1. Name: Liza Esther ALEXANDER （ID No.: SP16001）

2. Current affiliation: Iowa State University, Iowa, USA

3. Research fields and specialties:
Biological Sciences

4. Host institution: RIKEN- Center for Sustainable Resource, Kanagawa, Japan.

5. Host researcher: Dr. Kazuki SAITO (Group Director), Dr. Yozo OKAZAKI (Research scientist)

6. Description of your current research

My PhD research is being conducted under the supervision of Dr. Basil J. Nikolau at Iowa State University (ISU), in the interdepartmental program of *Molecular, Cellular and Developmental Biology.* Plant epidermal cells express unique molecular machinery that juxtaposes the assembly of intracellular lipid components and the unique extracellular lipids that are unidirectionally secreted to the surface of the plant. The overarching objective of my project is to functionally characterize the genetic and metabolic networks that interrelate the intracellular and extracellular lipid metabolism. Physiologically this lipid-trafficking process is genetically programmed, but can change in response to environmental pressures (e.g., drought, temperature, pathogens), making them important to agricultural crop productivity. Additionally, these lipids are chemically most akin to petroleum hydrocarbons making this research insightful towards the development of biorenewable fuels and chemicals.

My research builds on past research developments at ISU that has been and continues to be supported by the National Science Foundation (NSF) and the Department Of Energy (DOE). Specifically, ISU has developed maize systems for dissecting the genetic and metabolic networks and technological platforms for analyzing and imaging the metabolic intermediates of these processes. My research specifically focuses on the functional characterization of one of these maize gene family in lipid biogenesis. The strategy I am taking is two pronged: 1) expression of the protein encoded by the maize gene in a heterologous host that lacks this function; three such hosts are being used, bacteria *E.coli*, yeast *Saccharomyces cerevisiae*, and Arabidopsis mutant lines that carry mutations in a homologous gene; and 2) characterization of maize plants carrying mutations at the gene. In both strategies I have generated unique genetic stocks that are being analyzed by targeted and non-targeted metabolomics analytical platforms. Since the genes I am characterizing are known to affect extracellular cuticular lipid deposition I use GC-MS analysis to specifically profile these lipids and ultra-high resolution Fourier transform ion cyclotron resonance mass spectrometer (FT-ICR/MS) to spatially image metabolites to individual cells, using well established procedures implemented by the Nikolau group at ISU.

The proteins encoded by these genes express its biochemical function within the cell interior, specifically in the ER membranes possibly affecting fatty acid elongation. Therefore more sophisticated analyses are required to comprehensively explore the lipid profiles that can reveal the relationship between extracellular and intracellular lipid networks. This NSF EAPSI award in collaboration with the JSPS has provided valuable insights and helped me expand this area of my PhD thesis.

7. Research implementation and results under the program

Title of your research plan:

Evaluating intracellular and extracellular lipid metabolic networks at the level of individual cells

Description of the research activities:

The project focused on understanding the molecular genetics and metabolic relationships between the intracellular and extracellular cuticular lipid networks. The latter network is restricted to a single cell layer, the epidermis of plant aerial organs. Genetic stocks of maize and Arabidopsis designed at ISU that revealed changes in the extracellular lipid profile were used in this study, these include 1) transgenic Arabidopsis stems carrying specific maize genes 2) maize seedling leaves and 3) maize silks from inbred lines that showed differential expression in extracellular lipids. The comprehensive intracellular lipid profiles were analyzed via liquid chromatography/quadrupole time-of-flight mass spectrometry (LC/Q-TOF/MS) guided by Dr. Yozo Okazaki, a Research Scientist in the Saito group. Integrating these new intracellular lipid data with the already generated extracellular lipid data provided invaluable insights on the interrelationship between the networks as disrupted by genetic permutations.

The results from the transgenic Arabidopsis stems and maize seedling leaves showed that the specific maize genes used in the study influenced the intracellular levels of fatty acids of specific carbon chain lengths namely 30 and 32. The finding was able to support already generated extracellular lipid data that had shown changes 30 and 32 carbon length fatty acid derivatives. In addition to the changes in the fatty acid composition, several other lipid species were also seen to be influenced such as sphingolipids, glycolipids, acyl glycerols and polyprenols. Studies conducted at ISU by the Nikolau and Yandeau-Nelson groups have shown that the extracellular lipids are also richly expressed also in maize silks with a ~5-fold developmental increase in accumulation of these lipids along the length of the emerging silk. The intracellular profile of these maize silks also showed differences mainly between the different genotypes but with fewer differences across the developmental gradient of the silk. Several uncharacterized metabolites were also seen to be altered in the study and using tools developed at RIKEN – namely MS-DIAL and MS-FINDER, some of these metabolites have fully annotated and others partially identified. Although a lot more work needs to be done to understand the gene functionality, this project has demonstrated the utility of integrating molecular genetic strategies with advanced instrumentation for biochemical analyses (i.e., PTV-GCMS, LC/Q-TOF/MS and MALDI-FTICR imaging), and thus generated new knowledge concerning metabolic networks that occur uniquely within specialized single cell tissues. A manuscript highlighting these findings is in progress.

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

Amazing experience at RIKEN and Japan as a whole. The work ethics, hospitality and friendliness of those at RIKEN and around is something I would treasure forever. The beauty of Japan lies in its terrains, food, and mostly its people. Festivities celebrated with fireworks and dances, temple architectures, visits to Hakone and other surrounding areas along with the exquisite variety of food at every spot have definitely made a mark!

9. Advisor’s remarks (if any):

I, Kazuki Saito hosting Liza Esther Alexander, must say that she made a magnificent job together with my colleague, Yozo Okazaki, regarding the detailed lipid analysis of her samples. She has been excellently integrated with our people in RIKEN for the last several weeks. I am quite convinced she will be able to pave the way to success for her scientific career in future.

RESEARCH REPORT

1. Name: Matthew Barcus （ID No.: SP16002 ）

2. Current affiliation:

Cornell University

3. Research fields and specialties:

Biological Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Shinya FUSHINOBU

6. Description of your current research

Chicken feathers are a large byproduct from the poultry industry, yet the high protein content of the feathers (>85%) offer a unique opportunity to be used as an animal feed and fertilizer, provided they are properly processed. Using enzymes to break down feathers has the potential to reduce energy requirements during the rendering process and yield a better end product. Wax esters are present on the surface of the feathers due to the birds preening, which protects their plumage. By removing the waxy barrier created from preening, we would expect the feather to be more easily rendered into coproducts. Soil microorganisms associated with the ability to degrade feathers were screened for lipolytic enzymes. These enzymes were further tested for the ability to degrade wax esters. The top performing enzyme was selected to further study its catalytic mechanism. Due to low sequence similarity with known protein structures, it was necessary to begin crystallization work in order to gain insight on how the enzyme is able to hydrolyze the bulky, hydrophobic substrates. Knowledge gained from the study may also provide insight on how the enzyme can be optimized for chicken feather rendering and many other industrial processes that have waxy substrates.

7. Research implementation and results under the program

Title of your research plan:

Structure determination and molecular modeling of the catalytic mechanism of a wax-ester hydrolase isolated from a feather-degrading soil microorganism

Description of the research activities:

The main component to the research project was trying to crystalize the wax-ester hydrolase. The purified enzyme was subjected to hundreds of different conditions to find optimal parameters for crystals to grow. From over 400 conditions there were two hits. Adjustments were made with the concentrations of salt, buffer, and precipitant in an attempt to grow larger and better crystals. Some crystals were then tested using an in-house X-ray to determine if the crystals were indeed protein and to evaluate how well the crystals would diffract. A homology model of the wax-ester hydrolase was also constructed to provide some insight on the enzyme and serve as an alternative should the 3D structure not be determined. Furthermore, the enzyme activities of the wax ester hydrolase were able to be evaluated against different substrates using thin layer chromatography.

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

During my time in Japan, not only was I able to experience first-hand what lab culture is was like in this part of the world, I was also able to visit many wonderful cultural spots in and around Tokyo. I was able to visit Yamanashi during a lab outing where we enjoyed onsen at the base of Mount Fuji, picked fresh peaches, and ate delicious houtou. A couple other weekend trips I was able to see Odawara castle, travel through Hakone, and swim at the beaches in Shimoda. My time in Japan was also filled with delicious food.

9. Advisor’s remarks (if any)

RESEARCH REPORT

1. Name: Jessica L. BERGMAN （ID No.: SP16003）

2. Current affiliation: California State University Northridge

3. Research fields and specialties:

Biological Sciences

4. Host institution: Tropical Biosphere Research Center, University of the Ryukyus

5. Host researcher: Dr. Saki Harii

6. Description of your current research

My current research focuses on the implications of intraspecific genetic variation of phenotypic plasticity in a scleractinian coral under pCO_2 conditions predicted to occur by the end of the current century. Using *Pocillopora damicornis* as a study species, and growth as a means to evaluate a plastic response in scleractinians, I have tested the hypothesis that plasticity in growth differs between genotypes. Corals are well-known to vary in plasticity among genotypes, however identifying those genotypes that differ in plasticity is critical to testing the association of phenotypic plasticity with tolderance to ocean acidification. Having identified differences in plasticity of growth among genotypes, I am testing the hypothesis that under elevated pCO_2, genotypes with a high phenotypic plasticity grow faster than those with a low plasticity. The result of these experiments will be explored in a fitness context to evaluate the potential for natural selection to act on plasticity as a means to respond in a beneficial way to ocean acidification. This research will be done as part of fulfillment of my master's thesis.

7. Research implementation and results under the program

Title of your research plan: The effects of climate change on coral larvae in relation to coral reef connectivity

Description of the research activities: The purpose of my experiment was to focus on the behavior and physiology of larvae from a common coral (*Pocillopora damicornis*) and how these features will be affected by ocean acidification (OA), as part of a larger objective to better understand how OA and climate change will alter connectivity among coral reefs and mediate changes in species composition. My approach tested for the effect of OA on the behavior of larvae in-situ at two different depths: < 1 meter and 3 meters, over the course of the first 24 hours after larval release. Additionally, I examined the effect of 24-hour exposure to OA on total lipid content of the larvae, as a measure of larval physiology. Initial assessment of results indicate that in-situ, at < 1 m of depth, larval position in the water column differs significantly by time of day, with larvae tending to swim to the top of the water column over a 24 hour period. However, at 3 meters, larval position in the water column varies both with time of day and with treatment conditions. The larvae are distributed more unevenly than at < 1 m, and can be found more often at the bottom of the water column than at the top. These differences in behavior may be explained by differing light conditions at different depths in the water column. Total lipid content of larvae was not found to differ significantly after 24 hours of exposure to OA conditions, although it decreased from initial measurements taken on the larvae. The results of the research activities, and differences in larval behavior between ambient and OA conditions, will provide insight to a critical knowledge gap of how position of coral larvae in the water column will be affected by OA. On a larger scale, they will add to existing research characterizing barriers to connectivity between populations in future ocean conditions.

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

This was an incredible research experience – the constant collaboration and endless academic resources at my fingertips, as well as experiencing a new and fascinating culture, made the JSPS summer program an enriching and invaluable addition to my master's program.

RESEARCH REPORT

1. Name: Dena BLOCK （ID No.: SP16004）

2. Current affiliation: University of California, Berkeley

3. Research fields and specialties:

Biological Sciences

4. Host institution: Nagoya University

5. Host researcher: Professor Kunihiro MATSUMOTO

6. Description of your current research

Trade-offs between reproduction and maintenance of the soma are a general feature of organismal physiology reflecting choices in energy allocation and affecting stress resistance and lifespan. How organisms coordinate the complex interplay between environmental inputs, metabolism, stress response, and reproduction remains unclear. Members of the transthyretin-like (*ttr)* gene family of the nematode *C. elegans* have been shown to respond to stress and affect lifespan, but the actual roles of these proteins in worm physiology remain elusive. While little is known about *ttrs* in *C. elegans*, the single vertebrate transthyretin is a carrier of lipophilic vitamins and hormones. I am currently focusing on the function of one *ttr,* TTR-1, by evaluating which types of lipids TTR-1 can bind *in vitro*. The project will shed light on a gene family of unknown function and its potential role in integration of stress response and lifespan by hormonal signaling.

7. Research implementation and results under the program

Title of your research plan:

Investigating the role of a putative lipid-binding protein in hormonal signaling and control of lifespan in the worm *C. elegans*

Description of the research activities:

In order to asses the lipid binding capabilities of TTR-1, I proposed to express tagged TTR-1 in HEK293 mammalian cells and purify the protein for use in a protein lipid overlay assay. In this assay, a lipid-spotted nitrocellulose membrane is incubated with tagged protein, and protein bound to spotted lipids is detected by tag-specific antibodies. This assay has already been used to demonstrate binding of another member of the *ttr* family, TTR-52, to phosphatidylserine.

Most of the summer was spent optimizing conditions for expression of tagged TTR-1 in HEK293 mammalian cells. I found that I needed to use a specific transfection reagent, and that TTR-1 is degraded by the proteasome. While treatment with a proteasome inhibitor allowed expression of TTR-1, immunoprecipitation of the protein was complicated by poor efficiency of elution from the beads. More work will need to be done to optimize the expression and immunoprecipitation efficiency of TTR-1 protein.

I was also able to do some other work characterizing TTR-1, such as examining its upstream regulation using a TTR-1::GFP translational reporter, and beginning to construct a transcriptional reporter by fusing GFP to the promoter region of TTR-1.

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

My experience during this program was invaluable. I am extremely grateful to the Matsumoto lab for teaching me new techniques in the lab and for making me feel welcome. I enjoyed many experiences with my labmates, such as going to a summer festival, going to the Higashiyama Zoo, and eating ramen, mochi, and the Nagoya specialty Hitsumabushi. I was also able to visit my host family again and go sightseeing with other JSPS fellows.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Jared Broddrick （ID No.: SP16005 ）

2. Current affiliation:

University of California at San Diego

3. Research fields and specialties:

Biological Sciences

4. Host institution: Kwansai Gyakuin University, Sanda, Hyogo

5. Host researcher: MATSUDA Yusuke

6. Description of your current research

Exploring and developing new sustainable resources to counter increasing consumption has become a focus of research efforts in the academic and private sector. Considerable hope in meeting these challenges has been placed on leveraging photosynthetic metabolism; organisms that are able to fix carbon dioxide and subsequently produce energy-dense products. Modeling photosynthetic metabolic capabilities mandates a systems biology framework for hypothesis generation, data analysis and simulation of cellular fitness. The systems biology approach of genome-scale constraint based modeling coupled with flux balance analysis (FBA) has a proven record of contextualizing organism specific information and enabling the characterization of cellular. A genome-scale reconstruction, the first step in genome-scale modeling, is a repository of cellular metabolic functions based on the genome annotation of the modeled organism. It represents the connectivity of the metabolic network resulting in a mathematically solvable representation of metabolic capability. This provides a framework for hypothesis generation through predictive *in silico* biology. A genome-scale reconstruction of the model diatom *Phaeodactylum tricornutum*, an important photosynthetic marine organism, has recently been completed by the researcher enabling evaluation of metabolic changes to cellular fitness. During the development of this metabolic reconstruction, unique aspects of diatom metabolism were revealed. These aspects were investigated in conjunction with Dr. Yusuke Matsuda at the Kwansai Gakuin University in Sanda, Hyogo Japan.

7. Research implementation and results under the program

Title of your research plan:

Light Dependent Protein Sorting in Diatoms

Description of the research activities:

There were three objectives to the research at KGU with MATSUDA sensei. First was to investigate the possibility of simultaneous metabolic enzyme localization to both the mitochondria and chloroplast. To this end, fluorescence protein tagged enzymes were detected by laser confocal microscopy. The results indicated no simultaneous targeting under the conditions we investigated. This negative result has interesting implications on current diatom metabolic hypotheses. Second, we investigated the possibility of a unique metabolic connection between the mitochondria and chloroplast. Again, using confocal microscopy, there was indeed evidence enzymes in this pathway were chloroplast localized but associated with the mitochondria/chloroplast interface. Additional experiments are planned. Finally, quantitative metrics of diatom growth were collected that should enable more accurate modeling of metabolism.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): This program was one of the finest academic experiences of my life. Every aspect from travel to language to personal interactions were unique and special. I have an interest in continuing my collaborations with my host researchers and I am now considering additional research opportunities in Japan. Also, I am hoping to facilitate research exchanges between my host lab and my home lab back in the US.

9. Advisor's remarks (if any): MATSUDA sensei and his group were incredible. Before I arrived, a researcher in the lab generated dozen of clones for me to test making the research possible. Additionally, I was constantly supported by the lab and their help enabled my successful research. Finally, MATSUDA sensei was a generous, kind host and I will miss spending my days in his lab. Words alone cannot express my gratitude for his support.

RESEARCH REPORT

1. Name: John Kenneth (Kenny) BUYCO (ID No.: SP16006)

2. Current affiliation: California Institute of Technology

3. Research fields and specialties: Engineering Sciences

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: Kyoto University

5. Host researcher: Masayoshi NAKASHIMA

6. Description of your current research

At Caltech, I am researching the collapse vulnerability of buildings to earthquakes. More specifically, I am calculating which ground motion intensity measures are most correlated with collapse. To do this, I run computer simulations of earthquake ground motions applied to mid- to high-rise steel buildings.

We are also investigating how building code changes in the U.S. have affected collapse risk of buildings over time. We also have benchmark Japanese steel building models that are 6 and 20 stories for comparison to equivalent buildings in the U.S.

7. Research implementation and results under the program

Title of your research plan:

U.S. Performance-Based Seismic Evaluation of Roppongi Hills Mori Tower

Description of the research activities:

In Japan, I have worked with a Master's student to analyze the 54-story Roppongi Hills Mori Tower according to procedures in the U.S. for the design and analysis of high-rise buildings in earthquake-prone areas (e.g. Los Angeles). To do this, we ran simulations of seven different earthquake ground motions representative of earthquake risk in Tokyo on a computer model of Mori Tower and recorded the response. Much of the time this summer was spent creating the computer model of Mori Tower and verifying its correctness by comparing its response to small earthquakes to data provided by the Mori Building Company. We found that, even taking into consideration that the earthquake risk is greater in Tokyo, Mori Tower meets the requirements for a new high-rise building in Los Angeles. We presented the results to Mori Building Company in Tokyo on August 1. They were satisfied with the results and want to apply our methods to more of their high-rise buildings in Tokyo so they can communicate the performance of their buildings to American clients.

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

During my stay in Japan, I have visited many cities for sightseeing, including Tokyo, Kyoto, Nagoya, Kobe, and Nara. The research lab here is very close-knit, and we traveled together to Osaka for a conference and to Shirahama for a weekend vacation at the beach. I've had a wonderful time in Japan and I will be sad to leave.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Ian T. BYRNES （ID No.: SP16007）

2. Current affiliation: Colorado State University

3. Research fields and specialties:

Interdisciplinary and Frontier Sciences

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

5. Host researcher: Dr. Thomas Hinton

6. Description of your current research

This summer research project was designed to improve our understanding of the transport and dynamics of noxious materials in the environment within the Fukushima Prefecture of Japan. Radioactive cesium was one of the most significant radionuclides deposited in the environment as a result of the accident at Fukushima Dai-ichi Nuclear Power Plant (FDNPP) on March 11, 2011. Fukushima Prefecture has a varied environment that includes ponds, fields, and forest. This research focused on radioactive contaminant migration in ponds. There are several thousand ponds in the prefecture that were used for irrigation of rice paddy fields and recreation. Four ponds, within 10 km of the power plant, were selected for this project; Inkyozaka, Suzuuchi, Funasawa, and Kashiromori. The research was conducted in collaboration with the Institute of Environmental Radioactivity (IER) at Fukushima University, Fukushima City. The data from this project will be used for determining the long term retention of radiocesium in the target irrigation ponds. Results will also inform potential modeling efforts to be used in studying other ponds in Fukushima Prefecture. The research will be submitted to the Journal of Environmental Radioactivity to be published.

7. Research implementation and results under the program

Title of your research plan:

Radiocesium Dynamics in Irrigation Ponds Surrounding the Fukushima Dai-ichi Nuclear Accident Site

Description of the research activities:

To collect the required data, three types of samples were taken. Bottom sediment cores of 30 – 50 cm depth were taken at three locations within each pond under study. The cores were sliced in the laboratory and measured for radiocesium quantity. Grab samples of the top layer of sediments were taken at each core location. Once dried, the samples were packaged for radiocesium measurement and sequential extractions. The extractions were performed to determine the ratio of mobile/bioavailable radiocesium to the quantity that is bound to the sediments. Finally, water samples were taken from each pond. 50 mL were filtered for ion chromatography to identify the concentration of major cations in the water. Four L were filtered and the filter paper was measured for radiocesium to identify the quantity suspended in the water. All research activities were conducted with the support of the IER either in the field or at the laboratory.

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

During my summer research, I had the opportunity to participate in a weeklong practicum led by the director of the IER, Dr. Kenji Nanba. In this course, we visited prefectural offices in Fukushima Prefecture such as the agricultural research center or the marine and inland fisheries research center. At these offices, we learned about how the prefecture investigates areas of agriculture and farming and how they had to adjust to large scale monitoring of radioactive contaminants as a result of the Fukushima Dai-ichi accident.

9. Advisor’s remarks (if any):

Ian is well prepared for research work and did a good job both in the field and in the laboratory. I am looking forward to interesting and useful data, outcomes of data analysis and interpretation. I am sure he will be able to write and publish a good paper.

RESEARCH REPORT

1. Name: Caitlin J. CAMPBELL （ID No.: SP16008）

2. Current affiliation:

University of Maryland Center for Environmental Science Appalachian Laboratory

3. Research fields and specialties:

Biological Sciences

4. Host institution: Japanese Agency for Marine Science and Technology

5. Host researcher: Dr. Naohiko OKHOUCHI

6. Description of your current research

Understanding the dietary strategies of animals is central to identifying the ecological and evolutionary processes that shape communities, and because the dietary flexibility of a species influences its susceptibility to habitat disturbance and extinction, is key to conservation and management efforts. However, knowledge of diets of many species is limited by difficulty in identifying and quantifying food sources. Bats, in particular, are difficult to study due to their high degree of mobility, use of diverse habitats, and the inherent challenge of observation or capture of small, volant, nocturnal creatures. Compound-specific amino acid nitrogen isotope ($\delta^{15}N$) analysis offers a novel and noninvasive method to estimate trophic position of many species, but its applicability to bats remains unknown. In this project, I used the $\delta^{15}N$ data of amino acids obtained from the hair of seven highly-specialized bat species to validate the application of amino acid nitrogen isotope analysis, and applied the method to study two species with less well-characterized diets. Greater insight into the feeding behavior and dietary flexibility of bats is highly relevant, as many bat species throughout the world– including the insectivorous species– are of conservation concern as the result of global environmental change.

7. Research implementation and results under the program

Title of your research plan:

Amino Acid Nitrogen Isotopes Reveal the Trophic Position and Dietary Strategies of Bats

Description of the research activities:

Bulk nitrogen and carbon stable isotope analysis was applied to 153 hair samples of 10 species of bat. Species were selected for amino acid nitrogen isotope analysis based on the specialization of their diets as determined by literature review and by variation of stable nitrogen isotopes tested. Individual samples were selected based to represent the full range of nitrogen isotope enrichment present in the samples. The amino acids of 30 bat hair samples were derivatized and analyzed on an isotope ratio mass spectrometer; results were used to calculate trophic position using relationships between amino acid isotope ratios available in the academic literature. Individual trophic positions calculated from amino acid $\delta^{15}N$ values ranged from 1.9±0.3 (purely vegetarian) to 3.8±0.3 (carnivorous, high on the food chain). The trophic positions calculated for each species were within the range of those based on *a priori* estimates from the known dietary strategies of these species. Thus, these results validate the application of amino acid $\delta^{15}N$ data for assessing the dietary complexity of bats feeding in marine and terrestrial environments.

