM) equipped with an X-ray energy dispersive spectrometer (EDS). The oxidation resistance was determined by the weight change after oxidation tests in air and these heat treatments were carried out in box furnace. Weight change was determined by weighing balance.

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

This work has been performed by the assistance of very helpful and hospitable colleagues. The current visit has also enabled me to experience unique and interesting culture and traditions of Japan.

9. Advisor's remarks (if any):

N/A

RESEARCH REPORT

1. Name: Maximilian Thaller （ID No. SP17508）

2. Current affiliation: Chalmers University of Technology

3. Research fields and specialties: Mathematical and Physical Sciences

4. Host institution: Rikkyo University

5. Host researcher: Prof. Tomohiro Harada

6. Description of your current research

In my research the Einstein-Vlasov system plays a central role. The Einstein-Vlasov system of equations and its solutions is a mathematical model to describe large matter formation in the universe, such as galaxies or galaxy clusters. It is a system of partial differential equations which describes how an ensemble of collisionless particles behaves under the influence of self-produced gravity which in turn is described by Einstein's field equations.

7. Research implementation and results under the program

Title: Uniqueness of static, isotropic low-pressure solutions of the Einstein-Vlasov system

It is a very interesting problem to understand the dynamics of cosmological solutions of the Einstein-Vlasov system. A cosmological solution is a four dimensional space-time manifold that admits a so called compact Cauchy-hypersurface. In other words, there exists a time such that the remaining three dimensional part (space part) of the space-time resembles a compact space, like a three dimensional torus, a sphere, or the topological space $S2 \times S1$. The question whether black holes can form in such a setting is of particular interest, cf. [4, Sect. 11.3, 11.3.5]. To get insights to this question a numerical code describing the time evolution of the Einstein-Vlasov system shall be developed.

During my stay at Rikkyo University progress on this project has been made. The system of equations can be divided into three parts: the so called constraint equations, the evolution equations, and the Vlasov equation, describing the motion of the particles. First I focused on the Vlasov equation. With some help of my PhD supervisor, Håkan Andréasson, a code that solves the Vlasov equation with the particle in cell method, provided the constraint equations are solved, could have set up. A major challenge are the constraint equations. During my visit of Chulmoon Yoo in Nagoya, who has experience with the constraint equations, cf. [3], some progress at the problem could be made. Time did not yet permit to fully pursue all ideas to a conclusion but we identified some suitable ansatz functions which reduce the number of unknowns and allow for the numerical solution with a shooting method.

Besides numerical results, a research project with Tomohiro Harada about the application of a uniqueness theorems on static regular matter space-times was started. R. Beig and W. Simon proved a theorem stating that non-rotating stars have to be spherically symmetric and are uniquely characterized by their surface potential, if the material that the stars consist of fulfills certain assumptions, cf. [2]. In astrophysics stars are described as a perfect fluid. In

contrast to Vlasov matter the pressure is isotropic, i.e. the same in every direction, and the fluid has an exactly determined velocity at each point in space. The dynamics is described by the Euler equation. To obtain a closed system of equations, an additional equation linking energy density and pressure is needed, the equation of state. It characterizes the material the fluid consists of, and incorporates some physical assumptions into the model. Vlasov matter differs in quite some points from a perfect fluid but if one makes the special assumption that the pressure is isotropic, some similarities to a perfect fluid can be found. In a certain coordinate frame we formally obtain the same system of equations as in the perfect fluid case conserving some of the different features of the models, such as the velocity dispersion. Isotropic Vlasov matter can be used to model a globular cluster consisting in many stars. An equation of state linking pressure and energy density can be. This equation of state however does not incorporate some external physical assumptions, as in the case of a perfect fluid, but it follows from the Vlasov equation and the form of the distribution function of the particles. We derived conditions for in which situations the uniqueness theorem of Beig and Simon can be applied to isotropic Vlasov matter. Roughly speaking this is the case when the pressure of the matter is not too high. Physically this means that a not too dense globular cluster has to be spherically symmetric, and small deviations from spherical symmetry will vanish. If the pressure of a body of Vlasov matter becomes too high one enters the realm of gravitational instability, cf. [1]. This means small deviations will lead to a collapse of the object and the spherically symmetric configuration cannot be considered as preferred any longer.

References:

[1] H. Andréasson, G. Rein, *A numerical investigation of the stability of steady states and critical phenomena for the spherically symmetric Einstein-Vlasov system.* Class. Quantum Grav. **23** (2006) 3659-3677

[2] R. Beig, W. Simon, *On the Uniqueness of Static Perfect-Fluid Solutions in General Relativity* Commun. Math. Phys. **144**, 373-390 (1992)

[3] Chul-Moon Yoo, Tomohiro Harada, Hirotada Okawa, *3D Simulation of Spindle Gravitational Collapse of a Collisionless Particle System*, arXiv:1611.07906

[4] A. Rendall, *Partial Diff. Equations in General Relativity*, Oxford Univ. Press (2008)

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

A big emphasis was put on scientific discussion and exchange. The most inspiring presentations for me was a presentation of Tomohiro Harada on “Primordial black hole formation in the matter-dominated phase of the Universe”, at Waseda University Tokyo (June 23rd), and a presentation by Ken-ichi Nakao on the non-linear collisional Penrose process at Osaka City Univ. (August 8th). I gave presentations about my research at Rikkyo Univ. (June 27th), Nagoya Univ. (August 3rd), and Osaka City Univ. (August 8th).