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

My time in Japan has been fruitful in each of the scientific, cultural, and social realms. The opportunity to learn the process of amino acid nitrogen isotope analysis, from derivatization to quantification with mass spectroscopy was very valuable, and my time spend in the Department of Biogeochemistry at JAMSTEC has been collegial, welcoming, and full of enriching scientific exchange. I also had fantastic the opportunity to assist with fieldwork with fellow bat ecologists from the University of Tokyo and Doshisha University, which permitted me to discuss research topics and to discover new (to me) species of Japanese bats. My experience in Japan has been enriching, and I hope extends into ongoing and future collaborations.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Calli Campbell （ID No.: SP16009 ）

2. Current affiliation: MBE Optoelectronics Group, Arizona State University, Tempe, AZ, USA

3. Research fields and specialties: Engineering, Materials Science

4. Host institution: University of Tokyo, Bunkyo-ku, Tokyo

5. Host researcher: Masakazu Sugiyama

6. Description of your current research: Currently, research at Arizona State University is focused on the epitaxial growth of cadmium telluride (CdTe) based structures and solar cell devices using molecular beam epitaxy (MBE). CdTe is II-VI semiconductor with a near ideal band gap for absorbing sunlight and a high absorption coefficient. MBE is an ultra-high vacuum (UHV) fabrication process which allows for the layer-by-layer growth of ultra-high quality, virtually impurity-free single crystal semiconductors like CdTe. Our most recent focus is on the growth and characterization of the ternary alloy $Mg_xCd_{1-x}Te$ which is a very promising material for II-VI/Si (1.7 eV/1.1 eV) tandem solar cells. These devices can potentially reach over 30% solar conversion efficiency while benefiting from low manufacturing costs of silicon solar cells.

7. Research implementation and results under the program

Title of your research plan: EAPSI: Real-time, in-situ study of novel Si(100) substrate preparation for epi-growth of GaP/Si(100) for tandem solar applications

Description of the research activities: During the fellowship period, etching techniques of the silicon (100) surface were investigated in order to prime the Si(100) surface to grow single crystal gallium phosphide (GaP), which will a buffer layer on which to grow indium gallium phosphide (InGaP) with high crystal quality. Both Si and InGaP solar cells have been produced with high solar conversion efficiencies. With bandgaps of 1.1 eV (Si) and 1.7 eV (InGaP), this tandem configuration connected in series can result in efficiencies well beyond what a single junction Si or InGaP cell can achieve on its own. At the RCAST lab, solar cells are grown using metalorganic vapor phase epitaxy (MOVPE). This is an equilibrium deposition technique in which metalorganic gas precursors are introduced to a single crystal substrate, in order to build ("grow") single crystal semiconductor material layer-by-layer on top.

Reflectance anisotropy spectroscopy (RAS) is a way to look at a cubic Si(100) surface and see the population ratio between Si dimers aligned in one or the other orthogonal directions, revealing the difference in reflection of a cubic surface with respect to the energy of the incident white light. RAS is non-destructive to the Si surface and is able to operate in high pressure environments. Thus, RAS can observe the surface of Si as it is being etched and subsequently grown upon.

Two techniques shown to produce "single domain," fully aligned Si surface dimers involve heating the sample while exposing it to an etching environment of either hydrogen or arsine to provide energetic conditions for a single domain surface to be revealed. The H_2 method was attempted first at moderately high H_2 pressures and a substrate temperature of 850°C, the maximum temperature the substrate heater can achieve. No anisotropy was observed, only noisy spectra. A likely reason is because the deoxidation and anneal happened at temperatures above 1000°C in the literature.

Professor Thomas Hannappel, a collaborator who is very experienced with RAS of the Si(100) surface, visited the group during the fellowship period and helped develop a procedure of etching of the Si(100) surface with arsenic, as in the literature arsine was shown to produce single domain surfaces at temperatures below 850°C. Initial studies proved this technique to be more successful in the RCAST MOVPE system, as there is less noise in the RAS spectra after deoxidation and anneal at moderate substrate temperatures in the range of 730-780°C, though the RAS spectra seen is still not comparable to those from literature or from collaborators in the Hannappel group. Studies using this technique, varying precursor pressure, annealing time and temperature, are being continued upon the end of the fellowship period.

8. **Please add your comments, including any cultural experience during your stay in Japan (if any):** Working at the University of Tokyo was incredible, both for my academic and cultural enrichment. The people I met and worked with were knowledgeable and always willing to help me learn and grow, not to mention the stellar research and facilities I had the opportunity to be introduced to at Todai. I was able to visit Kyoto and world heritage sites like the fantastic Golden Pavilion, and I was even able to spend a weekend at an authentic ryokan in Kobe. I can't wait to return to Japan.

9. Advisor's remarks (if any):
Ms. Calli Campbell is a very skilled student in crystal growth and she interacted with the students and researchers in my team intensively and her stay in my group seems very successful. Even though she was not allowed to operate our MOVPE system by herself due to our internal safety regulation, she collaborated with qualified students to operate the system and tried to a subject which is completely new in our group. If her stay were longer, she would have obtained more fruitful results.

RESEARCH REPORT

1. Name: Rex Cheung （ID No.: SP16010 ）

2. Current affiliation: University of California - Davis

3. Research fields and specialties:

Mathematical and Physical Sciences (Statistics)

4. Host institution: Nara Institute of Science and Technology

5. Host researcher: Kazushi Ikeda

6. Description of your current research

My proposed project involves the use of driver's behavior data to build an algorithm to detect the possibility of a traffic accident. In brief, driver's behavior data is a collection of features about the behavior of a driving course, such as the brake usage, vehicle speed, lateral and longitudinal acceleration, etc. Accurately predicting the probability of an accident occurring is an important step to building a safe and reliable driving assistant system.

The original proposal proposes to use change point detection techniques in time series analysis as well as Hidden Markov Models to build an anomaly detection algorithm, where if one sees an unusual signal from the driver's behavior data, the algorithm can output the probability of having an upcoming accident. Through investigating some existing literatures and thinking more about the procedure, we altered the original approach, to building a prediction algorithm of the driving states of a driver. A driving state usually consists of a few different levels, examples including safe and unsafe, turning left and right, going straight or turning, etc. The solution to building this algorithm will be done in two stages: first, we will build a detection algorithm that can detect the driving state given the current driving data. Then we will build a prediction algorithm that can predict the future driving states given the current states and driving behavior. The novelty of this work lies in the usage of a multi-class semi-supervised classifier as the detection algorithm, as well as the prediction algorithm itself.

7. Research implementation and results under the program

Title of your research plan:

Predicting Traffic Accidents based on Engineering and Statistical Methods

Description of the research activities:

Most of my research activities involve coming up with the mentioned algorithms and implementing them into software. As mentioned above, we aim to develop a detection algorithm as well as a prediction algorithm that can accurately predict the driving state given the driver's behavior data. The first part of this task, to build a detection algorithm, is almost completed during the stay at Japan. Most of the computer code has been set up (using the statistical software R). The remaining task is to verify the accuracy of the proposed algorithm, as well as tuning the different input features and parameters of the algorithm to improve the performance.

Once the detection algorithm is completed, the second stage, to build a prediction algorithm, will begin. Current idea is to use basic time series techniques from statistics to forecast the features used for the classifier, then apply the detection algorithm to predict the future driving states. The challenge is then to decide what forecasting algorithm should be applied to forecast the features such that we can get an accurate prediction on the driving states.

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: Chien-I Chiang （ID No.: SP16011）

2. Current affiliation: Department of Physics, University of California, Berkeley

3. Research fields and specialties: Mathematical and Physical Sciences

4. Host institution:

Kavli Institute for the Physics and Mathematics of the Universe, University of Tokyo

5. Host researcher: Prof. Hitoshi Murayama

6. Description of your current research

My current research focuses on building physical models that explain accelerating cosmic expansions. Due to the attractive nature of gravity, one will expect that if the universe is expanding, it should expand with decreasing rate. However, based on observations, our universe is currently undergoing an accelerating expansion, and there are other strong evidences indicate that a much dramatic accelerating expansion (dubbed inflation) occurred in the primordial universe. My current research is to construct models that attempt to explain these phenomena under the framework of supersymmetry and supergravity, which are, although under stringent experimental constraints from particle colliders, beautiful theoretical structures that unify particles constituting matters and particles mediating forces.

7. Research implementation and results under the program

Title of your research plan: Quintessence Model in Supergravity

Description of the research activities:

During my stay at Kavli IPMU throughout the summer, I've studied a specific quintessence model in supergravity. Quintessence is a scalar field model that attempts to explain late time cosmic explanation. When incorporating quintessence models into supergravity, the potential is determined by a real function called Kahler potential and a complex holomorphic function called superpotential. The typical problem of embedding quintessence model into supergravity is that if supersymmetry is broken, quintessence often acquires a large mass that will spoil the slow-roll of the quintessence. To evade such problem, we try to build a quintessence model with Kahler potential of the sequestered form, where quintessence and supersymmetry breaking sector are sequestered. Under such construction, the quintessence field does not acquire a mass term from supersymmetry breaking, and hence the problem previously mentioned can be avoided. By requiring the potential to be bounded from below, the model ends up having four free parameters. Due to the nature of the Kahler potential, one cannot construct large-field type potential in this framework. But with some degree of fine-tuning, potential with flat plateau can be constructed and observationally consistent background evolution solutions can be found. However, because of the light mass of the quintessence, we need to further examine if the gravitational coupling with the matter particles will result in large violation of equivalence principle leading to inconsistency with observations. Such issue is under current investigation.

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: Brian CHMIELOWIEC （ID No.: SP16012）

2. Current affiliation: Massachusetts Institute of Technology

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Waseda University / Kyoto University

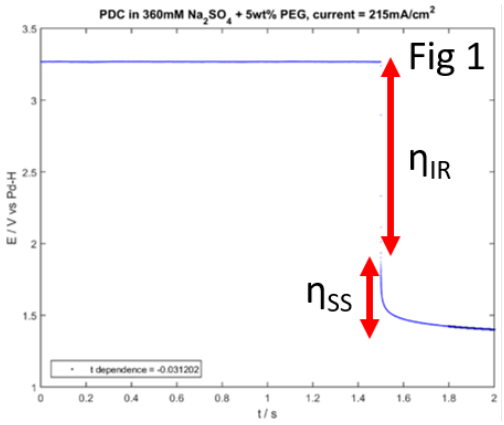
5. Host researcher: Prof. Takayuki HOMMA / Prof. Toshiyuki NOHIRA

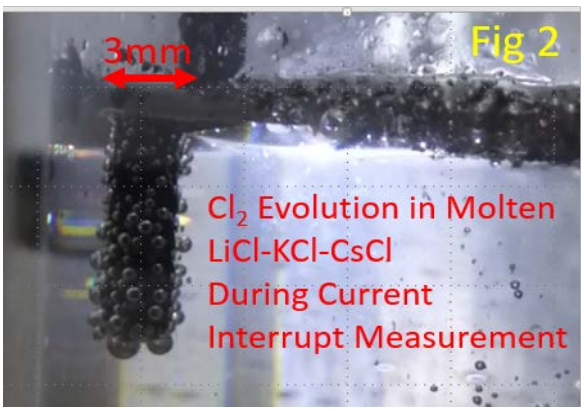
6. Description of your current research: Molten Sulfide Electrolysis (MSE) is a promising clean and energy-efficient extractive metallurgy technique to produce high purity metal from sulfide bearing ores without the unwanted emissions of sulfur oxide gases (SO_x). This extraction is accomplished using electricity to separate the sulfide ore, M_xS, into the constituent metal, M, and sulfur gas, S_2. My thesis research focuses specifically on the case of cuprous sulfide (Cu_2S) reduction to copper metal and elemental sulfur. Understanding and controlling the different loss mechanisms (inefficiencies) associated with the sulfide-based electrolyte is critical to designing efficient industrially-sized electrolysis reactors. The greatest challenge in this effort is the lack of knowledge of the physical chemistry of liquid sulfide systems compared to more traditional electrolytes such as molten salts, molten oxides, and aqueous systems. Thus it is difficult to control the hydrodynamic conditions at the anodic gas evolving interface when such quantities as the density, viscosity, surface tension, gas saturation, and the three phase contact angle between the solid electrode, the liquid electrolyte, and the sulfur gas are unknown. Post mortem analysis of bulk electrolyses performed in molten sulfides has revealed large gas bubble voids that block the electrode surface and limit the current pathway, resulting in large inefficiencies and early termination of the electrolysis. Due to the chemical compatibility and high temperature (>1100°C) nature of these systems, it is difficult to perform any optical measurements in operando to correlate the bubble evolution behavior with the electrochemical response. By studying gas evolution in more conventional electrolytes (aqueous potassium hydroxide solution and molten chloride) while in Japan, we hope to develop a predictive model that can describe the behavior in the MSE systems.

7. Research implementation and results under the program

Title of your research plan: Controlling Gas Evolution and Natural Convection to Optimize the Current Distribution and Energy Efficiency of Electrochemical Cells

Description of the research activities: The voltage, E_{cell}, required to power any electrochemical cell consists of several contributions: $E_{cell} = E_{min} + \eta_{IR} + \eta_{CT} + \eta_{MT} + \eta_{SS}$, where E_{min} is the thermodynamic minimum (perfect efficiency) voltage required, η_{IR} is the overpotential due to conducting current through the electrolyte (ohmic resistance), η_{CT} is the overpotential due to the kinetics of the reaction, η_{MT} is the overpotential required to transport material to the electrode surface, and η_{SS} is the overpotential due to supersaturation of any gas species evolved at an electrode surface. For the systems under study, η_{IR} and η_{SS} are the two most important sources of inefficiency and are most directly affected by bubble generation at the electrode surface. The Current Interrupter (CI) method was utilized to measure these two quantities (Fig 1). Videos were simultaneously taken of the electrode surface during the CI to measure the size of the electrogenerated bubbles, the wettability of these bubbles (contact angle), and the induced natural convection of the electrolyte due to the rising motion of the bubbles (Fig 2). A clear difference was noted in these properties as the composition of the electrolyte was varied. Additionally, the potential decay curve varied drastically between the aqueous and molten salt electrolytes indicating a different timescale of relaxation which can be correlated to the mass transfer phenomena observed in the videos taken during the electrolysis.





8. Please add your comments, including any cultural experience during your stay in Japan (if any): I've had a fantastic time experiencing Japanese food and culture (both working and social). The homestay during orientation was a great introduction to life in Japan. I tried my best to achieve a state of zen at Enkaku-ji and I also participated in a traditional tea ceremony with my family. I visited as many UNESCO world heritage sites as possible. I am still in awe of the impressive architectural features of all the temples and shrines. I will most certainly miss the food and the people. Everyone from the students, to the staff, to the professors were most helpful and I am sincerely grateful for their support.

9. Advisor's remarks: A study on the gas evolution phenomena during electrolysis is crucial to optimize the electrochemical cells. Mr. Chmielowiec has worked very hard on his experiments and obtained a lot of electrochemical data and valuable video data, which are worth publishing in the future. (T.N.) He also has very actively interacted with our students to be a good role-model for them. It should be also noted that he attended a workshop in the field of materials tailoring and won the best poster presentation award.(T.H.)

RESEARCH REPORT

1. Name: Sy-Tsong Dean **CHUENG** (ID No.: SP16013)

2. Current affiliation: Rutgers University

3. Research fields and specialties:

Interdisciplinary and Frontier Sciences

4. Host institution: Institute for Integrated Cell-Material Sciences (iCeMS), Kyoto University

5. Host researcher: Prof. **CHEN** Yong

6. Description of your current research

Current stem cell therapy has limited control over stem cell fate and can lead to low mature differentiation efficiency to replace damaged cells. Furthermore, *ex vivo* differentiation of stem cells has been proven to suffer poor cell survival upon transplantation into the body. To address these challenges, nanomaterials have been developed to precisely control stem cell fate. Nanomaterials are highly versatile in nature, they enable us to effectively and dynamically control the differentiation of stem cells. Subtle changes in the physical microenvironment such as the surface material orientation, ECM protein composition, and shape can significantly influence the therapeutic potential of stem cell.

Nanotechnology-based approaches for guiding stem cell fate include: 1) soluble microenvironmental factors; 2) insoluble physical microenvironment; and 3) Nano-topographical features. Soluble microenvironment describes the growth factors, cytokines, and chemokines associated with nanomaterials delivered to the stem cells. Insoluble physical microenvironment describes the biochemical cues given to extra cellular matrix (ECM) protein for enhanced attachment and orientation. Lastly, nano-topographical feature describes the physical topographical cues nanaomaterial provides to the stem cell. Overall, nanotechnology-based approaches offer physicochemical control required to differentiate stem cells into cell lines of interest. With the increasing interest to develop innovative tools and technologies, we can also expect creative solutions.

As tissue formation is heavily dependent on the recruitment of progenitor cells from the surrounding area, biomaterials introduced as implants are critical in bridging the gap when the defects are too severe to heal autogenously. Therefore, it is important for biomaterials to be able to orchestrate the biochemical and biophysical cues to facilitate cell-cell and cell-ECM interactions to facilitate stem cell therapy.

7. Research implementation and results under the program

Title of your research plan: Hybrid Nanomaterial for Guiding Mature Hepatocyte Differentiation from iPSC

Description of the research activities:

As the vital organ essential for digesting food and ridding toxic substances, liver can be damaged through a various of factors ranging from genetics to viruses and alcohol use. In order to replace the damaged tissue, this project employs a unique nanomaterial-nanofiber hybrid scaffold approach that would improve stem cell therapy to enhance and direct hepatocyte differentiation from human induced pluripotent stem cells (iPSCs). Through a strong collaborative effort, we have successfully developed a novel nanomaterial-based hybrid scaffold for the treatment of liver disease. Using electrospinning technique, we have optimized gelatin nanofiber fabrication. The research also explored the biochemical properties to enhance the differentiation of hepatocyte from iPSCs. Building directly on the scaffold, nanomaterial, thin films of nano-sheets of graphene oxide, was deposited on top of the gelatin nanofiber to enhance cell attachment and differentiation.
After achieving iPSC tissue culture confluency, iPSCs were seeded onto nanomaterial-nanofiber hybrid scaffold to allow for hepatocyte differentiation. Upon generation of hepatocytes, RNAs of hepatocytes differentiated across experimental conditions were collected to check for gene expression level through PCR. Immunocytochemistry assay was also conducted to evaluate the morphology and gene expression of differentiated hepatocytes for comparative studies among different substrates.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): The city of Kyoto has provided me with an excellent cultural experience from its rich history and diverse cuisine. The people of Japan have shown great hospitality and acceptance for anything foreign. Additionally, they have also shown me their intriguing philosophical differences between the eastern and western part of Japan let alone that of Japan and America. This was truly a great opportunity for me, and I will treasure the professional relationship I have built over this past summer.

9. Advisor's remarks (if any):

Dean showed his great skills and knowledge to carry out our projects during his stay at our lab. He worked and communicated with our lab members closely. Actually, his great presence stimulated and encouraged our lab members in terms of research, career, and life. We had a great time building up our collaborative relationship during this summer.

RESEARCH REPORT

1. Name: Anthony Clay （ID No.: SP16014 ）

2. Current affiliation:

North Dakota State University

3. Research fields and specialties:

Chemistry

4. Host institution:University of Fukui

5. Host researcher: Prof. Yasuharu Yoshimi

6. Description of your current research

The natural abundance of carboxylic acid derivatives, ease of handling and simple preparation via well-established synthetic methodologies make decarboxylation a practical and useful methodology. Judicious implementation of photochemistry allows for the control of reactive reaction intermediates permitting their use to afford products of complexity. Yoshimi and coworkers have displayed that a union of the two, coined photochemical decarboxylation, can be utilized to efficiently yield various amino acid derivatives. However, controlling the specific orientation along the pathway of reaction has proven to be challenging. Through the collaborative efforts of Yoshimi and Siva et al the project outlined below strives to employ atropisomers, molecules whose specific orientation is orientated about an axis, to aid in retention of chirality throughout photochemical decarboxylation. We set out to determine whether or not atropisomers can be utilized to retain chirality of the amino acid starting material and afford high enantiomeric excess in the product. Ultimately, this project aims to further display the utility of atropisomers in controlling reactive species leading to chirally enriched products.

7. Research implementation and results under the program

Title of your research plan:

Asymmetric Photochemical Decarboxylation: Memory of Chirality

Description of the research activities:

In order to begin photochemical investigations and evaluate the ability of atropisomers to afford high selectivity in the photochemical reaction, first the desired compounds needed to be synthesized. The acid compound with the necessary alkenyl tether was synthesized in high yields in three easy steps namely, Fischer esterification of salicylic acid, allylation with allyl bromide, and base hydrolysis. Two acids of this type were synthesized, one which lacked a methyl group at the *ortho*-position of the aromatic ring and the latter with the *ortho*-position occupied. The last step prior to photochemical reaction was acid coupling with an amino acid derivative. This occurred with pyroglutamate methyl ester. The product was used in photochemical reactions, which underwent cleavage wherein the starting material was the only compound observed. All in all the summer was spent mainly on synthesizing the needed molecule for photochemical investigations. Since decomposition was noticed during photochemical reactions of the proposed starting material synthesis of another starting material was attempted.

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 visit the dinosaur musuem in Fukui where I learned a lot about fossils, stones and methods to acquire both. I visited Tojinbo Cliff, Hikone Castle, Tokyo, and Eehei-ji Temple. I was introduced to various foods, eg. Don bori, sashimi, tempura and soba and udon noodles. The group and my Japan host treated me with great hospitality and made me feel apart of the group. I love Japan and hope to come back some day.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Karen Clothier （ID No.: SP16015）

2. Current affiliation: Johns Hopkins University

3. Research fields and specialties:

Social Sciences, Interdisciplinary and Frontier Sciences

4. Host institution: Tsuda College

5. Host researcher: Hajime Ono

6. Description of your current research

My research is aimed at better understanding the factors that affect how second language learners learn grammatical constructions that do not exist in their native language, i.e. what is lost in translation. For example, in Japanese a speaker can say the equivalent of (1) "Mary said that Susan kicked *jibun* (自分)" and depending on the situation mean either that Susan kicked herself or Susan kicked Mary; an English speaker would have to use two different phrases: (2)"…Susan kicked *herself*," or (3) "…Susan kicked *her*," to express those two events. In my task, participants read sentences like (1)-(3) in their native language with the words *jibun*, *her*, and *herself* replaced with novel words. They are shown a picture with each sentence that makes the meaning of the sentence unambiguously clear. They are told to try and figure out the meaning or correct use of the three words, based on the sentence-picture pairs. For the *jibun*-like word, I systematically manipulate the frequency of *her*- vs *herself*-like interpretations to see if learners can track and reproduce that difference in subsequent tasks using these words, i.e. if they can learn the ambiguity of *jibun*. Previously, I found that English speakers tend to treat *jibun* as if it were a synonym of *her* or *herself* dependent on which interpretation was more prevalent in their input: English speakers do not have access to or cannot generate the necessary abstract syntactic representation of *jibun* in the limited learning environment provided in this experiment. However, other researchers have claimed that such abstract representations are available in similar paradigms. By administering the same task to native Japanese speakers, I hoped to validate this task as a model of Japanese, and rule out the alternative that it is simply too hard to remember the patterns of the three novel words with so little practice.

7. Research implementation and results under the program

Title of your research plan:

Understanding the role of abstract syntactic representations in second language acquisition

Description of the research activities:

At the beginning of the summer I worked with my host researcher to finalize details of my task. Drawing on his linguistic expertise and native speaker intuitions, I was able to complete the design on my task stimuli (Japanese sentences with matching pictures) and implement it on two computers. He also helped me recruit and train five student research assistants to administer my task in Japanese to participants. With their help we were able to collect data from 72 student participants. After the students finished their classes and went on summer break, I spent the remainder of the summer analyzing the results we had collected.

Data analysis is still in the preliminary stages, but seems to suggest that native Japanese speakers do not treat my novel LD reflexive like their native *jibun*, compared to English speakers. This strengthens my original conclusion that, at least for this particular structure, much more elaborate or extensive information may be necessary to enable learners to access or generate new abstract representations even when they have such representations in their native grammar.

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

After my data collection was complete I was able to take a week off and explore the Japanese countryside, mountains and onsen. It was a very relaxing and beautiful trip. I'm grateful to have had the opportunity to visit old friends and make new ones!

9. Advisor's remarks (if any):

Ms. Clothier did a wonderful job in my lab. Her main aim was to collect data through experiments, but at the same time, she collaborated with our post-doc and graduate students in the lab. I am sure that they became interested in what she is doing for her research, and learned some of the skills and methods she uses for her research. We sincerely hope that there are more opportunities for international collaboration like this in the future.

RESEARCH REPORT

1. Name: Andrew Cudd （ID No.: SP16016 ）

2. Current affiliation: Michigan State University

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Kavli Institute for the Physics and Mathematics of the Universe, Universty of Tokyo, Kashiwa, Chiba, Japan

5. Host researcher: Mark Hartz

6. Description of your current research

Neutrino physics is the study of the elementary particles of neutrinos, which are currently not very well understood in physics. The T2K (Tokai to Kamioka) experiment makes precise measurements of the properties of neutrinos. These neutrinos are produced by a beam of protons which are accelerated to high energies and then collide with a specified target. The T2K measurements depend on the properties of this initial proton beam and how it interacts with the target material. The properties of the beam are studied with both physical measurements and computer simulation. These simulations, performed with Monte Carlo packages FLUKA and GEANT, are important for predicting and checking the observed behavior of the proton beam. This project will improve the neutrino beam simulations for the T2K experiment by incorporating new advancements in simulation technology to improve accuracy, and by incorporating new physics data collected by other experiments to improve precision. These improvements will improve the overall accuracy of the measurements made by the T2K experiment. In addition, the project will involve some development of a new beam line monitor to provide more precise measurments of the inital proton beam. These measurements are an input to the simulation and will reduce the overall uncertainty in the simulation.

7. Research implementation and results under the program

Title of your research plan:

Reducing Uncertainty in the Simulation and Measurement of the T2K Neutrino Beam

Description of the research activities:

I ran the neutrino flux simiulation software to produce the predicted neutrino flux for the most recent T2K data taking period. The resulting prediction was used as an input to the lasted neutrino oscillation analysis, which was publically shown at the beginning of August. I improved the automation of running the flux software and documentation of how to use the software.

I helped test some changes to the beam data analysis code by comparing the new output to the original output. Once all the checks are done, the changes can be made permenant and incorporated into the full analysis.

Finally I helped with the development of a new beam line monitor. The new monitor uses beam induced fluorescence of nitrogen gas to measure the position of the beam. I built a system to log the pressure values from the pressure gauges attached to the chamber to monitor the pressure with time. Using the new data logger I helped perform various tests involving leaking nitrogen gas into the chamber and comparing the pressure readings to a simulation of the vacuum chamber.

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

The homestay was a great experience and the JSPS Summer program was organized very well. I am looking at applying for another JSPS Fellowship in the future.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Kenneth Czuprynski （ID No.: SP16017）

2. Current affiliation:

University of Iowa,
Department of Applied Mathematical and Computational Science

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 Tsukuba

5. Host researcher: Masayuki Umemura

6. Description of your current research

We have been conducting research related to the numerical solution of the radiative transfer equation (RTE). Radiative transfer has a vast number of applications; these range from topics in heat transfer to topics in radiation therapy. However, the equation presents computational difficulties when considering the numerical solution. First, the equation contains a large number of independent variables. In a general steady-state case, it contains a spatial component, a directional component, and a frequency component; as a result, three dimensional radiative transfer calculations involve six variables in phase space. The integro-differential form of the RTE also presents difficulties as it couples the solution over large portions of the domain. As a result, there is a need for robust and efficient numerical methods for the RTE.

Our recent work has been in developing stable algorithms for the solution of the energy dependent RTE. There are three large components to our development of such methods. First, we consider the well-posedness of the original boundary value problem; this provides insight into solution regularity properties and the conditions which allow for existence and uniqueness. Second, we propose a fully discrete scheme for the solution of the RTE. Lastly, we analyze the properties of the method by proving stability and providing error estimates.

7. Research implementation and results under the program

Title of your research plan:

A Method Connecting Radiation Diffusion and Radiation Transfer Along Resonant Lines.

Description of the research activities:

The goal of this project was to investigate ways in which solutions of the RTE could be coupled with solutions of the radiation diffusion equation. The diffusion equation is an accurate approximation in certain regions and is much easier to solve. Working with a post-doc and graduate student, we combined solutions of the diffusion equation with solutions of the RTE. First, it was necessary to identify the diffusion approximation that should be used. In the astrophysical context of resonant line transfer, there are various approximations that result in a diffusion form of the equation. As a result, it was necessary to identify the best numerically stable version of the diffusion approximation. Following this, parallel implementations of a diffusion solver and radiation transfer solver were implemented. Solutions of the diffusion equation and transfer equation were then combined. The solution of the diffusion equation is significantly faster than full radiative transfer computations. Coupling the solutions allowed for a significant reduction is total computation time.

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: Brittanie DABNEY （ID No.: SP16018 ）

2. Current affiliation: Colorado State University

3. Research fields and specialties:

Interdisciplinary and Frontier Sciences

4. Host institution: Toyo University

5. Host researcher: Prof. Shosaku KASHIWADA

6. Description of your current research

The goal of this study was to characterize the fate of sediment-associated metal nanoparticles through the food chain by using applications in applied ecotoxicology, gene expression and bio-imaging were to be used to access the trophic transfer of zinc nanoparticles. An additional field experiment identified the insects tolerant to metals and how much of the insect community in Japan will contribute to the transfer of metals up the food chain.

First we deployed a field colonization experiment and currently I am sorting the insects for further benthic analysis. I performed experiments to study the accumulation of zinc nanoparticles in sediment collected on the Yamada river in Gunma prefecture. Now we are preforming the trophic experiment.

7. Research implementation and results under the program

Title of your research plan:

Trophic Transfer of Sediment-Associated Zinc-Nanoparticles in Aquatic Ecosystems

Description of the research activities:

Preliminary data from the field experiment show that there is an effect of both fine sediment and metal contamination on aquatic insect total abundance. Chironomid larvae primarily dominate the community, in treatments with metal-contaminated fine sediment. During my stay I was able to receive training on identification of aquatic insect species in Japan at Ehime University. This will allow me to complete further analysis of the field data and compare with study sites in the United States.

Initial results from the laboratory experiment shows no significant difference in accumulation in chironomids at low concentrations in the sediment. Further experiments will study if nanoparticles are transferring from insect to fish. Elemental analysis using transmission electron microscopy suggests that zinc nanoparticles are binding to other particles in the water column and may not be even distributed in sediment. This has implications on the exposure of nanoparticles to benthic invertebrates and more work needs to be done on the distribution of nanoparticles in sediments.

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

During my stay I was able to connect with other researchers in Japan and learn about new areas of research. I have also been able to travel and experience Japanese culture.

9. Advisor's remarks (if any)

RESEARCH REPORT

1. Name: Sauvik DAS （ID No.: SP16019）

2. Current affiliation: Carnegie Mellon University

3. Research fields and specialties:
Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Koji YATANI

6. Description of your current research

Robust authentication is an essential component of all secure spaces and systems [1]. However, recent work bridging social psychology with computer security [2-4] suggests that more work is needed to uncover the authentication needs of local groups of individuals who collectively own resources and who largely trust each other (e.g., families, small work groups, student organizations)**.** For these small, local groups, existing forms of authentication (e.g., passwords, keys, fingerprint readers) fall short in a number of dimensions: (1) individual identifiability, (2) social inclusivity, (3) ease of sharing or revoking access with guests and temporary members, and (4) facilitating shared responsibility for security across group members. Moreover, group authentications should strongly consider norms and risk perception in group settings (e.g., is it common for lab members to have guests or very uncommon? Are group members okay with risking lower security for greater convenience?). Thus, **new socially-compatible security solutions are needed that better meet the underserved authentication needs of small, local groups**.

Accordingly, my research this summer has focused on prototyping more socially-compatible forms of authentication for local groups. The form-factor we focused on is the Security Artificial Intelligence Assistant (SAIA). SAIA is an intelligent personal security assistant that uses facial and speaker recognition to recognize group members. To group members, SAIA is a talking head avatar that has its own personality that makes authentication more negotiable by recognizing social and environmental context. For example, if SAIA recognizes a group member and an unknown guest, she can directly provide that guest access for a limited amount of time. She can also recognize when old group members come to visit and inform existing members to grant the old member access. SAIA can also understand environmental context: if it is very late at night, she will be more strict. In effect, SAIA is meant to be simple authentication personified: another member of the group, rather than a unnegotiable machine.

7. Research implementation and results under the program

Title of your research plan:

A Cross-Cultural Exploration and Evaluation of Group-Centric Authentication

Description of the research activities:

We spent the first two or so weeks brainstorming potential group authentication concepts that seemed promising. We particularly were interested in the idea of making security for groups more negotiable. Indeed, one of the largest frustrations of authentication is that authentication is binary – either all access is granted or none is, and it is entirely contingent on challenge/response. Instead, the way groups have "authenticated" each other in the offline world for centuries is by group members interacting with each other (e.g., do they have the same accent, or know the same secret handshake). Accordingly, we focused on creating a smart "virtual" group member which could authenticate other members.

Once we had honed in on this design direction, I spent the remainder of my time in Japan implementing an Android application version of SAIA. At this point, the application has real-time facial detection and recognition of group members as well as a talking avatar that can dynamically respond (grant, deny, or grant temporary) access to different situations (e.g., known people, unknown people or known people with unknown people).

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

My stay in Japan was certainly culturally enlightening. I participated in a number of matsuri events (including watching fireworks at Adachi and near the Sumida river), traveled to a number of different Japanese cities (including Osaka, Nara, Kyoto, Nagoya and Fukui), and improved my language abilities. My lab members also frequently introduced me to a variety of different Japanese foods. On one lab outing, we all went to Tsukiji market and ate Kaisen-don (a variety of sashimi over rice).

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Robert D. DEVINE （ID No.: SP16020）

2. Current affiliation: University of Notre Dame

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Earthquake Research Institute (ERI), The University of Tokyo

5. Host researcher: Prof. Toshimi KABEYASAWA

6. Description of your current research

Recent earthquakes are reminders that there is still research to be done on building design. In many low-rise (height to length ratio less than 2.0) reinforced concrete (RC) structures, common in residential and nuclear-safety related applications, the primary earthquake load resisting systems are shear walls. This work is part of a project at the University of Notre Dame to better understand the behavior of low-rise RC walls with high-strength materials, and ultimately promote advances which will reduce costs and improve buildings' resistance to seismic hazards. Experimental low-rise RC wall specimens will be tested in the Fall of 2016 at the University of Notre Dame. My work during this summer research was the construction of the numerical finite element models (FEM) of forty possible test specimen specifications, varying the 1) unconfined concrete compression strength; 2) rebar yield strength; 3) reinforcement ratio (assumed to be the same in the longitudinal and transverse directions) and; 4) moment-to-shear ratio. This work will aid in the selection of parameters to test in the experimental wall specimens, both partial wall slices tested monotonically as deep beams and scaled capstone wall specimens tested reverse cyclically. Additionally, the research will investigate which parameters result in the greatest strength and initial wall stiffness, both important for the force-based design methodology utilized for shear-critical low-rise walls.

In addition to the numerical modeling aspect of the project, I gained valuable experience from Japanese researchers with experience testing RC members with high-strength materials and innovative seismic retrofit solutions for RC walls. During the research period, I assisted Prof. KABEYASAWA and his students with the experimental testing of four walls utilizing super reinforcement with flexibility (SRF), a durable exterior fabric sheet wrap for RC members, as a retrofit option for low-rise RC walls. In addition, I visited other research institutes, including E-Defense, home to the world's largest earthquake simulator, Osaka University, and Tohoku University to learn from Japanese researchers about their experience in both modeling and experimental testing RC specimens for seismic applications.

7. Research implementation and results under the program

Title of your research plan:

Numerical Modeling of Low-Rise Reinforced Concrete Shear Walls with High-Strength Materials

Description of the research activities:

The numerical modeling was done using the non-linear FEM software ATENA. Prior to modeling the experimental specimens, concrete and steel material models were calibrated and validated using public experimental data of low-rise RC walls with normal- and high-strength materials. A parametric study of 36 wall slice specimens, varying the previously mentioned parameters, were modeled to predict peak lateral strength. Additionally, four capstone walls were modeled, all with high-strength materials. This study's results were used with another validated FEM developed previously at Notre Dame. Both will be used to determine the parameters to be tested experimentally on the future deep beam and capstone wall specimens.

Additionally, I worked with Prof. KABEYASAWA and his students on their current experimental work on walls utilizing SRF for seismic retrofit. Previous work has been done at ERI to show improved performance of columns utilizing the material. This work looked to expand its applications. My responsibilities included physical assistance of the experiments at ERI and continued collaboration in analyzing the tests, including co-authoring a paper in an American journal in the near future.

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

I visited three research facilities, Hyogo Earthquake Engineering Research Center, Osaka U., and Tohoku U., to learn about the current high-priority RC seismic design research. After discussions with professors and students, I learned about modeling and experimental techniques deployed by these facilities on research projects. Current high-priority research includes damage to non-structural building walls, detailing of seismic resisting structures in developing nations, and residual structural capacity after major seismic events.

My cultural experiences involved visits to the Kansai and Hokkaido regions during these research visits and a home-stay in Zushi City, Kanagawa. During my stay in Tokyo, I enjoyed both experiences in the city and mountains, including a climb of Mt. Fuji.

9. Advisor's remarks (if any):

It was fortunate that we could plan RC wall tests on seismic performance verification of retrofit using SRF concurrently with the stay of Mr. Robert DEVINE. The objective of the tests was similar to his research, so that I hope he could get some insights, especially on retrofit performance of sheet reinforcement. He was very active and friendly in the collaboration with our students, including physically hard work in association with the wall tests. He learned recent research topics in the field, as well as Japanese culture, from his visits to other facilities and cities, such as Kobe, Osaka, Kyoto, Sendai, and Sapporo. We will continue collaborative work of analyzing the wall tests in the future by e-mail.

RESEARCH REPORT

1. Name: Jenna E. DOREY （ID No.: SP16021 ）
2. Current affiliation: CUNY Graduate Center / The New York Botanical Garden
3. Research fields and specialties: Biological Sciences
4. Host institution: Okayama University of Science 5. Host researcher: Professor Takuji HOSHINO

6. Description of your current research

This research is a collaborative effort between Jenna E. Dorey (CUNY Graduate Center/New York Botanical Garden) and Professor Takuji Hoshino (Okayama University of Science) to reconstruct the phylogeny and historical biogeography of a clade of about 57 sedges (*Carex*, Cyperaceae) that is disjunct between North America and Asia. In North America, diversity is concentrated in eastern North America, and in Asia species diversity is highest in Japan. We postulate that this clade (sections *Paniceae, Bicolores, Limosae,* and *Laxiflorae*) was once continuous throughout a connected landmass in the Northern Hemisphere. Additionally, we hypothesize the closing of Beringia was the vicariance event that led to the present-day disjunction, and current patterns of diversity within the clade are due to recent species radiations in eastern North America and East Asia, respectively. Finally, we will test whether the Asian and North American species are two separate, monophyletic clades, or conversely, if species found on one continent are more closely related to species found on the other continent.

Our goal during EAPSI was to complete field and laboratory work to sample and sequence all 16 species in the Japanese flora, and integrate these data with those that were already generated for North American taxa. We will then reconstruct a fossil-calibrated, dated molecular phylogeny and model the geographic evolution of the clade through ancestral area reconstruction. This project is the first to use modern biographic methods to study the East Asia-North America distribution in *Carex*, the most diverse plant genus in the temperate zone. We expect that *Carex* are a model group for answering broader questions about geographic patterns of biodiversity and evolutionary processes due to 1) high species diversity in the genus, 2) speciation due to niche differentiation along microhabitat gradients, and 3) their restricted ability for physical dispersal. These three traits will help to identify the role that Beringia played in shaping patterns of diversity in the present-day flora, and provide insights on long-term range shifts in dispersal-limited flora due to changes in climate.

7. Research implementation and results under the program

Title of your research plan:

Reconstructing the evolutionary history of an Asian-North American disjunction in sedges (*Carex*, Cyperaceae)

Description of the research activities:

During EAPSI we conducted three different multi-day collecting trips: one to northern Okayama Prefecture, one to Hokkaido, and one to Toyama Prefecture. These trips were accompanied by other members of Dr. Hoshino's laboratory, as well as researchers from other laboratories in Japan and Korea. We were able to sample nine species from our target clade, including species that are endemic to the Toyama and Hokkaido regions of Japan. In total we added 69 new specimens to the herbarium at the Okayama University of Science, and sent some duplicate collections to the New York Botanical Garden, and the Toyama Science Museum. All Japanese species that we were unable to sample during field work were acquired from herbarium material and existing DNA samples in Dr. Hoshino's lab, such that were were able to sample all 16 of the Japanese members of the clade. J.E. Dorey extracted DNA using a Qiagen DNeasy plant mini kit, then amplified 6 different gene regions (ETS, ITS, *trnL-trnF, atpB-rbcL*, *rps16,* and *rpL16*) by polymerase chain reaction (PCR) and checked the results by gel electrophoresis. J.E. Dorey then purified the PCR products using a Qiagen Qiaquick PCR purification kit and performed Cycle Sequencing. Next, the sequenced the products by capillary electrophoresis using an Applied Biosystems 3130 Genetic Analyzer. During the summer we generated over 100 new DNA sequences, which we are currently in the process of editing and aligning before reconstructing reconstructing our final phylogeny. Between work in Japan and North America, we have now generated DNA sequences from 6 different gene regions of 94 different samples from 63 unique taxa.

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: Jacob EDWARDS （ID No.: SP16022 ）

2. Current affiliation: Colorado State University

3. Research fields and specialties:
Biological Sciences

4. Host institution: Okinawa Institute of Science and Technology

5. Host researcher: Yoko YAZAKI-SUGIYAMA

6. Description of your current research

Much like humans learn their native tongue as infants, many songbird species learn their individual song during a “critical period” in early development. The critical period for zebra finches occurs in two phases: a sensory – listening – phase, when the young finch listens to and forms a memory of his father’s song, and a sensorimotor – practice – phase, when he gradually refines his own song by comparing his vocalizations to the encoded memory template. After about 60 days of practicing, his song “crystallizes” and will not change for the rest of his life. During the critical period, the juvenile bird must balance an important ecological tradeoff: developing a song that is characteristically “zebra-finch-like”, *i.e.* recognizable by members of his own species, as well as unique enough to mark him as an individual within his social context. Therefore, we asked: how does the songbird brain process incoming auditory information during the song-learning critical period? Previously, the Yazaki-Sugiyama lab identified two neuronal subtypes in the zebra finch primary auditory cortex – the Field L complex. Their work labeled these subtypes high-firing rate (HF) and low-firing rate (LF) neurons for their behavior in response to auditory playback. LF neurons appear to respond specifically to syllabic information, whereas HF neurons respond to the temporal patterning of auditory signal, whether birdsong or white noise. We hypothesized that to solve the song-learning tradeoff, juvenile zebra finches process two streams of information in parallel: temporal patterning that is zebra-finch specific, and song morphology that is individual-specific. To test this hypothesis, we attempted to trace the connections of LF and HF neurons to map out the brain regions that their respective information is being sent to. By performing intra-cellular recordings and injecting neuronal tracer dyes, our initial results suggest that

the Field L complex is bifurcating the auditory information stream and distributing it among a highly recurrent, parallelized network involved in multiple aspects of song recognition and production.

7. Research implementation and results under the program

Title of your research plan:

Divergent auditory processing pathways optimize an ecological tradeoff during a critical period of learning in zebra finches.

Description of the research activities:

Human infants can learn a variety of languages, in spite of being raised in vastly different cultural and auditory environments. Similarly, individual songbirds learn their unique songs from adults during a defined time in early youth. However, because songbirds sing to attract mates and recognize individuals within the colony, they face an important trade-off while learning: develop a song that is recognizable by members of the species, but is also unique enough to convey attractiveness and individuality. To understand how acoustic information is processed in songbirds, we performed intracellular recordings alongside neuronal tracing procedures to image the connectivity between cellular subtypes that encode specific aspects of song information in zebra finches. Based on the results of our work, we suggest that the developing zebra finch brain processes relevant acoustic stimuli in parallel: temporal and morphological information processing occur in separate pathways in a recurrent network, but converge on a common output to generate adaptive learned behavior.

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

The JSPS Summer Program was an incredible way to spend the summer experiencing the culture of Japan and training in a different laboratory setting. Okinawa is a beautiful island with a rich history. Besides participating in research, I enjoyed the opportunities to explore ancient castles, climb waterfalls, and view the stunning diversity of aquatic life in the many reefs surrounding the island.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Kara J. EMERY （ID No.: SP16023）

2. Current affiliation: University of Nevada, Reno

3. Research fields and specialties:

Social Sciences and Biological Sciences

4. Host institution: Chuo University

5. Host researcher: Prof. Masami YAMAGUCHI

6. Description of your current research

The neural correlates of color appearance are poorly understood, and how observers vary widely in their experience of color remains elusive as a result. My current research uses individual differences in measures of color appearance to understand the underlying dimensions. Furthermore, there exists an overarching ambiguity in the perception of blues and yellow in adult observers, as illustrated in #thedress phenomenon. Behavioral measures show that, compared to other colors, observers contrast thresholds are higher for blue and yellow, and observers need a larger difference in contrast between two blues or two yellows to tell them apart. A recent study has investigated the neural correlates for this behavioral using fMRI, and discovered an asymmetry of decreased brain activity to the blue-yellow axis compared to the red-green axis (Goddard et al, 2010). Because these colors nominally stimulate the cone photoreceptors equally, the asymmetry is more likely to due to the influence of higher-order mechanisms on color appearance. A possible explanation for this asymmetry is based on the color statistics of the natural environment such that blues and yellows are often natural illuminants, and are also the prominent colors in natural scenes. I have collaborated with Prof. Masami YAMAGUCHI's infant perception laboratory at Chuo University to investigate whether blues and yellows also appear less colorful or ambiguous to infant observers. The results of this project will help reveal how both visual sensitivity and color appearance are shaped by experience and the timescales of these effects.

7. Research implementation and results under the program

Title of your research plan:

Differences in blue-yellow color perception in infants and adults

Description of the research activities:

The research activities consisted of two separate studies, a neuroimaging method and a behavioral paradigm. We measured adult and infant brain activity using a functional near infrared spectroscopy (fNIRS) system (ETG-4000; Hitachi Medical). Because infants quickly become fussy, we tested only two color axes, blue-yellow and red-green, and used

the same stimuli with adults. The fNIRS probes for adults and infants are centered on the occipital lobe. We averaged the oxygenated hemoglobin (oxy-Hb) concentration at each channel across all trials, and compared the activity during each condition to the baseline using a z-score. Preliminary analyses reveal that for the infants (age =168-239 days, n=5), two show greater oxy-Hb concentration to the red-green stimulus, two to the blue-yellow stimulus and one shows an increase to red-green in the left hemisphere and blue-yellow in the right hemisphere. For the adults (age = 21-34, n=6), two show higher oxy-Hb to the blue-yellow direction, and four show higher oxy-Hb to the red-green direction. All reported differences between conditions are statistically significant ($P < 0.0001$). We will continue collecting data with adults and infants, as well as children ages 3-5 years to assess a developmental trajectory. The behavioral paradigm investigates #thedress image in infants to investigate. When adult observers are asked to name the original dress image, about 40% label it as white-gold and 60% as blue-black. However, when the original image is inverted, almost all observers agree that the dress is yellow. We tested whether this trend persists in infants using a preferential looking paradigm with the assumption that the infant will prefer the more colorful stimulus. We presented the infants with both the original dress image and an inverted dress image and measured their preferences. For 27 infants, 16(59.3%) preferred the inverted image (original dress as white-gold), and 11(40.7%) preferred the original image (original dress as blue-black). We will collect data with more infants, as well as with the same infants overtime to test whether their preferences persist.

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 visit many Japanese restaurants, a Kabuki performance, and many cities and universities. I learned two new methods (fNIRs and preferential looking), how to independently analyze this data, and also formed on-going collaborations with leading vision scientists in Japan. I owe all of these experiences to Prof. Masami YAMAGUCHI and her lab for exceeding expectations in the extra effort they put forth in making my stay in Japan better than I could have ever imagined. We have even been able to create the opportunity for my return to Japan in the coming year.

9. Advisor’s remarks (if any):

Kara J. EMERY was working very hard to conduct her infants’ experiment in my lab. Her theme is very new and challenging, and she had a chance to get special advices from prominent professor in this region. She enjoyed her stay and she made many Japanese friends. I really appreciate her stay in my lab. We hope to continue her research in Japan.

Research Report

1. Name: Ryan Falkenstein-Smith （ID No.: SP16024）

2. Current affiliation: Syracuse University

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Institute of Fluid Science, Tohoku University

5. Host researcher: Prof. Takashi Tokumasu

6. Description of your current research

Over the past few decades there has been an increasing demand for fossil fuel power generation facilities to reduce harmful pollutants exhausted into the atmosphere, while simultaneously satisfying the steadily climbing energy demand. This has caused several facilities to adapt various carbon capture technologies, which, although successful in capturing carbon dioxide (CO_2), significantly sacrifices plant efficiency. One solution is an oxygen transport membrane reactor (OTM), which delivers pure oxygen to methane for a complete combustion reaction, thus successfully separating CO_2 in the product stream from nitrogen in the surrounding atmosphere.

Despite its novelty, OTMs have some restrictions that could potentially limit its application. OTMs are comprised of perovskite materials with the chemical structure ($ABO_{3-\delta}$) giving the material mixed ionic and electronic conductive properties (MIEC). However, in the presence of enriched CO_2 environments, A sites, mainly comprised of alkaline earth metals, tend to form carbonates, ultimately jeopardizing the stability of OTMs. In order to improve chemical stability, some researches examine dual-phase membranes which includes the addition of highly oxygen ionic conductive materials (IC) exhibiting substantial CO_2 tolerance. While the inclusion of IC materials can improve the stability long term, it does sacrifice the oxygen permeation performance, due to the limitation set on oxygen bulk diffusion.

More specifically, the addition of IC materials restricts the electronic pathways in the membrane, diminishing oxygen permeation performance while theoretically maintaining stability in harsh environments. Additionally, it is very difficult to examine oxygen diffusivity and ionic conductivity accurately since most methods investigate electronic conductivity is order of magnitudes larger in comparison. Therefore, an alternative method for capturing dual-phase oxygen permeation performance is to design a molecular simulation model that investigates oxygen diffusion.

7. Research implementation and results under the program

Title of your research plan:

Molecular dynamics simulation of dual-phase oxygen transport membrane

Description of the research activities:

Modeling dual phase structures consists of creating a simulation that examines oxygen diffusion through a membrane with multiple compositions. However, in order to accurately represent a dual phase structure multiple components must be modelled individually. These components include the bulk diffusion through a single material, the diffusion across a grain boundary of a single material, and the diffusion across the interface between both materials were the major focus. Although each of these components include similar applied conditions, they can vary in regards to how they are constructed. Single material models were constructed accordingly with the respect to their atomic structure, while grain boundaries models were varied based on supporting experimental data. Although a simple model was constructed to represent the dual phase interface, there must be more research regarding the interface atomic structure before a solid conclusion can be drawn.

All simulations were run using the LAMMPS program, a molecular dynamic simulator that examined the oxygen diffusion under varying temperatures similar to those found in experimental methods. After completing the appropriate simulations an obtaining diffusion coefficients under applied conditions, a general model was constructed to combine all components previously described. This was done by averaging the oxygen diffusion based on the randomized structure of the constructed model.

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

Over these past few months I have had the pleasure of working with several international researchers who have provided a fresh perspective to my research. Although the drive behind our work is similar, how we approach a problem differently is beneficial to how research is conducted. Many of my colleagues approached a problem pragmatically while it was stated that I tackled issues more subjectively. Together, through a combination of both our ideas, research methods were strengthen producing an outcome better than either of us could have ever expected.

RESEARCH REPORT

1. Name: Marlena R. FRAUNE （ID No.: SP16025 ）

2. Current affiliation: Indiana University

3. Research fields and specialties:

Social Sciences

4. Host institution: Toyohashi University of Technology

5. Host researcher: Prof. Michio OKADA

6. Description of your current research

Robots are becoming more prevalent, washing dishes, vacuuming floors, and educating children in various countries. As such, it is critical to understand responses to groups of robots and if people respond negatively to “entitative” or cohesive robot groups like they do toward entitative human groups (e.g., rival sports teams). Further, because people in different cultures respond differently to groups, it is important to examine these effects across cultures. Japan is the ideal location to perform the study to contrast results to the USA because Japanese people typically are more relationship-oriented (rather than independence-oriented) and have more exposure to robots than US Americans.

To understand how components of robot group entitativity affects responses toward them, this study manipulated *Robot Type* (Single, Diverse Group, Entitative Group) in two *Distinct Cultures* (USA, Japan). That is, the research in Japan was a follow-up to a previous study in the United States. In the entitativity manipulation, robot appearance and behavior was either diverse or identical (i.e., entitative). Eighty-five participants in Japan performed a task on their cognitive skills while the robots examined their performance. Then, the participants took surveys, which measured for perceived entitativity of the robots, perceived threat of the robots, and willingness to interact with robots in the future. Findings will enhance understanding of entitativity in social psychology and cross-cultural literatures and enhance robots for future intergroup interaction with humans.

7. Research implementation and results under the program

Title of your research plan:

Investigating human perceptions of groups of robots to enhance human-robot collaboration and robot design

Description of the research activities:

Upon my arrival at Toyohashi University of Technology (TUT), I began attending lab meetings in Okada-sensei's ICD Lab. I worked closely with Okada-sensei's students, Yusaku Nishiwaki-san and Yamamura Yuji-san.

Because the experiment involved human participants, I worked with the ethics boards at Indiana University (IU) and TUT. Yusaku-san facilitated my communication with the ethics board at TUT, allowing me to conduct the study in a manner that the ethics committees in both countries approved of.

At TUT, I constructed the robots as they had been in the United States, programmed them to perform the behaviors as they had in the United States, and completed the setup of the study. Yamamura-san helped me recruit and run participants and helped translate any questions the Japanese participants had.

I have just finished running participants and them beginning to analyze data. Then, I will write a paper on the results with Okada-sensei and his lab, and submitted for publication at the prestigious Human Robot Interaction conference.

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

Most memorable of the cultural exchange I experienced during the stay was a party Okada-sensei hosted at his own house. Everyone in attendance made food from where they grew up, resulting in an international buffet of Japanese, Turkish, and American food. Most delicious was the Osaka-style takoyaki that Okada-sensei taught us to make. As we dined, conversation alternated between Japanese and English so everyone could enjoy and join in the revelry.

9. Advisor's remarks (if any):

Marlena kept in touch me, her advisor at IU, weekly to discuss her research. Her reports from TUT suggest that she had ample support for her work there so that, despite some initial delays due to the IRB, she accomplished her goal of finalizing the planned study. I am delighted that her stay has been productive in terms of her research and providing a rich cultural experience. It has also further strengthened the ties between our lab and that of Prof. Okada at TUT. We look forward to continuing this collaboration in the future through student exchange and collaborative research.

RESEARCH REPORT

1. Name: Shannon GRIPPANDO （ID No.: SP16026 ）

2. Current affiliation: University of Arizona

3. Research fields and specialties:

Social Sciences

4. Host institution: Kobe City University of Foreign Studies

5. Host researcher: Dr. Montserrat SANZ

6. Description of your current research

Broadly, my research investigates how literacy affects spoken language and the organization of language in the brain. Previous research has shown that there is a correlation in English between the number of letters in a written representation of a sound and the duration of that sound (Brewer, 2008). For example, given the final /k/ sound in the words *tic*, *click*, and *clique*, the duration of the final /k/ is longer in *click* versus *tic* and longer still in *clique*. This effect has not been studied in languages with writing systems other than alphabets. Therefore, the goal of my research during the JSPS Summer Institute was to determine whether similar durational effects correlated with written language representations exist in a language with a character-based writing system like Japanese's kanji. I argue that the previously found effects in English are not necessarily restricted to alphabetic writing systems and phonologically-salient letters. Rather, this effect could be the result of general written language complexity relative to a language's writing system influencing speech patterns. Thus, under this view, durational effects of this sort would not result from a one-to-one mapping of letters to sounds but from the increased cognitive resources required to access or produce words associated with more complex written forms. To test this effect in Japanese, I measured the duration of participants' spoken production of target sets of homophones (words with identical pronunciations) that varied in their level written complexity on one of two measures: 1) the number of pen strokes used to traditionally write the character; 2) the number of characters used to form a single word. For example: 目/me/ (5 strokes) versus 芽 /me/ (8 strokes); or 糊 /no̞li/ (1 kanji) versus 海苔 /no̞li/ (2 kanji). In line with the English results, I hypothesized that the words with the more complex written forms would be produced with a longer speech duration. Frequency, pitch accent, number of morae in a word, participants' familiarity with the words, and place and manner of articulation were other factors controlled for in materials creation and data analysis.

7. Research implementation and results under the program

Title of your research plan: THE EFFECTS OF WRITTEN LANGUAGE COMPLEXITY ON SPEECH DURATION IN JAPANESE

Description of the research activities:

I successfully conducted three experiments during my time with the JSPS Summer Institute, running more than 80 participants. In line with the research outlined above, in the first two experiments, I collected speech data from participants orally producing target words using several display methodologies (in an attempt to determine and alleviate any reading effects that might be present in my study). I also began to collect data in a third experiment to determine if the durational effects found in the original English study (Brewer, 2008) are limited to speech patterns in speakers' first language or are also present in the speakers' second languages. The Japanese data will be compared to data from bilinguals from other language backgrounds (such as Spanish-English speakers) to determine: 1) if this effect is present in second-language English speakers; and 2) if the nature of an individual's first-language writing system influences the manifestation of this effect in their second-language English. Finally, if there are durational differences in Japanese's speakers' speech correlated with written complexity, the next step in this research is to compare the speech patterns of Japanese adults to preliterate Japanese children to determine whether the process of becoming literate is a primary driving force behind this effect (rather than other behavioral causes). To prepare for this next phase of my research, I met with a school district's Board of Education to discuss the logistics of running experiments at the local kindergarten and elementary schools in the coming year.

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

Working and living in Japan is always a delight. My host researcher, my colleagues, my host families, and my new friends have made this a remarkable experience, both personally and professionally. I am truly grateful to have participated in the JSPS Summer Institute and look forward to returning to Japan again to continue researching and collaborating with scholars in Japan.

RESEARCH REPORT

1. Name: Jonathan R GROSS （ID No.: SP16027）

2. Current affiliation: University of Southern California

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Muroran Institute of Technology

5. Host researcher: Prof. Tsutomu SAITO

6. Description of your current research

Prior to the JSPS Summer Program, an exploding wire experiment was constructed by the PI is his home lab. By rapidly heating and vaporizing a narrow wire, a cylindrical shock wave is produced. The visualization technique known as Background Oriented Schlieren may be used to determine the density field in a 2D compressible flow field. This motivated work to develop image processing scripts for BOS, as well as a recently developed variation known as Simplified Background Oriented Schlieren.

7. Research implementation and results under the program

Title of your research plan: Development of a Background Oriented Schlieren System for Accelerated Quantitative Measurement of High Speed Flows

Description of the research activities:

Image processing scripts were developed in Python to perform the visualization technique known as Background Oriented Schlieren (BOS), and a variation known as Simplified Background Oriented Schlieren (S-BOS). Experiments were also performed featuring compressible flows. Images and videos of the flows were captured and used to test the image processing scripts. These flows included a viscous boundary layer between two high speed flows in a supersonic wind tunnel, and the thermal plume from a candle. Various background images were used for both BOS and S-BOS.

After confirming that the image processing scripts were able to produce schlieren like images of the respective flows, additional work focused on ways to improve upon the S-BOS method. Experiments were performed using color background patterns to confirm that by using the different color channels in the captured image as separate monochrome images, the camera could be used to simultaneously capture images featuring horizontal and vertical background patterns. These were used to

find the displacement of the background image in the horizontal and vertical directions at the same time.

Currently one drawback of the S-BOS method is that the method produces periodic artifacts in the processed image. While the application of a Gaussian filter can be used to remove the artifacts, the brightness of the image is not linearly proportion to the displacement of the pixels. Other methods were investigated to remove the artifacts and produce an image featuring brightness values proportional to pixel displacement. This is necessary to be able to produce a quantitative density field from the processed image. While modifications to the S-BOS method have not successfully corrected for this problem yet, their development is ongoing and remains promising.

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

During my time in Japan I took the opportunity to explore the area around me and experience as much of Japan as I could. Much of this consisted of eating as many different kinds of food as possible, which were all delicious. Outside of the food, I became friends with my lab mates and with some of the other students in the dorm I was staying in. We sang karaoke, visited onsen, and danced in a parade during the Muroran Summer Festival. Aside from activities in Muroran, I also visited Hakodate, Sapporo, and Noboribetsu. At these places I had the opportunity to attend other festivals, buy a yukata, see fireworks, and visit numerous shrines.

RESEARCH REPORT

1. Name: Jonathan Maxwell Grossman （ID No.: SP16028）

2. Current affiliation: Rice University Department of Computer Science

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Waseda University

5. Host researcher: Professor Hironori KASAHARA

6. Description of your current research

The development of analytic techniques for predicting the time that a kernel of a computational application will consume on a given architecture is an untenable research goal. Such techniques would be required to account for randomness from complex memory hierarchies, manufacturing imperfections, power management policies, thread scheduling, and data-dependent computation. Such techniques are fragile to any future changes in architecture.

However, using past kernel behavior to infer future kernel performance has shown promise in recent related literature. By training performance models on a diverse set of kernels, we can use those performance models to predict the performance of future, unknown kernels by identifying similarities in the kernels themselves.

The common questions that then arise in this area of research are: 1) What inputs are used for the performance model (dataset features, kernel features)?, 2) How do we know when we have a sufficiently well-trained performance model (i.e. how do we avoid overfitting)?, and 3) How do we measure similarity between past kernels and future kernels?

In this work, we explore an alternative and entirely novel approach to this problem. First, we build an automated pipeline for extracting performance metrics from arbitrary directive-based parallel programs. We use this pipeline and low-overhead instrumentation to measure basic block-level performance, collecting millions of samples of the straight-line performance of code blocks in varying execution configurations (e.g. CPU w/ 2 threads, CPU w/ 4 threads, GPU, etc). When predicting performance, we similarly decompose the target kernel into straightline code regions and use genome alignment techniques (in particular, Needlman Wunsch global alignment) to find matches between

new code blocks and known code blocks such that we can predict the execution rate of each individual block of the kernel. We then use runtime knowledge of condition variables to predict the control flow of the kernel, allowing accurate weighting of different code blocks in the final performance prediction for each supported execution configuration.

7. Research implementation and results under the program

Title of your research plan: A Hybrid Offline-Online, Genetically-Inspired Approach to Automatic Platform Selection in Heterogeneous High-Performance Computing

Description of the research activities:

To date, the following work has been completed:

1. An automated tool for creating checkpoints of the heap and stack state of C+OpenMP programs immediately prior to parallel loops.
2. An automated tool for auto-generating “checkpoint-resume micro-apps” which can load the generated checkpoints and replay the same parallel region on the state of a checkpoint. These micro-apps currently support both replay on a host OpenMP runtime and on CUDA devices. These micro-apps aid in streamlining the sampling process. There is a one-to-one mapping of checkpoints to checkpoint-resume micro-apps.
3. An automated tool for generating variations of each checkpoint-resume micro-app which include instrumentation of different basic blocks in the kernel, for both the CUDA and OMP versions.
4. Infrastructure for using the above three tools to automatically sample a set of input programs, generating a basic block database containing the instructions of a basic block and its performance on each execution configuration.

In addition, the following work is in-progress:

1. A tool for extracting the block structure of an arbitrary OMP/CUDA kernel.
2. A tool for matching the block structure of an OMP/CUDA kernel to a database of blocks.

Work that has not begun, but will be completed in continuing collaboration between Waseda University and Rice University includes:

1. A runtime API for querying a final performance prediction for a kernel given the state of runtime conditionals.

RESEARCH REPORT

1. Name: Mary Gertrude L. Gutierrez （ID No.: SP16029 ）

2. Current affiliation: University of Southern California, 925 Bloom Walk Avenue, HED 216, Los Angeles, California 90089, USA

3. Research fields and specialties:

Engineering Sciences

4. Host institution: University of Tokyo, 4-6-1 Komaba, Meguro-ku, Tokyo 153-8505, JP

5. Host researcher: Professor Shoji TAKEUCHI

6. Description of your current research

The proposed research for this grant was to encapsulate biomimetic cytoskeletal structures within artificial cells known as giant unilamellar vesicles (GUV). GUVs exhibit a phospholipid bilayer like that of cell membranes and are a commonly used artificial cell platform for probing membrane biophysics. Currently, polymeric direct laser writing (DLW) structures were successfully fabricated using the Nanoscribe instrument in the lab of Professor Takeuchi. Various 2-D and 3-D geometries ranging from torus, icosahedron, cube, and helices on curves, were fabricated in the 6-20 μm size range. The structures were observed using common light microscopy and SEM.

The encapsulation of the micron sized structures within phospholipid bilayers vesicles in the form of GUVs was also successfully observed and imaged. Using a hydrogel assisted approach for phospholipid bilayer formation, Nanoscribe structures were encapsulated within GUVs. While vesicles encapsulated varying sizes of polymeric cytoskeletal-like structures, structures at the preferred average size of the GUVs (~12 μm radius) were most favorable. GUVs could also be triggered to grow from Nanoscribe DLW structures with specific geometries and sizes allowing for various 3-D arrangements.

A remarkable feature of torus shaped NanoScribe structures was that their placement, arrangement, and size could direct GUV growth and formation in specific arrays of monodispersed vesicles. Typically using a hydrogel-assisted approach of GUV formation, as implemented here, GUV location and arrangement cannot be controlled. This, therefore, introduces the possibility of spatial control of GUV arrays and 3-D structures of GUVs,

which could elucidate biophysical structural properties, cell-cell adhesion and communication, and extracellular matrix properties using an artificial cellular tissue system of GUVs and DLW structures.

Title of your research plan:

EAPSI: Engineering a cytoskeleton to probe the biophysics of cell membranes

Description of the research activities:

DLW structures were designed in CAD of various size and geometric constraints. These structures were then printed using DLW on a Nanoscribe resulting in micron-scaled 3-D printed polymeric structures on a hydrogel coated glass coverslip. 2-D structures were also formed using the Nanoscribe as well as common 2-D lithography techniques. The polymer used was a biocompatible photoresist capable of exhibiting features as small as 200 nm. Upon developing structures, a hydrogel-assisted method of GUV formation was implemented to form GUVs on or around structures. Placement of GUV, size and encapsulation of DLW structures were dependent on DLW structure geometry and size. Structures and bilayers were observed using fluorescence microscopy.

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

Having spent two years studying Japanese prior to my arrival for the JSPS program, the cultural immersion in day-to-day life as a research in Japan has been phenomenal. In addition to learning a more reflective approach to research, I have enjoyed the beautiful outdoors, festivals, foods, and traditions that make Japan completely unique.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Jennifer Iglesias （ID No.: SP16030）

2. Current affiliation: Carnegie Mellon University, Mathematics Department

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: National Institute of Informatics

5. Host researcher: Dr. Takuro Fukunaga

6. Description of your current research

There are many naturally occurring optimization problems in today's society which fall into a class of problems called NP-hard. These problems include: what is the fastest route for a truck to make all desired deliveries, what is the best way to assign tasks to many workers with different talents so that all the tasks are finished as quickly as possible, and what is the least number of boxes needed to pack a certain set of items. These problems often need to be solved quickly. However, NP-hard problems are widely believed to have no algorithms which solve these problems both quickly and exactly. Hence, many researchers in mathematics and computer science work to find approximation algorithms; algorithms which run quickly (in polynomial time) and find a solution which is pretty close to optimal.

My research focus is on designing approximation algorithms for network design problems. Network design problems are where the goal of the problem is to build a cheap network so that some requirements are fulfilled. One problem of particular interest to me is the design of overlapping networks (DON) problem, which can also be called a publisher-subscriber problem. In this problem, there are some publishers and subscribers, and every subscriber has some set of publishers they are interested in. In order to satisfy all the demands, a network for every publisher and every subscriber is built so that every subscriber's network has some node in common with every publisher it is interested in. The goal is to build a network to satisfy all the subscribers and which minimizes the total cost of all the networks.

7. Research implementation and results under the program

Title of your research plan: Designing Overlapping Networks with Node Weights

Description of the research activities:

This summer we investigated the DON problem with node weights. I had previously studied the problem where the cost of the network was based on edge weights. However, in applications on wireless networks, it is more practical to consider node weights rather than edge weights. Thus it is an important research subject to design an efficient approximation algorithm for the DON problem with node weights.

To tackle the DON problem with node weights, we took an approach of using the concept of universal approximation. In universal approximation, we are given a set of instances of a problem, and the goal is to create a solution which induces a near-optimal solution for all given instances. We believe that efficient universal approximation algorithms for node-weighted network design problems are useful for solving the DON problem with node weights. Motivated by this observation, we investigated universal approximation algorithms to several typical node-weighted network design problems while they were considered only for edge-weighted problems previously. In particular, we considered node-weighted Steiner tree, group Steiner tree, and facility location problems. We also developed better lower bounds on universal approximability for edge-weighted Steiner tree problem, and developed the first lower bound for facility location problem with metric connection costs.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I really enjoyed my time in Japan. The culture and language here are so different from any other I've experienced. I found myself constantly amazed at the language, history, and innovation of this country.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Malia Jenks （ID No.: SP16031 ）

2. Current affiliation: University of Oklahoma

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: University of Kyoto

5. Host researcher: Keiichi Maeda

6. Description of your current research

Type Ia supernova (SN Ia) have been used and will continue to be used in studying the expansion of the universe because of their usefulness as standardizable candles. As important as these supernova are in the study of dark energy there are still several things we don't know about them. We still do not know the makeup of the progenitors system(s). A type Ia supernova is caused by thermonuclear runaway in a white dwarf star. This occurs when the mass of the white dwarf reaches the Chandrasekhar limit. This means that the white dwarf must be in a binary system so it can gain mass. There are two primary paths that are believed could result in one of these supernova. The first of these is known as the single degenerate scenario. In this scenario the white dwarf gains mass through an accretion disk from the Roche lobe overflow from a non-degenerate companion: a red giant or a main sequence star. The other possible path to a Type Ia supernova is known as the double degenerate scenario. This scenario involves a system with two white dwarfs. I am studying a models of double mergers that do not explode during the dynamical merger. I am modeling the viscous evolution of post mergers stars at the Chandrasekhar mass. This research is focused on the differences of the evolution of similar and dissimilar mass progenitors. Previous research has shown that mergers of dissimilar mass white dwarfs will eventually collapse to a neutron star and not produce a supernova. This work will study if the differences in the merger of similar mass white dwarfs can lead to supernova.

7. Research implementation and results under the program

To study the evolution of merging white dwarfs of varying masses we decided to look at three cases of Chandrasekhar mass mergers: one merger of dissimilar masses of .9 and .5 solar mass white dwarfs, one merger of two white dwarfs of .7 solar masses each, and one in between with .8 and .6 solar mass white dwarfs. We started from a smooth particle hydrodynamic (SPH) simulation of the merger, then will use the FLASH code to model the post merger evolution of the system. First results from the SPH simulation had to be converted to a mesh grid to serve as the initial conditions for the FLASH code. To study the viscous evolution an alpha viscosity prescription needed to be added to the

FLASH code. The final results will come when the simulations have finished running.

Title of your research plan:

Detailed Simulations of a Poorly Explored Progenitor System for Type Ia Supernovae

Description of the research activities:

Convert results of SPH simulations to appropriate initial inputs to FLASH simulation.

Learn to use FLASH code

Add alpha viscosity prescription to FLASH

Run FLASH simulations

Meet with other researcher in Japan and present my previous research.

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

I attended the Gion Festival with member of my host research group.

I went to Kobe for the fireworks festival.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Jamie M. KASS （ID No.: SP16032）

2. Current affiliation: City University of New York

3. Research fields and specialties:
Biological Sciences

4. Host institution: Yokohama National University

5. Host researcher: Prof. Fumito KOIKE

6. Description of your current research

The North American raccoon (*Procyon lotor*) is invasive throughout much of Japan and is a major threat to agriculture, cultural sites, and native species. I am conducting a study on the dynamics of invasive raccoon range expansion in Japan and its possible effects on other resident mid-sized carnivores. The research has two main components: 1) determining the landscape-level drivers of raccoon expansion by developing a multi-season occupancy model with raccoon trapping data from Kanagawa prefecture, 2) investigating the nature and degree of climatic niche overlap country-wide between raccoons and the masked palm civet (*Paguma larvata*: invasive) and raccoon dog (*Nyctereutes procyonoides*: native). The aims of this research are to provide Japanese environmental managers with knowledge that can help them better control raccoon expansion on a local scale, to elucidate broader scale niche characteristics of species of management concern, and to further advance methods in biogeography to better understand how species interactions affect distributions.

7. Research implementation and results under the program

Title of your research plan:

Investigating the drivers of invasive raccoon spread in Japan and its effects on resident mid-sized carnivores

Description of the research activities:

My time this summer was mostly allocated between three activities: tabular data collection from Japanese researchers, field studies and outings, and code development for running statistical models and producing summary figures and maps.

I traveled to three locations for data collection and site inspection. I first visited Dr. Mieko Kawamichi at the Kansai Wildlife Research Association and examined raccoon damage to temples and shrines. I then had a meeting with managers at the Osaka Prefectural Government Animal Protection and Husbandry office to discuss the current status of raccoon management and the nature of the data they collect. I also visited Dr. Takafumi Tatewaki at the University of Human Environments in Aichi to scout some areas around where raccoons first began breeding in the wild in central Japan, and we discussed the methods he uses to estimate mammal abundance based on roadkill data. Lastly, with Dr. Koike, I visited the Kanagawa Prefectural Office and talked with an environmental manager about their trapping data. I was given permission to use both this 6-year dataset for Kanagawa and an 11-year dataset from Osaka for my research, and am currently developing models for this data.

In an effort to examine local scale interactions and abundance, I conducted two camera trapping studies: one in Yokohama Nature Observation Forest, and the other on the campus of Yokohama National University.

Finally, I wrote code to process and clean the Kanagawa dataset for modeling, run multi-season occupancy models, and generate figures and maps of summary statistics and the model predictions. I also collated Japanese land use data from the Ministry of Land, Infrastructure, Transport, and Tourism Internet spatial database for use in my models.

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

I have learned that acquiring permission for field work in Japan involves a lengthy application process and in-person interviews, and that all data collection from agencies necessitates an in-person interview and numerous follow-up emails that go up and down the chain of command. However, once all the paperwork was completed, the experience of performing the field work and interacting with the park rangers was very enjoyable. I have spent the entire summer conducting all activities in Japanese, and have thus improved my polite language in emails considerably. More difficult than writing is speaking with appropriate respect and demeanor during in-person interviews, but everyone I met with was extremely forgiving and respectful regardless of my speaking ability. I have had a wonderful experience here at Yokohama National University, thanks in no small part to the hospitality of Prof. Koike and the friendliness of my lab mates.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Reid Kawamoto （ID No.: SP16033）

2. Current affiliation: California Institute of Technology

3. Research fields and specialties:

Engineering Sciences

4. Host institution: University of Tsukuba

5. Host researcher: Professor Takashi MATSUSHIMA

6. Description of your current research

My research is on investigating the mechanics of granular materials, in particular, natural sands such as the ones used and built upon in engineering practice. I take a bottom-up approach that focuses on the grain scale and the complex particle-to-particle interactions such as contact, friction, and rolling that ultimately influence an entire assembly's ability to resist and be deformed by loading. Up until going to Japan, I developed computational methods to characterize and simulate granular materials from the grain scale, allowing one to simulate a granular assembly based on a picture of it (from X-ray computed tomography). Now, armed with these computational tools, I can use them to gain insight into granular phenomena such as strength, failure, liquefaction, shear banding, and more. Furthermore, my research may also help bridge the gap between the grain scale and the continuum scale, which treats the material like a bulk and does not consider particle-to-particle interactions. In Japan, I made one such effort, investigating how continuum properties are affected by grain shape.

7. Research implementation and results under the program

Title of your research plan:

A 3D Mechanics-based Index for Characterizing Particle Shape in Granular Materials

Description of the research activities:

Particle shape has been shown to play a huge role in influencing the macroscopic properties of granular assemblies, such as strength and dilation. Efforts to characterize particle shape thus far have largely focused on geometric properties, such as sphericity and roundness. However, such characterizations do not consider the underlying micromechanics of particle shape in the behavior of granular materials, that is, the ability of particles to resist rolling and sustain shear stress in a granular assembly based on shape. Professor Matsushima previously introduced a mechanics-based particle shape index in two dimensions, and in my research with him, we expanded this particle shape index to three dimensions and investigated how it affects both particle-wise and macroscopic quantities such as stress and dilation, using simulations of natural sand that I conducted in my prior research.

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

I am very thankful for this opportunity to conduct research in Japan. It was a very useful and enjoyable experience from both research and cultural perspectives.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Zachary Kelly （ID No.: SP16034 ）

2. Current affiliation: Johns Hopkins University

3. Research fields and specialties:

Chemistry

4. Host institution: Kyoto University

5. Host researcher: Professor Hiroshi Kageyama

6. Description of your current research

The goal of solid state chemistry is to understand and discover rational designs for materials to produce specific properties. These valuable emergent behaviors are used in technology and include electrical conductivity, magnetism, and the highly coveted emergent phenomena, superconductivity. Superconductivity, which allows the flow of electricity with no energy loss, has applications in electrical power generation and distribution, medical instrumentation, and new technology. However, one of the main issues with superconducting materials is they must be at extremely low temperatures in order to work, making them difficult and expensive to operate. Despite discovering superconductivity over a century ago, currently little is known about its underlying cause. By discovering the mechanism of superconductivity, new, cheaper, and more practical compounds can be designed to achieve superconductivity at room temperature. It has been theorized that materials with special atomic structures, such as magnetic honeycomb compounds, could hold the key to understanding superconductivity.

Specifically, this summer I applied soft chemistry techniques to modify the new iridium based nonmagnetic honeycomb lattice, $Sr_3CaIr_2O_9$, to produce a new targeted magnetic honeycomb compound. Chemical reduction of Ir in this compound is theorized to yield an important magnetic material. I have also attempted several high pressure syntheses in order to produce an analogous magnetic honeycomb compound.

7. Research implementation and results under the program

Title of your research plan:

EAPSI: Synthesis of novel magnetic honeycomb compounds to explore new physics and emergent phenomena

Description of the research activities:

Initial experiments consisted of soft chemistry techniques to reduce the iridium based nonmagnetic honeycomb lattice, $Sr_3CaIr_2O_9$, and target a new magnetic honeycomb compound. Reactions using NaH, LiH, and CaH_2 did not yield the desired product. Instead there was either no reaction or the compound was completely reduced to Ir metal. Given this result, the strategy was adjusted to focus on high pressure reactions.

The high pressure reactions introduced new atoms in order to make the compound magnetic while maintaining the honeycomb structure. Several series of experiments were carried out to replace Sr with La and Ca with Y via high pressure synthesis varying pressure (0-7 GPa), temperature (1050-1500°C) and composition. These reactions yielded compounds which have not been previously reported. Work is continuing in order to elucidate the structure and measure the properties of these new materials, however the analysis is difficult due to the impurity of the samples.

It is possible that a new material with desirable properties has been synthesized. More experiments are needed to optimize reaction conditions to produce this material without impurities. Then additional diffraction experiments could be performed to completely solve the structure. Currently, more information is needed to know if this material is the targeted magnetic honeycomb compound. Nonetheless, this new material will provide additional insights into the structure-function relationship in solid materials, the overarching goal of solid state chemistry.

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

My studies in Japan have been invaluable in terms of both scientific and intercultural exchange. I have made many new friends and colleagues, not only in Japan but from around the world. This experience has given me deeper scientific, cultural, and personal insights which were only possible to gain through this program

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Mike Kersten （ID No.: SP16035）

2. Current affiliation: Texas Christian University

3. Research fields and specialties:
Social Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Takashi Kusumi

6. Description of your current research

The experience of chronic pain is associated with lower quality of life (e.g., happiness, energy, sleep) and impacts an estimated 20% of adults worldwide. With reports of pain being more prevalent and widespread in Japanese individuals than both non-Hispanic whites and other ethnic minority groups, it is important to identify protective factors that can lower pain sensitivity cross-culturally given its precipitating effects on psychological, social, and physical well-being. The proposed research was designed to test whether *nostalgia*, a sentimental longing for the past, reduces physical pain sensitivity in both American and Japanese samples. Nostalgic reverie has been shown to offer many psychological benefits (e.g., optimism, positive affect, social connectedness), with other work linking these same outcomes with greater pain resilience. To the extent that nostalgia is a pan-cultural emotion that is experienced by individuals across different societies, this study was first conducted in Japan to explore whether Japanese individuals become less sensitive to physical pain when they experience nostalgia. This research project was carried out in collaboration with Dr. Takashi Kusumi, an expert in nostalgia and cross-cultural research at Kyoto University in Japan.

7. Research implementation and results under the program

Title of your research plan:

Attenuating Pain with the Past: The Relationship between Nostalgia and Pain Sensitivity among American and Japanese Individuals

Description of the research activities:

Japanese students recruited from Kyoto University were randomly assigned to write about either a nostalgic or ordinary event and were then exposed to a painful procedure (i.e., algometer task). The results revealed that individuals who wrote about a nostalgic (versus ordinary) event evidenced lower pain sensitivity. Importantly, these findings add to the growing body of work on the interventional potential of nostalgic reverie by showing how nostalgia may serve as a psychological mechanism to help offset physical distress.

Following the conclusion of the JSPS program I plan to expand on this work in two ways. Frist, it is important to identify potential mediating variables to help explain the relationship between nostalgic reflection and reduced pain sensitivity. Previous work has shown that nostalgia elicits greater optimism, positive affect, and social connectedness, with other work outside of the nostalgia literature linking these same outcomes with greater pain resilience. Integrating these two lines of research, follow-up analyses will be conducted to examine whether these variables mediate the relationship between nostalgia and reduced pain sensitivity. Second, to examine whether nostalgia can lower pain sensitivity cross-culturally, I will compare the data consisting of Japanese participants from Kyoto University with a sample of American participants that will be recruited at Texas Christian University.

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

Dr. Kusumi was an incredible host researcher. He was very professional, accommodating, and well organized. Working in his laboratory allowed me to start conducting my research experiment as soon as I arrived in Kyoto and the data collection throughout the entire summer was seamless.

I had an enriching cultural experience while living in Japan for the JSPS Summer Program. I very much enjoyed attending the summer festivals, visiting historical sites, eating delicious food, and signing karaoke.

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

RESEARCH REPORT

1. Name: Daniel W. KIDD （ID No.: SP16036）

2. Current affiliation: Vanderbilt University

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Tokyo University of Science

5. Host researcher: Prof. Kazuyuki WATANABE

6. Description of your current research

Rectifiers such as the historically significant vacuum-tube diode convert alternating current (AC) into a one-way direct current (DC) by various mechanisms and serve as a key ingredient in modern electronics. Recent research shows that by using ultrashort laser pulses, one may be able to design nanoscale vacuum-tube diode rectifiers which operate at the much sought after petahertz regime, some 1,000,000 times faster than today's gigahertz speeds.

The proposed device consists of two tungsten nanotips which are very close to one another, sub-micrometer. These tips are hit by an ultrashort laser pulse which causes them to emit electrons – analogous to the thermal emission of electrons in the classical vacuum-tube diode. What allows for rectification is that while the emitted electrons follow the field of the laser in an AC behavior, one tip is sharper than the other; because of this, the electric field induced by the laser is stronger near this sharper tip and, thus, it emits more electrons than the other. This amounts to a net current of electrons leaving the sharp tip and entering the dull tip, guided by a supplied bias voltage across the system. This is essentially DC behavior of current travelling from the sharp tip to the other. The small separation of the tips along with the high speed of the emitted electrons, allows for an observed operational time faster than 1 terahertz. While this time-scale is still almost 1,000 times slower than that of the desired petahertz regime, this new device concept remains to be fully optimized and indicates a promising lead in the right direction.

Theoretical simulations of such devices allows for cheap investigation into the underlying physics and optimization of such new devices. Time-Dependent Density Functional Theory (TDDFT) is a particularly well-suited computational tool which is able to simulate the effect of lasers on small-scale molecules and materials. By studying this laser-induced nanoscale vacuum-tube diode system in such a manner, one may analyze its

limitations and potential functionality without the need for costly experiments.

7. Research implementation and results under the program

Title of your research plan:

Simulation of Laser-Induced Rectification in a Nanoscale Diode

Description of the research activities:

Initial small molecules, two atoms each, were tested as trial electrodes in order to investigate basic principles of charge transfer. After this, the atom geometry used throughout the following research was discussed and constructed as a triangular shape consisting of five atoms, resembling the sharp tip, and a rectangular shape of only four atoms, resembling the dull tip. Each molecule consisted of silicon atoms instead of tungsten and the two were separated at a distance of 0.8 nanometers, each for the benefit of computational times. With this geometry in place, many simulations were carried out in which this diode system was subject to a continuous external laser. The signature effects of rectification were observed, however slightly, in a net charge transfer from sharp tip to dull tip of only around half an electron over forty femtoseconds. This is reasonable, however, given that the simulated system is quite small – much fewer atoms than that of the actual experiments. By tuning varying laser parameters, it was possible to observe enhanced functionality. Further optimization by fine tuning continues.

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

Studying in Japan has been an invaluable experience. I am very grateful for experiencing research within a Japanese group. I believe this opportunity will greatly benefit my own research practices in the future and my understanding of the collaborative process. Particularly, the generosity of the people of Japan will remain a prevalent and influential memory along with, of course, the nation’s beautiful landscapes and rich history.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Brandon Kieft （ID No.: SP16037 ）

2. Current affiliation: Oregon State University

3. Research fields and specialties:

Biological Sciences

4. Host institution: Kwansei Gakuin University

5. Host researcher: Dr. Shinsuke Shigeto

6. Description of your current research

The goal of my current research at Oregon State University in the laboratory of Dr. Ryan Mueller is to define links between microbial community composition (which species are present in what proportions) and ecological function (i.e. nutrient and carbon cycling, total bacterial metabolism). The purpose of the research is to understand how communities of microorganisms control large-scale movement and recycling of elements through ecosystems such as estuaries. To make these links, our lab uses multi-omics techniques such as community DNA sequencing (metagenomics) and community protein characterization (metaproteomics).

7. Research implementation and results under the program

Title of your research plan:

Defining resource preferences of single cells from aquatic microbial communities using Raman microspectroscopy.

Description of the research activities:

This research project measured the incorporation of ^{2}H (deuterium)-labeled amino acids (AAs) into the biomass of single bacterioplankton cells in natural microbial communities from Osaka Bay, Japan. The objective was accomplished using a combination of stable isotope probing with ^{2}H and Raman microspectroscopy. After incubating natural microbial communities with ^{2}H-labeled AAs, incorporation of the isotope into biomass of individual cells was measured by the appearance of C-D bond bands in the cells' Raman spectra. The Raman measurements were conducted by Horiba Scientific in Kyoto, Japan. All other laboratory experiments were conducted at Kwansei Gakuin University in the laboratory of Dr. Shinsuke Shigeoto. In addition to the Raman data gathered in Japan, prokaryotic 16S rRNA gene sequencing will be conducted in the U.S. to correlate community-level data with single-cell level AA incorporation data.

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

The citizens of Japan are very receptive to foreign visitors and I always felt safe/welcome wherever I went. The only thing I would change is the heat and humidity!

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Mikhail Konev （ID No.: SP16038）

2. Current affiliation: University of California - Irvine

3. Research fields and specialties:

Chemistry

4. Host institution: Osaka University

5. Host researcher: Prof. Mamoru TOBISU

6. Description of your current research

Carbon-carbon bond forming reactions are ubiquitous in the realm of synthetic chemistry, allowing the strategic construction of pharmaceuticals and materials alike. Although many methods exist, simple, efficient, and mild conditions are desirable for ease of preparation and economic sustainability. Metal-catalysts are constantly being developed to satisfy these needs, and the design of new catalysts can provide further progress towards this endeavor.

During my tenure at UC – Irvine, I have pursued the development of nickel-catalyzed carbon–carbon bond forming reactions of alkyl electrophiles. My first project focused on the development of a stereospecific variation of the Heck reaction, a transformation which has been used in many complex syntheses and is known as part of the foundation of modern organometallic chemistry. My studies focused on the utilization of secondary alkyl electrophiles with control of stereochemistry at the site of oxidative addition to form enantioenriched methylenecyclopentanes. My second project focused on nickel-catalyzed cross-electrophile coupling reactions, which have also seen a rapid increase of interest due to their recent advance in synthetic utility and mechanistic understanding. The high functional group tolerance and mild conditions inherent to these types of reactions makes them ideal for accessing targets where traditional cross-coupling methods would otherwise be difficult. This project led to the development of an intramolecular cyclization of benzylic esters with aryl halides to yield pharmaceutically relevant indane and tetralin motifs, as well as an intermolecular variant which allowed for the synthesis of a variety of diarylmethane compounds.

7. Research implementation and results under the program

Title of your research plan:

Catalyst Development for the Synthesis of Biaryl Compounds

Description of the research activities:

The cross-coupling reaction between carbon-oxygen (C-O) and carbon-hydrogen (C-H) bonds is an appealing process for the straightforward construction of C-C bonds. My project began with the evaluation of a catalyst system known in Professor Tobisu's laboratory which was identified to activate unreactive C-O bonds of readily available phenol derivatives to form C-boron bonds. The previously known catalyst was not effective for C-H activation, therefore I had to investigate various reaction parameters to optimize the desired cross-coupling. I evaluated a variety of strongly electron-donating N-heterocyclic carbene ligands and found that an IMes derivative provided the highest yield of the C-C coupling. I further investigated varying organic and inorganic bases as well as their associated counterion effects, and identified several inexpensive reagents that allowed the transformation to proceed in good yields. Further attempts to improve the yield of the reaction with metal additives did not produce any favorable results. I also was able to show that the reaction can proceed in both an intermolecular fashion, as well as an intramolecular cyclization variant of the C-C coupling. Finally, I made attempts towards a carbonylative cross-coupling for the synthesis of acylated aromatic compounds, however, my catalyst system only returned starting material, and any modification of the catalyst also only returned starting materials.

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

This opportunity was a valuable experience in gaining a new perspective with regard to research and life in Japan. It was fascinating seeing how Japanese chemistry laboratories organize their research space and their curriculum in graduate school.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Benjamin Lawson （ID No.: SP16039）

2. Current affiliation: University of Michigan

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Kyoto University

5. Host researcher: Yuji Matsuda

6. Description of your current research

My research concerns the properties of novel quantum materials. The focus on my work at Kyoto University has been on the growth of Li0.9Mo6O17 crystals also known as “purple bronze” for their purple color.

Purple bronze is a bizarre material that shows quasi one-dimensional behavior. This strongly anisotropic material has been studied for several decades, yet there are still many questions as to why it has the unique features that it does. In particular, purple bronze becomes superconducting below 1.8 K. The nature of the superconductivity is predicted to be unconventional. However, there have been few studies of the superconducting state in this material. My research in Kyoto hopes to shed light on this unconventional superconducting mechanism.

Scanning Tunneling Microscopy (STM) and thermal transport are two methods to determine the behavior of an unconventional superconducting mechanism. STM directly looks at the underlying behavior of the superconducting state in a material. As for thermal transport, heat in a material is carried by particles and quasi-particles. The manner in which supercurrent is carried in a superconductor will also effect the transport of heat in a material. Thus thermal transport is a useful probe for determining unconventional superconductivity. These are the two techniques that we intend to use to study the potentially unconventional superconducting state in purple bronze.

In addition to studying purple bronze, my research at Kyoto university concerns other interesting quantum systems such as Topological Kondo Insulators and quantum spin systems as well as other useful techniques like capacitive torque magnetometry. The

purpose of these other projects is to increase academic exchange and build collaboration between Professor Matsuda's group in Kyoto and my home group in Michigan.

7. Research implementation and results under the program

Title of your research plan:

Investigation of the unconventional superconducting mechanism in $Li_{0.9}Mo_6O_{17}$

Description of the research activities: The goal of the research agenda was to grow Li0.9Mo6O17 crystals also known as "purple bronze" and study their superconducting properties. To date, we have succeeded in growing purple bronze; however, the crystals are not of high enough quality to show superconductivity. Preliminary tests under magnetic field show similar behavior to a controversial report of a magnetic field-induced superconducting state. This may motivate further studies in high magnetic field to confirm or deny this very interesting, controversial property. New higher quality crystals are being grown to study the superconducting state in an ongoing collaboration after the summer program.

In addition to the studies on purple bronze, we conducted torque magnetometry studies on Topological Kondo Insulator (TKI) candidates. TKIs are a new, very intriguing state of matter that has caused no little stir in the scientific community. Torque experiments on these materials during the program will hopefully be the start of a fruitful future collaboration.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): Japan is a fantastic country with wonderful culture. Food, a major aspect of culture, has been one of my favorite things about my stay in Japan. On the occasional weekend, I have been able to travel to other cities around Japan. It is really fascinating to see the cultural differences around the country from Osaka to Tokyo and elsewhere. Even experiencing Onsen has been a fantastic experience for an American who does not have a parallel institution in my own culture. I cannot begin to summarize the rich cultural experience of my time here in a short paragraph.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Matthew Lawson （ID No.: SP16040 ）

2. Current affiliation:

UC Davis

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: Kyoto Univeristy

5. Host researcher: Dr. Yoshimura Kazuyoshi

6. Description of your current research:

We are characterizing the temperature and magnetic field dependence of Hf2Te2P, focusing on the behavior of the Knight shift as a function of high magnetic field at very low temperatures, where previous magnetic susceptibility measurements suggested the presence of de Haas–van Alphen oscillations.

Hf2Te2P is a structural analog to the Dirac semi-metal candidate Zr2Te2P.

Further characterizations include studies of T1 (a marker for dynamical magnetic susceptibility) as a function of temperature.

7. Research implementation and results under the program

Title of your research plan:

EAPSI: Probing Phase Transitions in Magnetic Materials

Description of the research activities:

While our initial plan focused on CsCo2Se2, due to unforeseen issues with sample availability, we switched to studying Hf2Te2P instead, while synthesizing new CsCo2Se2 samples. We successfully overcame a variety of equipment malfunctions, and developed an experimental strategy to search for a very tiny quantum effect called the deHass van Alphen oscillation using NMR (normally it is detected by magnetic susceptibility instead). Our measurements did not conclusively observe these oscillations, however future work with a larger magnetic field might.

In the mean time, the synthesis of the CsCo2Se2 samples is ongoing, and will be the first step in future collaborations between me and Kazuyoshi Yoshimura's research group.

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

I was fortunate enough to experience a wide variety of the rich culture Japan has to offer, including many visits to local temples, a lab trip to Beppu, a short visit to Okinawa, and visits to several local museums.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Rachel Levanger （ID No.: SP16041 ）

2. Current affiliation: Rutgers, The State University of New Jersey

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Nagoya University

5. Host researcher: Dr. Takashi Ishihara

6. Description of your current research

It has been said that turbulence is the last unsolved problem in classical physics. Even the great Werner Heisenberg is attributed to the following quote:

> "When I meet God, I am going to ask him two questions: Why relativity? And why turbulence? I really believe he will have an answer for the first."

Even so, this doesn't mean that scientists, such as myself, are giving up in finding new approaches to studying such an intractable problem. I team up with computational and experimental scientists to study turbulent fluid flows, whether simulated or generated experimentally in a lab. My background, rather than being in physics and numerical analysis, is in the quantification of the mathematics of shape: algebraic topology. It is with tools from this complementary discipline that we hope to discover novel methods by which to study turbulent fluid flows, leading to increased understanding of these complex phenomena.

For my research at Nagoya University, I am working with a computational physicist and long-time researcher of fluid dynamics, Dr. Takashi Ishihara, who specializes in numerical solutions of the famous Navier-Stokes equations in fluid dynamics. We are studying the vorticity fields of fully developed turbulent systems (think of whirlpools or tornadoes and hurricanes) as well as a simulation of what is called homogeneous charge compression ignition (HCCI). The former is a project that aims to uncover statistical properties of fully developed turbulent systems, while the latter is a test to see how these topological methods can help in the study of large-scale time series simulations.

7. Research implementation and results under the program

Title of your research plan:

Establish new topological methods for analyzing numerical simulations of three-dimensional turbulent fluid flows.

Description of the research activities:

For researching the vorticity fields of fully developed turbulence, I primarily utilized the method of diffusion map embeddings. A collection of 512 simulations were converted to persistence diagrams to quantify the spatial properties of the dynamics, and this was put through numerous correlation analyses with known statistical summaries currently in use by physicists. By using this method, we were able to find a new, and simple, relationship between three different statistical quantities and we are working on writing up our results for submission.

For researching the simulated combustion flows, we used the notion of speed in the space of persistence diagrams to determine which aspects of the combustion were active during which phases of the low-temperature oxidation period. Up until this time, methods were very cumbersome for studying such simulations, and only four chemical species plus temperature was used as a test. Our method proved to be amazingly insightful, and we are working on generating the full dataset to do a full-scale analysis of the entire simulation (including all 32 chemical species).

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

I really loved the experience of living and working in Japan and learning so much about Japanese culture. I had the opportunity of attending a workshop in Kyoto and also spoke at a conference in Sapporo on Hokkaido island. It was really informative to see how research is conducted internationally and made me realize how possible it is to collaborate even with people who are overseas. This experience has also made it easy to imagine doing international research collaborations in the future. I won’t shy away from the opportunity if it presents itself!

RESEARCH REPORT

1. Name: Alex Lewis （ID No.: SP16042）

2. Current affiliation: University of Tennessee

3. Research fields and specialties:

Biological Sciences

4. Host institution: □Kochi□Institute for Core Sample Research, JAMSTEC, Nankoku, Kochi 783-8502;

5. Host researcher: Dr. Shunichi Ishii

6. Description of your current research

My current research is focused on studying the effects of different bioprocess/operational conditions on microbial communities of microbial electrolysis cells for the conversion of biomass-derived streams. We want to study the development biofilm microbial communities and understand the interactions that take place between different functional groups within the community. The overall goal is develop these systems for integration in biorefinery platforms for rewnewable hydrogen production and water treatment.

7. Research implementation and results under the program

Title of your research plan: **Investigating conversion of biomass streams in bioelectrochemical systems through functional metagenomics**

Description of the research activities:

During the summer program, I was trained in how to assemble metagenomic DNA sequence data, and how to analyze the results. The training consisted of:

1. Learning de novo assembly procedure
2. Learning about draft genome clustering and functional gene annotation
3. Learning about accurate community composition analyses from metagenomes
4. Learning techniques of connection mapping and tetranucleotide frequency for develop bin genomes
5. Learning methods for functional annotation and comparative metagegnomics
6. Learning mRNA read mapping method to quantify gene expression levels
7. Learning normalization method and comparative metatranscriptomics

After learning this pipeline, sequence data generated from reactors in the U.S. were analyzed via this platform, to uncover the microbial community and functional capabilities present for conversion of biomass-derived streams. The data is still be analyzed with goal future collaborations.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): Great experience and learned a lot from my host researcher and hope for future collaboration.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Brian Lohman （ID No.: SP16043）

2. Current affiliation: University of Texas at Austin

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: National Institute of Genetics

5. Host researcher: Dr. Jun Kitano

6. Description of your current research

Although modern molecular genetics and statistics have become incredibly effective at identifying candidate genes for virtually any phenotype, genetic mapping is inherently correlational. Quantitative trait locus (QTL) mapping often links focal phenotypes to large regions of the genome containing multiple genes. Similarly, gene expression profiling often identifies hundreds of genes as differentially expressed as a function of population or experimental treatment. Establishing causality of candidate genes requires functional testing without perturbing any other genes. Molecular biology offers several solutions to this problem, most notably through genetic manipulations via CRISPR/Cas9. The CRISPR/Cas9 system enables knockouts of any gene and has been well developed for model systems. However, it remains to be widely applied in many up-and-coming model systems. For example, the threespine stickleback (*Gasterosteus aculeatus*) is a powerful model system for studying evolutionary genetics (including my focus, evolutionary immunology), but transgenic and knockout tools have rarely been applied to validate inferences from genetic mapping.

My research goal is to understand the genetic basis for naturally-occurring variation in host immune function which leads to variation in parasite prevalence using the threespine stickleback as a model system. I have identified several promising candidate genes which have known functions in host immunity, and whose expression is correlated with host infection status. I am currently using modern molecular genetic tools, including CRISPR/Cas9 to establish causality of candidate genes.

7. Research implementation and results under the program

Title of your research plan:

EAPSI:The genetic basis of recently evolved host immunity in a model host-parasite system

Description of the research activities:

While working in Dr. Kitano's lab I learned the basics of CRISPR/Cas9 design, construction and implementation. I designed and built all necessary CRISPR constructs for three of my own candidate genes, previously implicated in population dependent immune responses to parasites. I learned microinjection of stickleback embryos and constructed knockouts of my candidate genes. I learned and carried out all necessary screening methods, including the genomic cleavage and heteroduplex mobility assays.

I have started to optimize lipid-based transfection of primary cell culture with CRISPR constructs. In doing so, I taught Dr. Kitano my previously established methods for stickleback primary cell culture. In summary, the Bolnick lab can now use CRISPR/Cas9 to edit genes and the Kitano lab can now culture stickleback cells.

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

I enjoyed my time in Japan immensely, most especially hiking to the summit of Mt. Fuji for sunrise.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Nicholas LOUTREL （ID No.: SP16044）

2. Current affiliation: Montana State University

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Takahiro TANAKA

6. Description of your current research

With the detections of the events GW150914 and GW151226 by the Advanced LIGO gravitational wave detectors, a new era of astrophysics and relativity has been established. The events, which were verified to be the late inspiral and mergers of black hole binaries, have provided us with invaluable information about the populations of black holes within the universe and some of the strongest tests of Einstein's theory of General Relativity (GR) to date. However, there is one modified theory of gravity that remains largely unconstrained from these events, namely dynamical Chern-Simons gravity (dCS). This theory differs from GR in that it is parity violating, meaning systems are only different between the two theories if they change sign under a spatial reflection. One such system is black holes with spin angular momentum. If two spinning black holes form a binary system, the gravitational interaction causes the plane of the orbit to precess, similar to a spinning top. Since the black holes will inspiral due to the emission of gravitational waves, the precession of the orbital plane will modulate the observed gravitational wave signal seen by detectors such as Advanced LIGO. If nature follows dCS gravity instead of GR, the gravitational interaction of the spinning black holes will be modified, causing a different precession pattern for the orbital plane, and thus inducing a different modulation within the observed gravitational wave signal. Such a difference will be crucial to constraining this modified theory, and ultimately understanding the gravitational interaction on a fundamental level.

7. Research implementation and results under the program

Title of your research plan:

Spin Precession in Dynamical Chern-Simons Gravity

Description of the research activities:

We have focused on approaching the problem of spinning black holes in dCS gravity through an effective field theory formalism. Such a method relies on establishing a set of symmetries that the theory must uphold. In the scenario under investigation, we require the underlying physics must not be dependent on the shape of spacetime (background independence), on the frame of reference chosen by an observer (Lorentz invariance), and on the clock used by an observer (reparametrization invariance). These symmetries restrict our effective theory to black holes with three properties: mass, spin angular momentum, and a scalar dipole moment (similar to a magnetic dipole). From our effective theory, we have derived the equations describing the dynamics of such black holes and verified the existence of conserved quantities associated with the dynamics, namely the energy and angular momentum of the black holes.

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

I have visited many of the shrines and castle in Kyoto and the surrounding regions. I have visited an onsen and have been to a tsugaru-shamisen performance. I have also been to a few festivals during my stay, including the Gion festival and the Kobe fireworks festival.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Seth Daniel MALLETT （ID No.: SP16045）

2. Current affiliation: Georgia Institute of Technology

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Port and Airport Research Institute (PARI), Foundations Group

5. Host researcher: Dr. Takaaki MIZUTANI, Dr. Satoshi MATSUMURA

6. Description of your current research

Civil infrastructure, including buildings, transportation systems, and power and communication networks, is vital for an advancing and functional society, and it is often used as a measure of an entities quality of life. Furthermore, in today's political, economic, and environmental atmosphere, the demand for adaptive, sustainable, and resilient facilities, subjected to events such as climate change, natural disasters, and man-made disasters, is becoming all the more significant. Yet, most of these infrastructures are constructed upon static, single function, and sometimes overly designed foundations. Therefore, in an attempt to address this issue, my research seeks to uncover nature's solutions for foundations and incorporate them into current infrastructure technologies.

The overarching goal of my research is to combine the biological principles of plant root anchorage into a conventional infrastructure foundation. In particular, my focus is on fibrous root systems and their ability to resist uplift forces, such as those from plant eating animals. Various geometrical and topological properties of fibrous root systems, such as branch length, number of branches, branching angle, and branching order, will be analyzed to determine the dominant properties of root anchorage capacity.

My previous work has consisted of fibrous root index characterization tests that seek to classify fibrous root systems based upon their mechanical behavior without the complexity of soil, as well as, deriving first order analytical solutions for the pullout of fibrous roots system from soil. My research in Japan seeks to uncover the failure surface during uplift that each analytical model has innately assumed. Finally, my research will conclude with a multitude of experimental and numerical tests of various geometrical configurations to investigate the role of fibrous root system shape on anchorage capacity.

7. Research implementation and results under the program

Title of your research plan: Fibrous root-inspired infrastructure foundations

Description of the research activities:

The purpose of my research at PARI was to evaluate the global soil movement and failure surface when a fibrous root system is either lifted up from or compressed into soil. To do so, 4 root analogs were fabricated using 3D printed plastic, and then embedded into dry sand within an acrylic cylinder. The root analogs were then attached to a loading device to either lift or compress the models. The container with loading device was then placed within an X-ray CT scanner, and after a prescribed incremental load was applied to the root analog, the container with embedded model root was scanned. During loading, the force and displacement were continuously measured. The 4 root analogs were uplifted from 3 different soil types to study the effect of particle size and angularity, and an additional data set was obtained to study compression.

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

Japan was an amazing place to spend my summer. In particular, my host researcher, Dr. Matsumura, was extremely accommodating, allowing me to pursue much more than my proposed research and also organizing multiple Friday evening activities to introduce me to the Japanese research culture. Also, luckily, on the weekends, I was able to travel a great deal, such as to Mt. Fuji and Okinawa. And probably one of my favorite things about Japan and the thing I will miss the most upon returning to the US, is Japanese food; the attention to detail is evident in not only the incredible flavors but also the presentation.

9. Advisor’s remarks (if any)

RESEARCH REPORT

1. Name: Kelsey A. MARTINEZ （ID No.: SP16046）

2. Current affiliation: Syracuse University Department of Biology

3. Research fields and specialties:

Biological Sciences

4. Host institution: Tohoku University, Graduate School of Life Sciences

5. Host researcher: Prof. Kouki HIKOSAKA

6. Description of your current research

Invasive plant species from East Asian forests are becoming increasingly abundant in North American forests. Differences in energy capture may explain how these invaders become prolific. This project will examine differences in leaf traits impacting energy capture in invasive species in their native (East Asia) and invasive ranges (North America) relative to non-invasive, but naturalized species from East Asia on both continents. Seedlings or saplings of East Asian maple, Viburnum, and honeysuckle species growing in Aobayama Botanical Garden and on gardens on Tohoku University campus in Sendai, Japan were used as focal individuals. Specifically, this study measured and compared photosynthetic rates, leaf nitrogen partitioning to photosynthetic pools, and leaf anatomical traits related to energy capture in the focal individuals. Focal individuals were located along a light gradient to understand how different species react to changes in light availability – a limiting, but potentially dynamic, resource in forest understories. A replicate study will be completed in Syracuse, NY to make species comparisons on both continents. The results of this study will help inform management decisions of invasive species in North America, an endeavor in which large amounts of resources and labor are invested annually.

7. Research implementation and results under the program

Title of your research plan:

Leaf traits impacting energy capture of North American forest invaders home and away

Description of the research activities:

During my stay at Tohoku University with host researcher Prof. Kouki Hikosaka, I successfully measured a variety of traits of North American invaders in their native East Asian habitats. These traits include photosynthetic rate, physical leaf traits (thickness, toughness, chloroplast area) and chemical leaf traits, such as chlorophyll content, rubisco content, total nitrogen content, and cell wall nitrogen content. A large portion of my time working with Prof. Hikosaka was spent learning how to extract proteins from frozen leaf tissue and how to properly analyze the homogenate. During my collection of photosynthetic data in the field, I got to spend invaluable time observing and learning the flora of Japan, which allowed me to develop further hypotheses about why certain East Asian species may be successful invaders in North America.

After completing a similar study of the same species in Syracuse, NY, I plan to analyze the data in such a way that will allow us to understand which, if any, leaf traits vary between continents. This will give insight into how species become prolific in their non-native ranges. Additionally, the use of plants in multiple light levels will inform us of how certain species are able to invade habitats with both high and low light availability, a common characteristic of North American forest invaders. At this point, the data are still being collected, so no preliminary results can be reported.

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

During my stay in Japan, I had many opportunities to experience Japanese research and social culture. I attended weekly lab meetings and graduate student seminars in addition to weekend social outings with my lab mates. These experiences will be beneficial in my future endeavors as a researcher.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Lida MEHDIZADEGAN NAMIN （ID No.: SP16047）

2. Current affiliation: Worcester Polytechnic Institute

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Koretaka YUGE

6. Description of your current research

My current research focuses on developing viable catalysts for the fuel cell industry. Among different kinds of fuel cells, direct ethanol fuel cell (DEFC) can be an effective way of energy production provided that they use suitable catalysts. Alloys have shown to have high catalytic activity and as a result are potential candidates to be used in DEFCs and are the main focus of my research. The method which I am using is density functional theory (DFT) which is a computational chemistry method. The most conventional catalyst in fuel cell industry, platinum, is highly expensive and is not effective in the reactions which occur in DEFCs. One possible solution to the problems mentioned above is to substitute platinum with other transition metals such as iridium. Iridium is much cheaper than platinum and possess high catalytic activity. By means of DFT, I modeled finite atomic configurations for iridium-based alloys. My results demonstrate that these alloys possess high catalytic activity in reactions occurring in DEFCs.

7. Research implementation and results under the program

Title of your research plan:

Developing iridium-based alloys as effective catalysts for direct ethanol fuel cells by the combination of density functional theory and cluster expansion method

Description of the research activities:

My research at Worcester Polytechnic Institute (WPI) merely focused on modeling different alloys by means of DFT. DFT calculations are however limited by finite computation power. To resolve this problem the combination of DFT with statistical physics methods such as cluster expansion has been suggested. To learn cluster expansion and to perform this technique for iridium-based alloys, I contacted professor Yuge at Kyoto University and as a JSPS fellow I had the great opportunity to learn this technique at materials informatics laboratory at Kyoto University. In order to know how the cluster expansion code works and to analyze the data obtained from it, it is important to learn the mathematical and physical background associated with the cluster expansion. As a result, in the first month of my JSPS fellowship, I was learning the prerequisite theories behind the cluster expansion. In the second month, I started to learn the cluster expansion code (GCVC) by reading the manual and performing some sample calculations. In order to perform GCVC code, DFT results (such as energy) as input files are required. Before coming to Japan, for iridium-platinum surface, I performed DFT calculations for different atomic configurations. However, at Kyoto University I realized before running the GCVC code for the surface, the results from the bulk is a necessity. Therefore, for the bulk iridium-platinum, I preformed DFT calculations for 114 different atomic configurations and I performed GCVC code to find the most stable atomic configuration based on these geometries. The next step for me after returning to WPI is to perform the GCVC code for iridium-platinum surface and then perform the method to other bimetallic iridium alloys to find the most viable iridium based alloys.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): During my stay in Japan I realized Japanese people are thoroughly caring, helpful, kind, considerate, and punctual. When I first came to Kyoto, There were instances when I did not know the direction to different places and people would walk with me to my destination. I had the chance to do some sightseeing with my host family and I quite enjoyed Japanese heritage and culture during my stay in Japan. Professor Kawai and my lab members at Kyoto University created a friendly atmosphere and invited me to some festivals which was occurring during my stay at Kyoto.

9. Advisor’s remarks (if any): Professor Yuge is an expert in modeling metal alloys and has ample experience in the cluster expansion method. He developed GCVC code himself and he has several publications regarding cluster expansion and other materials science projects. He not only guided me through my research, he personally tended to my needs in settling into my residence hall, obtaining my Shinkansen ticket and other needs.

RESEARCH REPORT

1. Name: Alysson MONDORO （ID No.: SP16048 ）

2. Current affiliation: Lehigh University

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Waseda University

5. Host researcher: Mitsuyoshi AKIYAMA

6. Description of your current research

The management of coastal bridges is a complex issue due to the presences of large surge loads from tropical storms, floods, and corrosive marine environments. Bridges have multiple failure modes under these hazards including (1) deck unseating from the substructure, (2) scour failure, (3) failure of the substructure due to inadequate or reduced capacity, and (4) fatigue cracks. Deck unseating is the predominant failure mode for low clearance, simply supported bridges. This occurs when the bridge deck is forced off of the supports by large, transverse hydraulic loads from the waves during a tropical cyclone. Scour failure, or the removal of soil from near the bridge piers, is the predominant failure mode for bridges, in general. Currently, these two failure modes are addressed in separate life-cycle management frameworks. However, there are dependencies between the two events, i.e. flooding may occur during tropical cyclones, that are not addressed. Additionally, the cost of failure and the impact of failure on the surrounding community is integrated into the current research through the use of the risk metric. The current research activities for this project include developing a methodology to assess the vulnerability of bridges to floods, tropical cyclones, and corrosion, investigate the performance of retrofit actions for all of the aforementioned hazards, and develop a risk-based framework that can aid in the effective management of coastal bridges.

7. Research implementation and results under the program

Title of your research plan: Risk assessment of coastal bridges and potential surge retrofit measures.

Description of the research activities:

Bridge decks, piers, and foundations are vulnerable to failure during extreme hydraulic loads. Their vulnerability is amplified over the life-cycle of the structure due to corrosive marine environments that deteriorate structural components. This project investigated the effect of climate change on the occurrence of hydraulic hazards and the resulting impact on the vulnerability of coastal bridges. It was identified that sea level rise, increased extreme precipitation, and the increased intensity of tropical storms are the top climate change concerns with respect to the management of coastal bridges. Sea level rise may permanently inundate low lying regions and overtop low clearance bridges. Increased precipitation generates more intense flooding and increases the vulnerability to scour damage. And, while the direct relationship between climate change and the increased intensity of tropical cyclones is highly debated, the increased intensity of the events presents a major threat to the performance of coastal bridges. This research is on-going and will continue after the JSPS summer program.

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

As a part of the research into the failure of bridges during extreme hydraulic events, site visits to Ishinomaki and Iwakuni were conducted among others. Ishinomaki sustained significant damage as a result of the 2011 Great East Japan Earthquake and Tsunami. The current state of rehabilitation was investigated. The Kintai Bridge in Iwakuni failed during a typhoon in 1950 and has been restored entirely. The site visits elucidated the economic and social importance of the bridges. The rehabilitation and replacement of the structures were and are being performed with great attention given to extreme hydraulic loads.

9. Advisor’s remarks (if any): n/a

RESEARCH REPORT

1. Name: Jacob Morrison （ID No.: SP16049 ）

2. Current affiliation:

Michigan State University

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Institute for Cosmic Ray Research, Kavli Institute for the Physics and Mathematics of the Universe

5. Host researcher: Dr. Yoshinari Hayato

6. Description of your current research

Neutrino physics probes a wide range of unknown physics, including the nature of neutrino oscillations and the ordering of the neutrino masses. The T2K (Tokai to Kamioka) experiment in Japan is making precision measurements of important experimental values related to neutrino physics. As T2K tries to improve the precision of their findings, better modeling methods must be included in order to keep pace with experimental measurements. I am working to improve the simulation software, NEUT, used by T2K.

NEUT makes use of a number of supplemental software programs as a part of its simulation routine. The software currently used by NEUT to simulate high energy events in T2K is outdated. The focus of my work is to update NEUT, such that it is compatible with an newer version of the high energy simulation program. This includes adapting NEUT to account for changes between versions of the supplemental code and, following successful adaptation, verifying the changes against neutrino event data.

7. Research implementation and results under the program

Title of your research plan: Improvement of Neutrino Simulation Software for High-Precision Measurements at T2K

Description of the research activities:

Following a brief introduction to NEUT, I began looking into how the ancillary software currently used by NEUT differs from the newer version that will eventually be implemented. Throughout the rest of the summer, I have been working on adapting NEUT, such that the new version works within the NEUT framework. Initially, I worked to understand how the improved supplemental code worked in a standalone fashion. I then successfully integrated the improved software into NEUT. However, due to some limitations of the new software, several issues have arisen. These issues likely can be solved by tuning parameters in the software; however, it is important to understand how and why these issues have arisen before moving onto the validation phase.

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

I used a JR pass to visit Hiroshima, Fukuoka, Kyoto and Osaka. During the trip, I went to many museums, enjoyed some of the local food specialties and walked around each city, seeing different historical locations. I also went to see the Sumida River Fireworks Festival in Asakusa.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: McCabe Olsen （ID No.: SP16050 ）

2. Current affiliation: University of Kentucky

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Osaka University

5. Host researcher: Prof. Takayuki HIBI

6. Description of your current research

My current research is discrete geometry and its intersection with commutative algebra through studying properties of convex lattice polytopes. For a positive integer *d*, a *d*-dimensional convex polytope is a *d*-dimensional generalization of a convex polygon and convex lattice polytope is a convex polytope whose vertices are integer point coordinates. Specifically, we have been focusing on a particular class of convex lattice polytopes called **s**-lecture hall polytopes.

Over this summer, we have produced several positive results for **s**-lecture hall polytopes. We should that, provided that **s** is a monotone sequence (that is, a sequence which either increases or decreases weakly) **s**-lecture hall polytopes satisfy the *integer decomposition property (IDP).* This property is a rather strong geometric property to have and it has algebraic implications as well. Given greater restriction on monotonic **s**-sequences, we were also able to provide necessary and sufficient conditions for when an **s**-lecture hall polytope satisfies certain other properties such as the *Fano property*, the *Gorenstein property*, and the *reflexive property.* These properties are of great interest in the study of combinatorial commutative algebra. Moreover, we prove a result which allows us to construct IDP and/or Gorenstein lecture hall polytopes from two lower dimensional lecture hall polytopes each with the same respective property.

We also were able to produce a new example of a *self dual reflexive simplex.* Such polytopes are very rare and prior to our work there were only two know families of such polytopes. Additionally, this polytope possesses very nice algebraic properties through its Ehrhart series and has small volume. This example is unimodularly equivalent to a particular **s**-lecture hall polytope.

7. Research implementation and results under the program

Title of your research plan:

A Unified Approach to Euler-Mahonian Identities

Description of the research activities:

One direction given in the original research plan involved studying Euler-Mahonian identities via constructions involving **s**-lecture hall partitions, such as **s**-lecture hall cones and **s**-lecture hall polytopes. However, it became clear that many algebraic and geometric questions regarding **s**-lecture hall polytopes remained open and we changed our focus to addressing these questions.

With collaborators Takayuki HIBI (Host Researcher) and Akiyoshi TSUCHIYA, we were able to answer some of these questions, which are described in greater detail under the section "6. Description of your current research." We have written two papers, which have both been submitted to prestigious mathematics journals :

- "Self dual reflexive simplices with Eulerian δ-polynomials," Takayuki HIBI, McCabe OLSEN, and Akiyoshi TSUCHIYA. *Submitted.* Preprint at: http://arxiv.org/abs/1607.04871
- "Gorenstein properties and integer decomposition properties of lecture hall polytopes," Takayuki HIBI, McCabe OLSEN, and Akiyoshi TSUCHIYA. *Submitted.* Preprint at: http://arxiv.org/abs/1608.03934

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: Georges PAVLIDIS （ID No.: SP16051 ）

2. Current affiliation: Georgia Institute of Technology

3. Research fields and specialties: **Engineering Sciences**

4. Host institution: Nagoya University

5. Host researcher: Professor Hiroshi AMANO

6. Description of your current research

GaN is currently one of the most attractive materials for Power Electronics and determining how to spread the heat efficiently is a major question to be answered. The PI's current research consists of improving the efficiency of GaN electronics by thermal engineering. The PI has studied the effects of different material substrates on the thermal performance of GaN based electronics through the several different measurement techniques. This includes the use of Raman Spectroscopy, Thermoreflectance and Gate Resistance Thermometry. The PI has compared and contrasted these techniques to determine the most suitable application for each measurement technique. The PI has also measured the residual stress associated with GaN-based devices grown on non-native substrates by Photoluminescence (PL) and Raman Spectroscopy. This has shown to affect the performance of the device.

Focusing on the more fundamental level of this research area, the thermal performance can be most significantly improved by altering the crystal structure of the materials. In order to conduct a thorough study of the effects of the material structure on the thermal properties collaboration with specialist in growth of GaN is necessary. Using the most modern technologies to grow epitaxial GaN at Nagoya University, a thorough study on how the defect density and impurity concentration can improve the thermal conductivity of GaN was conducted.

7. Research implementation and results under the program

Title of your research plan: How to Improve the Thermal Performance of GaN Based Devices

The PI has been able to complement his studies and obtain a more in-depth understanding of the fundamental research behind GaN-based electronics fabrication. In exchange, the PI has also had the opportunity to share his expertise in thermal characterization of wide band gap materials to improve the host research laboratory's knowledge in this field.

The collaboration provides direct insight into the state of art technology used to create advanced materials for future electronics. Understanding the method to grow complex materials will lead to the development of more efficient electronics used for lighting, electric vehicles and renewable energy. This will allow for more neighborhoods across the country to have light at night and ensuring a safer environment throughout the whole day. It will further reduce the nation's overall power consumption making the country have a more sustainable future.

Samples fabricated at Nagoya University have already been sent back to the Georgia Institute of Technology to be thermally characterized. Initial results show that the concentration of negative doping on the thermal conductivity has an insignificant effect. This suggests that when dealing with low defect densities, the quantity of impurities does not alter drastically the thermal conductivity of GaN. The undoped samples have proven to have higher thermal conductivities in which no intentional impurities are found. Regarding the thickness dependency of GaN thermal conductivity, the thermal conductivity decreases with film thickness.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I have been able to travel to several different places across Japan including Kyoto, Nara, Osaka, Fuji san, Okinawa and Ise Jingu. Each place has its own style of architecture and history behind its landmarks. I will never forget the sunrise at the top of Fuji san, the holy temples and shrines of Kyoto and Nara, and the calm clear waters of Okinawa. At each place I have managed to talk to local people and experience their food specialties. I gained deep insight into the mentality of Japanese people, their lifestyle and their perspective on current world affairs. Having joined a futsal team in Nagoya I have also met several of westerners living permanently in Japan and discussed how they have adapted to the Japanese lifestyle. Attending a conference in Nagoya, I also had the opportunity to meet His Imperial Highness the Crown Prince of Japan. Overall, I have never felt safer in a country before and the people of Japan are all very friendly and welcoming.

RESEARCH REPORT

1. Name: ピングリー・メリッサ (ID No.: SP16052)

2. Current affiliation: University of Washington, School of Environmental and Forest Sciences

3. Research fields and specialties:

Biological Sciences

4. Host institution: Hokkaido University

5. Host researcher: Prof. Kentaro TAKAGI

6. Description of your current research

Fire is an important driver of ecosystem processes yet very little is known about its effects on phosphorus (P), which is an essential nutrient for plant and animal life and limited in northern Japanese soils. Soil microbes and fauna, such as earthworms, provide an essential function in forest ecosystems by digesting organic matter to make P and other nutrients available for plants that otherwise exist in unavailable forms. At the same time, plants chemically alter their immediate root zones to enhance the availability and uptake of P from soils. The common measurement of soil P does not account for the variety of root-zone acquisition techniques and very little is known about earthworm alteration of soil P availability. This research project will measure soil P in contrasting soil types of northern Japan with an advanced method that mimics the variety of plant P acquisition techniques. In a laboratory experiment, we will combine soils with a common earthworm species and charcoal from wildfires in order to provide a context for biological activity and forest disturbance that is likely to alter soil P availability. The project will be conducted in the extensively studied Teshio Experimental Forest located in northern Hokkaido, Japan, in collaboration with Assistant Professor Dr. Makoto Kobayashi and Associate Professor Dr. Kentaro Takagi of Hokkaido University. The Teshio Experimental Forest is an ideal field research center that provides 22,550 hectares of undisturbed sub-boreal forests.

7. Research implementation and results under the program

Title of your research plan:

Ecological context of bioavailable phosphorus in sub-boreal forest soils of northern Japan.

Description of the research activities:

We collected two contrasting spodosol soils developed on serpentine and sedimentary parent material in the Teshio Experimental Forest of northern Japan in late June of 2016. Mature earthworms were collected at the same experimental forest and allowed to adjust to soil types for 48 hours before addition into the microcosms. Charcoal was formed from *sasa senanensis* bamboo at 500C for 2 hours, fragmented into a homogenous size class (1.2 – 2 mm) and mixed into microcosms at an application rate of 500 kg ha^{-1}. We used a fully factorial experimental design with five replicates of each treatment (e.g. soil type, earthworm, charcoal) to total 40 microcosms with a volume of 350 m^3. Microcosms were allowed to incubate at an average temperature of 13.9C for 4 weeks with weekly aeration and one addition of water (1 mL deionized H_2O). Earthworms were removed and weighed after the incubation period and microcosm soils were homogenized and divided into subsamples for pH, moisture content, and BBP extraction. We followed the biologically based P extraction method described by DeLuca and others (2016) with slight modifications of increasing the soil mass and extraction solution volume to approximately 2 g and 40 mL solution. Extracts were frozen at -5C for one week and analyzed with the malachite green method for phosphorus (P). Extracts from HCl were diluted and all samples were read at 630 nm with a spectrophotometer.

Preliminary results show an overall increases of bio-available P in soils developed on sedimentary parent material that is accessible through 1) the release of organic acids to solubilize actively cycled P sorbed onto clay particles or as a component of calcium, aluminum, or iron and 2) more recalcitrant inorganic P which is released by proton excretion. Treatment effects were distinguishable only when comparing soil types. Soils developed on sedimentary parent material showed higher bio-available P across all treatments except for earthworm only treatments, where there was no

significant difference in total P extracted.

Our results show that despite the low P concentrations in northern Japanese soils, both plants and microbes may access P by proton excretion to solubilize and release recalcitrant P. The presence of charcoal in these soils and interactive effect of charcoal and earthworm activity may also help alleviate P limitations. Wildfires, which have been absent for the majority of Japanese habitation in Hokkaido, may provide an impetus for P cycling and availability in the forest soils of northern Japan.

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: Isamar ROSA PLATA (ID No.: SP16054)

2. Current affiliation: Stanford University

3. Research fields and specialties:
Engineering Science

4. Host institution: Hokkaido University

5. Host researcher: Prof. Tamon UEDA

6. Description of your current research

Extraterrestrial construction presents many interesting and new challenges. Unlike Earth, on the moon, Mars and asteroids there are very limited resources, other than soil, out of which the shelters, roads and landing pads needed for exploration can be built. As a possible candidate, a new material composed primarily of soil held together by a solution of water and proteins called Protein-bound Soils was recently developed. This material has strength similar to unreinforced concrete. However, the material's behavior after it has been damaged has yet to be explored. This information is critical to designing a durable material that can resist extreme environments. In this project, a collaboration between damage modeling experts at Hokkaido University in Japan and protein-bound soil experts at Stanford University sought to explore for the first time the material's damage states and computationally model its response.

To date, experimental tests of mechanical properties have shown significant variability among Protein-bound Soil samples. This variability drives the creation of computational micromechanical models to gain a better understanding of the underlying mechanics that provide strength. Currently the focus is on the micromechanical properties, with emphasis on modeling periodic unit cells that capture the interactions between the particles and the protein bridges that bind them. Moving forward, mesoscale modeling is needed to understand how the material responds to damage and how its performance is affected by fatigue and environmental attacks. To achieve this, Isamar Rosa of Stanford University and Prof. Tamon Ueda of Hokkaido University, an expert in mesoscale damage in concrete, will explore how current mesoscale damage modeling can be applied to Protein-Bound Soils. This project would represent the first venture into mesoscale modeling of this new material and promises a framework to computationally model damage in similar earthen materials.

At Hokkaido University, the Rigid Body Spring Model (RBSM) was developed to computationally simulate fracture in cement mortar and concrete. The model uses the fundamental properties of cement mortar to set fracture criteria for an ensemble of springs that are then used to simulate the fracture response and ultimate strength of the material. Protein-bound soils, been conceived less than five years ago, does not have the body of literature that cement paste has. Hence, during the Summer 2016, the effort has been on obtaining experimentally these fundamental properties and modifying the existing RBSM code so it can be implemented to model protein-bound soils.

7. Research implementation and results under the program

Title of your research plan:

Modeling Damage in Protein Bound Soils

Description of the research activities:

- Modified existing 2D and 3D code used to model fracture in mortar using the Rigid Body Spring Model method so that it could be utilized to model Protein Bound Soils.
- Created test samples of Protein-Bound Soils at the Hokkaido University's Laboratory for Engineering for Maintenance Systems.
- Performed Triaxial Shear Stress tests in conjunction with Hokkaido University's Rock Mechanics Laboratory on material samples to better understand the material's failure response. The resulting information will be used both as an input in the Rigid Body Spring Model and for modeling the material's response to micrometeorite impacts.
- Designed an experimental regime to measure the maximum crack width which can transfer stresses in Protein-Bound Soils.

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

In addition, as part of the Laboratory of Engineering for Maintenance Systems, I got the opportunity to take part of the laboratory's field trip to visit the construction site for one of the tunnels of the Hokkaido Shinkansen and get a tour of the maintenance facilities for the train. It was a very cool and informative trip about one of Japan's most famous infrastructure.

9. Advisor's remarks (if any):

It is a good collaborative study for both Stanford University and Hokkaido University sides. Both sides can get the new direction of their studies. Ms Isamar ROSA PLATA did both numerical and experimental studies at Hokkaido University. She could not finish what she planned to do during her stay, but she will continue both the numerical and experimental studies through close communications with me even after she leave Hokkaido University. She also participated various student activities among the advisor's student group and got close to many of them.

RESEARCH REPORT

1. Name: Charlotte Royer （ID No.: SP16054 ）

2. Current affiliation: University of Maine, US

3. Research fields and specialties:

Biological Sciences

4. Host institution: Hokkaido University, Hakodate

5. Host researcher: Dr. Hiroyuki Mizuta and Dr. Toshiki Uji

6. Description of your current research

The red alga *Porphyra umbilicalis* is well-adapted to survive in the harsh intertidal zone, but the genetic mechanisms behind its stress tolerance, and the possible influence of "helper" bacteria remain poorly understood. Bacterial-algal relationships are well-documented; bacteria support algal morphology and provide services such as producing needed vitamins. However, the identities of most associated bacteria and their influence on algal gene expression and stress tolerance are unclear. *Porphyra umbilicalis* has a fully-sequenced genome available, but there is no way to target genes related to stress tolerance and bacterial association without developing a system of stable genetic transformation. Stable genetic transformation was developed in *Pyropia yezoensis* (nori), a close relative of *P. umbilicalis*, by Dr. Toshiki Uji's research group at Hokkaido University in Hakodate, Japan. Therefore, the goal of this project is to optimize conditions for transformation of *P. umbilicalis*, and test the system using in collaboration with Dr. Hiroyuki Mizuta and Dr. Toshiki Uji. For this study, the heat shock factor (HSF) gene was chosen as a target because it governs a wide variety of stress responses in the cell and is highly conserved across all domains of life.

7. Research implementation and results under the program

Title of your research plan: Development of a system of stable genetic transformation in the red alga *Porphyra umbilicalis*

Description of the research activities: Particle bombardment was used to introduce the pyAct1-pyGUS construct, originally developed for use in *P. yezoensis* by Dr. Uji. Initially, GUS expression was observed in one or two regions of neutral spores in several trials. Two sets of tissue were treated with sulfatase and ACC to weaken the cell walls and increase bombardment success. Bombardment of tissue treated in 1 mg/ml sulfatase for 5 days at 10°C resulted in 37 transformed regions in one of the tissue sections. Bombardment of ACC-treated tissue is still underway. The sensitivity of non-transformed *P. umbilicalis* tissue to the antibiotic hygromycin B was tested to assess its use as a selectable marker. In the first set of trials, older tissue was used, and tissues in the 5.0 mg/ml hygromycin B treatment showed signs of necrosis after one week, with other treatments showing degradation at later times. A second set of trials using younger is currently in its third week, with minimal signs of necrosis, indicating tissue age may affect its sensitivity to treatment. This protocol needs further optimization, and a test of hygromycin B on young spores is planned. A real-time PCR indicated that the transformation target, the HSF gene, is expressed in low amounts during heat shock. Tissues were heatshocked for different lengths of time and cDNA was produced. An RT-PCR was conducted targeting the HSF gene, using two heat shock protein (HSP) sequences as positive controls, and using the 18s rRNA sequence as a housekeeping gene. Results indicated that both the HSF and 18s genes had an increased but overall low expression during heatshock, while one of the HSPs had higher expression. This result, coupled with the difficulty of amplifying the HSF gene using qPCR and a variety of primer sets, indicates that the HSF sequence may need further optimization.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I was able to do many things in my host city of Hakodate, such as visiting Yunokawa Onsen and attending Minato Matsuri, and I was able to see Onuma National Park, Nebuta Matsuri in Aomori, and Bon in Sapporo. I enjoyed the cultural experiences very much, and I wish I could stay longer!

9. Advisor's remarks (if any): Ms. Royer has clarified the factors influencing efficiency of transient gene expression in *P. umbilicalis*; for example, treatment with sulfatase before bombardment is important for efficient expression of reporter gene, because the cell walls from *P. umbilicalis* are thicker than those of *P. yezoensis*.

RESEARCH REPORT

1. Name: Cody A. RUIZ （ID No.: SP16055）

2. Current affiliation: Kent State University

3. Research fields and specialties:
Biological Sciences

4. Host institution: Primate Research Institute, Kyoto University

5. Host researcher: Professor Hirohisa HIRAI; Asst. Professor Masanori IMAMURA

6. Description of your current research

Haldane's Rule states that hybrid males tend to have lower fertility than hybrid females. Extrapolation leads to the prediction that Y-chromosomal gene flow is impeded relative to mtDNA and autosomal markers. However, one case of widespread Y-chromosome introgression is known in primates: the Y-chromosome of the rhesus macaque, *M. mulatta*, has spread 200+ km into the range of the cynomolgus macaque, *M. fascicularis* (Tosi *et al*. 2002). Given that a number of Y-chromosome genes are involved in spermatogenesis (Bellot *et al.* 2014) and macaques are believed to engage in high levels of sperm competition (Dixson 2012), this leads to the hypothesis that introgression of the rhesus Y-chromosome is driven by an advantageous allele(s) related to sperm production. By analyzing the DNA sequence differences of spermatogenesis and non-spermatogenesis genes on the Y-chromosomes of these two macaque species, it is possible to assess the role of sperm competition in this unique case of Y-chromosome introgression.

My research may reveal sequence differences at multiple spermatogenesis genes between the two species, or it may reveal differences at both spermatogenesis and non-spermatogenesis genes. If my work leads to either of these results, subsequent studies examining levels of protein expression would be needed to investigate critical *functional* differences between the two species. Therefore, it is important that I become familiar with techniques used in protein expression analysis, such as RT-PCR, HE staining, and immunofluorescence microscopy, in the context of primate spermatogenesis.

7. Research implementation and results under the program

Spermatogenesis studies using a primate model, the Japanese macaque (*Macaca fuscata*), will begin Spring 2016 in the laboratory of Dr. Masanori Imamura at the Primate Research Institute (PRI) of Kyoto University. Use of this species in spermatogenesis research has several advantages: it is closely related to humans and thus more likely to provide accurate extrapolations compared to rodent models; macaques are commonly used in other biomedical studies, and thus such investigation broadens our knowledge of the biology of a vital research animal. Most importantly, however, the Japanese macaque is a seasonal breeder; changes **in the testes between the breeding and non-breeding seasons will inherently identify molecular mechanisms critical to spermatogenesis**. *M. fuscata* males show suppressed testicular function in the non-breeding season – lower sperm count, reduced testicular size, reduced serum testosterone – yet full spermatogenic function returns in the breeding season (Enomoto *et al* 1994). Though previous research examined hormonal and cellular pathways involved in this phenomenon (Tokunaga *et al*. 1999; Tominaga *et al.* 1977), an understanding of the genetic and molecular underpinnings remains elusive, and has consequently inspired the work of Dr. Imamura.

My current graduate research investigates differences in macaque spermatogenesis genes at the DNA level, and I naturally have a great interest in learning the techniques for examining differences at the protein level. I have therefore requested to join Dr. Imamura's laboratory team for Summer 2016, and he has graciously accepted. Under his tutelage, **I will learn these methods, and I will examine three possible mechanisms influencing the cessation of spermatogenesis in non-reproductive macaques: (i) quiescence of spermatogonia proliferation, (ii) apoptosis of germ cells and surrounding somatic cells, and (iii) spermatogenesis arrest occurring at a specific stage**. These mechanisms have been observed in rodent models, such as the Syrian hamster (Seco-Rovira *et al.* 2015), and will serve as a starting point for addressing the molecular dynamics involved in seasonal primate spermatogenesis.

Through this research, I have gained experience in three specific techniques. First, I learned to perform Reverse Transcriptase PCR (RT-PCR) analyses of spermatogenesis genes with the goal of detailing germ cell markers and epigenetic states involved in reproductive and non-reproductive macaque testes. Second, I practiced Hematoxylin-Eosin (HE) staining techniques and applied them to samples of Japanese macaque testes from reproductively active and inactive individuals. Finally, I learned immunofluorescence microscopy and applied this technique to

spermatogenesis-related genes and epigenetic modifications. Due to some unforeseen issues with some samples, specifically the lack of information about the breeding status of some individuals, we were forced to slightly change the focus of our RT-PCR investigation. We expanded our study to include both Japanese and rhesus macaque, and we focused on reproductively inactive juveniles compared to reproductively active adults in order to gain a similar understanding of the molecular mechanisms involved in the initiation of spermatogenesis regarding these two species as age progresses.

Title of your research plan:

MOLECULAR CHARACTERISTICS OF SPERMATOGENESIS IN THE SEASONALLY REPRODUCING JAPANESE MACAQUE

Description of the research activities:

During my eight weeks at the Primate Research Institute, Kyoto University, I gained invaluable experience regarding several advanced molecular biology techniques in the context of a macaque germ cell study. First, I extracted mRNA from several samples of macaque tissue, both Japanese and rhesus macaques. These included testis, lung, liver, and kidney. Then, I learned how to reverse transcribe the mRNA into cDNA – a reaction that produces the DNA molecule containing *only* the protein-coding sequence of a gene, since much of the DNA molecule is comprised of regulatory and non-protein coding sequence. I used this cDNA to carry out a RT-PCR, which allowed me to confirm **which** spermatogenesis and germ cell-related genes are being expressed in which tissues. Secondly, I practiced immunohistochemistry staining which uses targeted antibodies that bind to the proteins produced by target genes. Using a fluorescent microscope, I was able to visualize **where** several target genes were being expressed. This technique was only used on non-breeding Japanese macaques since the tissue quality from breeding-season individuals did not yield high-quality images of gene expression. Lastly, throughout my research internship, I was able to work with Dr. Imamura and two other graduate students in the Molecular Biology section at the PRI regarding a review article on primate spermatogenesis. Given our collective knowledge on different areas of this topic, I took the lead on this review article and created a working outline which incorporates our team's expertise on various areas including germ cell development, cross-taxa mechanisms of spermatogenesis, and epigenetic regulatory dynamics. Hopefully, we can complete this review article in the fall and submit to a peer-reviewed journal of our choosing.

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

During my stay in Japan, I was fortunate enough to visit Kyushu University in Fukuoka where I gave a guest lecture on my current graduate and JSPS summer research. This was made possible by Dr. Noriko Seguchi, a biological anthropologist at KU and former NSF-JSPS host, who I was fortunate enough to meet at a conference in April 2016. I also visited wonderful cities such as Nagoya, Osaka, and Nara. I visited great, exciting places such as Deer Park, Kaiyukan, and downtown Nagoya. Both my research and cultural experiences were made public via a weekly blog format which is available on the Kent State University Dept. of Anthropology website (https://www.kent.edu/anthropology/student-blogs). Feel free to check it out for more personal and detailed accounts of my research and experiences in Japan!

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: SATTARI, Sulimon （ID No.: SP16056）

2. Current affiliation: University of California, Merced

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Hokkaido University

5. Host researcher: Tamiki Komatsuzaki

6. Description of your current research

I work on geometric techniques for studying transport in chaotic systems. Transport can refer to mixing of a fluid flow, the escape of an asteroid from the solar system, or the reaction of chemicals. A major aspect of my research is symbolic dynamics, which involves using networks to characterize trajectories. For example, a particle bouncing between disks labeled A, B, C may have some long and complicated trajectory, but its trajectory can be labeled by just using the three symbols A, B, and C. If the particle hits a certain disk, we add that symbol to its itinerary, so that if a particle hits disk C, then disk A, we label its itinerary as CA. The set of allowed symbolic itineraries is called the symbolic dynamics of the system, and can be represented by a network of allowed transitions between symbols. Symbolic dynamics is useful for computing transport rates and for understanding the complexity of dynamical systems. One of my main research goals is to show the usefulness of symbolic dynamics to study chaotic systems.

7. Research implementation and results under the program

Title of your research plan: Computing network properties of symbolic dynamics to understand chaotic transport

Description of the research activities:

My interaction in Japan was with my host advisor Tamiki Komatsuzaki, and also with two other researchers Mikito Toda (Nara Women's University) and Hiroshi Teramoto (Hitachi, formerly at Hokkaido University). My work with Prof. Komatsuzaki covers the topics I studied with Prof. Toda and Prof. Teramoto. My work with Prof. Toda involves looking at the network structure of symbolic dynamics to identify hubs, i.e. nodes that are highly responsible for transport to other nodes. Specifically, we looked at analyzing betweenness centrality for complicated networks representing dynamical systems, and we did some interesting calculations on measuring the Markov property in systems that are not fully Markov. With Hiroshi Teramoto, I worked on using mathematical theorems regarding the complexity of networks to understand how the complexity of symbolic dynamics increases as more and more geometric information is included in computing the symbolic dynamics. It is likely that one or both of these projects will lead to an upcoming publication. My daily work at Hokkaido University has involved studying networks and using computer simulations to analyze these questions, and then writing reports and discussing them with the professors.

During this trip I gave an officially scheduled talk at Hitosubashi University, hosted by Prof. Shinohara. I also presented at Waseda and Tokyo Metropolitan Universities for Profs. Harayama and Shudo, respectively. At Hokkaido I also presented my work for Prof. Yanao from Waseda University. My American advisor Kevin Mitchell (University of California, Merced) also visited Hokkaido University from 8/12 to 8/19 for a week of interesting discussions with Profs. Komatsuzaki, Teramoto, and Toda.

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

I found that working with local Japanese researchers provided a much deeper cultural experience than, for example, visiting Japan with other Americans for a holiday. By mixing with Japanese people, I feel that I learned about Japanese culture, food, and way of life much more richly than I could by any other means.

9. Advisor’s remarks (if any):

I was pleased at hosting Mr. SATTARI under this JSPS program. I also made him interact with the other researchers in Japan besides my laboratory and he absorbed quickly several techniques and ideas. I think that what he achieved during this period is publishable in the near future and provides a new bridge between the young scientific community between the US and Japan.

RESEARCH REPORT

1. Name: Katharine E. SELF （ID No.: SP16057）

2. Current affiliation: Oregon State University

3. Research fields and specialties:
Biological Sciences

4. Host institution: Hokkaido University

5. Host researcher: Prof. Hiroshi UEDA

6. Description of your current research

Salmon homing to their natal tributaries to spawn is a well-known fact. The endocrine hormonal control mechanisms of olfactory memory in juvenile and adult salmonids is also known, but less understood. This project is based on work conducted by the Ueda lab at Hokkaido University on juvenile and adult chum salmon (*Oncorhynchus keta*). We investigated the potential differences in expression of the NR1 subunit expression of the N-methyl-D-aspartate receptor (NMDAR) in both hatchery-origin and wild-origin migrating juvenile smolt Chinook salmon (*O. tshawytscha*) from the Willamette river basin in Oregon, USA. The purpose of this study was to measure and compare the expression of the NR1 and TRHa and TRHb subunits in migrating hatchery and wild Chinook salmon from Oregon, USA. Migrating hatchery and wild juvenile Chinook salmon from the Willamette river in Oregon were collected in the spring of 2016. Fish were immediately frozen, transported to Oregon State University, and stored at -80°C. The samples arrived at Hokkaido University, Sapporo, Japan on June 6th. DNA extraction commenced on July 5th. Reverse transcription analysis followed by electrophoresis occurred from mid-July to August. Next, real-time PCR was conducted in triplicate, using CHS B-actin as the reference gene. For NR1, the wild-origin group yielded a higher relative expression rate than the hatchery-origin group. The same was true for TRHa and TRHb The variation in the wild-origin group was much larger than the hatchery group which will require a separate analysis so that we may directly compare the two groups. Despite this, although it had been observed that juvenile salmon increase their relative expression of the genetic markers in question, this is the first time this comparison has been made. Because nobody in the world has compared the hatchery and wild groups

before, we hope to build on it in future projects between Oregon and Japan. Both countries deal with many similar challenges regarding hatchery supplementation and salmonid conservation and so the two are poised to continue collaboration in the future.

7. Research implementation and results under the program

Title of your research plan:

GENETICS AND OLFACTORY IMPRINTING OF HATCHERY AND WILD SALMON FROM THE PACIFIC NORTHWEST, USA

Description of the research activities:

Salmon homing to their natal tributaries to spawn is a well-known fact. Although it was first proposed in the 1950s, the driving mechanisms have become better understood recently due to pioneering work conducted by the Ueda Lab at Hokkaido University in Sapporo, Hokkaido, Japan. Using this new information on memory indicator receptors in the brain (NR1) that interact with endocrine hormones (TRHa and TRHb in addition to others), it has become possible to measure and predict the efficiency of juvenile and adult salmon imprinting abilities. By applying the same techniques, I asked whether there may be a difference between fish from the Willamette River in Oregon, USA from a hatchery-origin versus from a wild-origin population. This is an important question for my lab at Oregon State University because the hatchery fish populations, in addition to anthropogenic affects, have thwarted efforts to recover historic populations of wild salmon. By using reverse transcription and Real-Time PCR techniques, I was able to observe that on average, wild-origin fish had a higher relative expression rate than hatchery-origin fish in the case of NR1, TRHa, and TRHb. Further analysis is needed to determine the amount of difference between the groups, but because this questions has never been asked before, the findings are exciting and very possibly scientifically significant.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I thoroughly enjoyed my time living in Japan. In the summer, Sapporo is a charming city with festivals, professional baseball, and nice weather. Hokkaido Prefecture had wonderful hiking, hot springs, and small coastal towns. The Japanese people are some of the most welcoming in the world, and look forward to sharing their culture with you, whether it is through sightseeing, visiting shrines, or the outstanding cuisine that varies from town to town and region to region.

9. Advisor's remarks (if any):

I am very pleased to become the host researcher of Katharine Self who has high ambition to research "Using genetics to compare olfactory imprinting ability between hatchery and wild salmon from the Pacific northwest of the United States" that has been carried out successfully. She also presented her research plan for several times. To the best of my knowledge, she has a very bright future as an academic and successful scientist, and her experience spending as a JSPS-NSF summer program fellow will not only broaden her training, but also provide future possibilities of international collaboration that will continue throughout her scientific career.

RESEARCH REPORT

1. Name: Andrew SEN （ID No.: SP16058）

2. Current affiliation: University of Washington

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Disaster Prevention Research Institute, Kyoto University

5. Host researcher: Masayoshi NAKASHIMA

6. Description of your current research

Steel concentrically braced frames (CBFs) are used in building infrastructure throughout Japan and the West Coast of the US to resist earthquake-induced forces. Many CBFs built in seismically active regions prior to about 1990 are considered vulnerable because they do not satisfy current code requirements for strength and ductility. In addition, CBFs have become less popular in new low-rise construction in Japan because they (1) undergo severe strength and stiffness deterioration after brace buckling and (2) are relatively stiff and therefore often require expensive pile foundations to resist overturning of the structure in an earthquake. A novel brace technology developed at Kyoto University, the brace with intentional eccentricity (BIE), offers an attractive alternative for both seismic retrofit and new construction of braced frames.

The BIE utilizes elastic-stability fundamentals to control the strength and stiffness of the brace. The system is configured such that the brace centroid is offset from its line of action, coupling axial-load demand with concentrated bending moments at the brace ends. The lower stiffness of the system reduces its lateral-load demand compared to the conventional CBF, and this facilitates designs which limit beam, column, and overturning demand. Further, the BIE has less dramatic deterioration and greater deformation capacity.

Although the benefits of the BIE are clear, the seismic performance of the BIE has not been studied beyond the component/subsystem level, nor has a design methodology been established. Thus, the proposed research seeks to evaluate seismic performance using state-of-the-art nonlinear dynamic analysis of a realistic building with BIEs. This work both leverages and builds upon my current doctoral research on the seismic performance

and retrofit of older CBFs in the US.

7. Research implementation and results under the program

Title of your research plan:

Seismic Performance of Vintage Japanese Braced-Frame Buildings Before and After Retrofit

Description of the research activities:

In collaboration with Prof. NAKASHIMA and post-doctoral, doctoral, and master's students, numerical models were developed to simulate both conventional CBFs and BIE frames. The BIE modeling approach was validated using experimental results from recent testing at Kyoto University, and these analyses demonstrated a need for additional experimental data necessary to simulate frame response through brace fracture and to collapse. Subsequently, three-story building models were developed and subjected to scaled sets of 44 ground-acceleration records in order to compare seismic performance at pre-fracture damage states using various brace eccentricities. These efforts have provided a sound modeling framework that can be readily adapted for future studies and have helped define practical BIE design procedures. Additional research activities included (1) attending a regional structural engineering conference, (2) assisting in the revision of a relevant academic journal article, and (3) assisting in various structural laboratory activities, including preparation for future BIE experiments.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): The opportunity to work with Japanese students and professors has provided great insight into Japan's approaches to academia and life. I was eager to learn about Japanese culture, and my colleagues reflected this eagerness while demonstrating sincere hospitality. In addition, during my stay, I was fortunate to experience life in Kyoto and visit Osaka, Nara, Kobe, Shirahama, and Hiroshima. In all, the JSPS Summer Program has allowed me to develop a deeper understanding of Japan's impressive history and modern outlook. With this broader world perspective, I look forward to strengthening the new connections I have made with researchers and friends in Japan.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Carter S. SMITH （ID No.: SP16059 ）

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

3. Research fields and specialties:
Biological Sciences

4. Host institution: Hokkaido University

5. Host researcher: Prof. Masahiro NAKAOKA

6. Description of your current research

Coastal habitats (e.g. seagrasses, salt marshes, mangroves, and oyster reefs) are extremely valuable biomes that provide a host of services to humans including wave attenuation during storms, carbon sequestration, and the provisioning of nursery habitat for commercially important fish and invertebrates. Unfortunately, most of these habitats have been greatly degraded as a consequence of human activities, with one of the more recent threats being the rapid growth of aquaculture. Like the rest of the world, Japan has experienced declines in catches of major coastal fishery species, and in response to this problem, aquaculture has become an increasingly popular way to meet seafood demands. It is estimated that as much as 50% of global fishery harvests are currently coming from aquaculture rather than wild stocks. While aquaculture can provide a viable means for producing the seafood that the global population relies on, more research is needed to elucidate the effects of aquaculture on coastal ecosystems and to determine the least harmful techniques. In particular, this project investigates the effects of long-line oyster aquaculture on *Zostera marina* seagrass beds in Northern Japan. Despite widespread introduction of oyster aquaculture enterprises into shallow bays with seagrass, relatively few studies have quantified the effects on seagrass beds, and none have examined differences in epifaunal community composition, which could have cascading effects on the food chain and overall ecosystem functioning. Our preliminary results suggest that aquaculture reduces seagrass stem height and biomass directly under and adjacent to aquaculture lines, and that high-density aquaculture has a stronger negative effect than low-density aquaculture.

7. Research implementation and results under the program

Title of your research plan:

Density matters: Assessing the impacts of oyster aquaculture on *Zostera marina* eelgrass beds

Description of the research activities:

To determine the effects of oyster aquaculture on the growth, morphology, and epifaunal community development of seagrass beds, we sampled *Zostera marina* in Akkeshi-Ko estuary, Hokkaido, using: 1) a randomized sampling design in control seagrass beds, and low and high-density aquaculture areas; and, 2) a Control Impact (CI) design between aquaculture and natural seagrass beds. We quantified water column nutrients, water column Chl-A, seagrass morphology, seagrass density, epiphyte Chl-A, and epifaunal community.

Preliminary results suggest that oyster aquaculture does have a negative effect on *Zostera Marina*, and that the magnitude of this effect varies based on the density of surrounding oyster lines. Seagrass in high-density areas consistently had lower biomass than control areas. Future results will illuminate if oyster aquaculture has any effect on the epifaunal community.

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

I have thoroughly enjoyed my time at the Akkeshi Marine Station and I hope to return some day soon. Highlights were exploring the natural wonders of Hokkaido, partaking in local festivals, and collaborating with all the researchers and graduate students at the lab.

9. Advisor’s remarks (if any):

I have enjoyed hosting Carter and working with her about one of the most important topics in Marine Conservation Ecology. The daily discussion and communication stimulated our graduate students in my lab to study further about their own research, and improve their motivation for more international communication.

RESEARCH REPORT

1. Name: Samuel SPEVACK （ID No.: SP16060 ）

2. Current affiliation: University of California, Merced

3. Research fields and specialties:

Cognitive and Information Science

4. Host institution: Kyoto University

5. Host researcher: Jun SAIKI

6. Description of your current research

The aim of my research is to understand the cognition differences between people in Japan and the USA. Particularly, a robust number of studies have shown that people in Japan and the USA show differences in how they view the environment. For example, while people both in Japan and the United States are more likely to attend to objects in the foreground than the background of a visual scene, several studies show that people in the United States attend more to objects in the foreground than people in Japan. Many believe that these differences are caused by overall differences in the social structures and social values belonging to Japan and the USA. However, differences in language and physical environment may also cause these cognitive differences.

To explore the underlying causes for visual attention differences between people in Japan and the United States, I conducted an eye-tracking experiment. The experiment measured eye movements as they looked at computer presented visual scenes. I also gathered each individual's alignment towards individualism-collectivism, linguistic background, and their familiarity with particular physical layouts of cities in Japan and the United States. These data will be used to show how these particular individual differences account for the gross differences between people in Japan and the USA.

7. Research implementation and results under the program

Title of your research plan:

Investigating how Social Values, Language, and Physical Environment Explain Differences in how People in Japan and the United States Look at Visual Scenes

Description of the research activities:

As part of my research at Kyoto University, I have done the following things: I finalized all of the computer code that runs my experiment. I worked with graduate students in my host lab to translate my experiment materials from English into Japanese. For my experiment, I intended to gather data from 40 participants. I have surpassed that goal, and have collected data form a total of 50 participants. Data analysis is still in progress.

In addition to my experiment, I have also had the opportunity to participate in many research related events. I have gone to many of my lab's weekly meetings and have met with other graduate students several times throughout the summer. In addition, I have met with other researchers at Kyoto University whom I wish to begin collaborations with.

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

I have seen many temples and shrines while in Kyoto. I have also been able to improve my Japanese, having the opportunity to speak Japanese with other graduate students in my lab.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Elizabeth Colette Thompson （ID No.: SP1612833）

2. Current affiliation: Department of Geophysical Sciences, University of Chicago

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Geodynamics Research Center, University of Ehime, JAPAN

5. Host researcher: Dr. Jun Tsuchiya

6. Description of your current research

I study material properties under high pressure and high temperature conditions to better understand the constitution and evolution of planetary interiors. I am currently working on laser-heated diamond anvil cell experiments to investigate the distribution and cycling of volatiles in the deep Earth using X-ray diffraction (XRD), nuclear resonance inelastic X-ray scattering (NRIXS), and high-pressure infrared spectroscopy. My research at the University of Ehime aims to compliment these experiments using Density Functional Theory base calculations to better understand the properties of hydrous mantle phases at high pressure. By combining these computational and experimental methodologies we can more accurately describe the surprisingly large effect that pressure-induced hydrogen bond symmetrization has on the bulk properties of hydrous mantle minerals. By systematically describing the influence of proton behavior on seismic observables such as density and sound speeds, we can better constrain the water budget of our inner planet.

7. Research implementation and results under the program

Title of your research plan:

Evaluating the elasticity of phase ε-FeOOH as a function of pressure

Description of the research activities:

This project aims to provide critical insight into the deep Earth's hydrogen budget via three *ab initio* investigations into key hydrous mantle phases: (1) determining the stability of FeOOH as a function of pressure, (2) determining the elasticity of FeOOH, and (3) first-principles calculations of the vibrational properties of aluminous phase D as a function of pressure. The first two calculations help to determine the possible water budget of the Earth's lower mantle by giving us insight into the potential solid solution formed between phase H ($MgSi_2O_4H_2$), δ-AlOOH, and ε-FeOOH. The third calculation is important for determining the effect of hydrogen bond symmetrization on the bulk properties of a hydrous mantle phase (phase D) that may usher water through the transition zone. These calculations are complementary to the principal investigator's experimental efforts to investigate hydrous phases under extreme conditions and will help constrain the water budget of the Earth's deep interior.

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

I attended an international conference held in Yokohama (Goldschmidt Conference), as well as a summer school held jointly between my host institution and several other Japanese universities.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Henry Tucker （ID No.: SP16062 ）

2. Current affiliation: University of Southern California

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Kyoto University

5. Host researcher: Masaki IZUMI

6. Description of your current research

The study of fusion categories and their invariants is the theme of my ongoing research program. These are mathematical objects generalizing the properties of complex representations of finite groups. My particular interest focuses on computation of the categorical Frobenius-Schur (F-S) indicators, a numerical invariant of fusion categories generalized from the classical indicators introduced in 1906 by Frobenius and Schur. An important question asks what families of fusion categories are completely determined by their indicators. In my Ph.D. thesis I established formulae for the F-S indicators of near-group and Haagerup-Izumi fusion categories, two important classes of singly-generated fusion categories, and in the process established new families of fusion categories (in the near-group class) which are determined by these invariants.

These results were made possible directly by methods and results of M. Izumi. In more recent work, Izumi has established further classification results for near-group fusion categories whose groups of invertible objects are non-abelian. This had lead to new questions regarding the indicators for these categories, as well as their respective realizations.

7. Research implementation and results under the program

Title of your research plan:

Realizations and Frobenius-Schur indicators for non-commutative near-group fusion categories

Description of the research activities:

By recent results of M. Izumi, any near-group fusion category with noncommutative tensor product must have a group of invertible objects isomorphic to an extra-special 2-group. The smallest examples are those with group of invertible objects the quaternion group or the dihedral group of order 8. In fact, Izumi showed that, for each extra-special 2-group, there are 3 inequivalent fusion categories with isomorphic group of invertible objects. He further showed that the categories associated to each of these groups are distinguished by the third FS indicators, and he conjectured that, for each possible rank (i.e. for each extra-special 2-group of order 2^{2k+1} for integers $k>0$) the associated non-commutative fusion categories are parametrized by the third cohomology group $H^3(S_3, C^*)$ where S_n is the symmetric group on n letters. Together we are working toward establishing this result by first realizing the smallest rank non-commutative near groups as Morita duals of the pointed fusion categories $Vect(S_4, w)$ where w is a 3-cocycle in $H^3(S_4, C^*)$. We utilize the Frobenius-Schur indicators of these Morita duals to establish that we have indeed obtained a complete set of equivalence classes corresponding to this minimal rank (i.e. with group of invertible objects order 8); in this case the FS indicators provide the parametrization desired in the context of the 3-cohomology group for S_3. This result will generalize to the higher order extra-special 2-groups by taking advantage of the structure of a certain subgroup of the degree 2+k special linear group over the finite field of order 2 which provides a convenient realization of an important subgroup from Izumi's classification result for which our parametrization 3-cocycle is expected to be trivial. This combined with the fact that every extra-special 2-group can be obtained as a free product of quaternion groups and order-8 dihedral groups will extend the minimal rank case to obtain the desired result.

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

In Japan I tried many different local cuisines, visited a number of major cultural sites, befriended a number of Japanese people as well as other international visitors to Japan, and learned a great deal about the everyday life experience of living in Japan. In addition to being professionally productive my time in Japan was an extremely personally enriching experience.

RESEARCH REPORT

1. Name: Allen WASHINGTON （ID No.: SP16063 ）

2. Current affiliation: University of California, San Diego

3. Research fields and specialties:

Biological Sciences

4. Host institution: Kyushu University

5. Host researcher: Prof. Hiroyuki SASAKI

6. Description of your current research

I am currently investigating the mammalian cell response to stress signals and growth factors that mediates recruitment of immune cells into damaged or abnormal tissues. Specifically, I am interested in interleukin-17D, a cytokine our lab previously found to mediate recruitment of immune cells, such as Natural Killer cells, into sites of tumor growth. Although the induced genes and the cognate receptors for IL-17A, B, C, E, and F are known, physiological function and target cells of IL-17D-mediated cell signaling are poorly defined. My research focuses on molecular approaches to identify the receptor for IL-17D and also to further characterize the function of IL-17D in immunogenic responses.

7. Research implementation and results under the program

Title of your research plan: Comparison of early response genes induced by Interleukin-17D using next generation sequencing of mRNA

Description of the research activities:

The project utilized molecular biology and cell culturing techniques to analyze the genes induced in cell lines stimulated by interleukin-17D. Two commercially available mouse cell lines, endothelial (SVEC) and melanoma (B16) cells, were cultured in nutrient rich medium; cells were serum-starved prior to stimulating the cells with 100ng/mL interleukin-17D or 17A (from R&D). The stimulation assay was conducted in triplicates. Triplicate samples were combined to form one biological replicate for RNA extraction. Two biological replicates per condition were prepared for two different cell lines each. In order to choose the best time point for analysis, mRNA was also separately checked for transcript levels of IL-17A-induced genes such as Ccl2 and Cxcl1 after various time points. Extracted mRNA quality was checked with Bioanalyzer (Agilent) and library construction was conducted following protocol using magnetic beads for purification of desired products (Illumina). Quantity of cDNA was calculated by dilution method using quantitative PCR. Illumina Hi-seq was used to run the sequencing of the indexed library. The raw data were processed for quality, specificity, and differentially expressed genes using bioinformatics tools such as FastQC, TopHat, and Cufflinks through Linux. The differentially expressed genes were filtered and visually expressed through programs such as Cuffdiff and CummeRbund to create graphs and heatmaps.

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

I’m grateful for JSPS for funding this program so that we can venture abroad to Japan to experience the wonderful culture while gaining new scientific and cultural insights. The contacts that I’ve made during this stay will certainly lead to future collaborations and post-doctoral opportunities in the near future.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Whitney WEBRE （ID No.: SP16064 ）

2. Current affiliation: University of North Texas

3. Research fields and specialties:

Chemistry

4. Host institution: National Institute for Materials Science

5. Host researcher: Dr. Jonathan HILL

6. Description of your current research

Within a decade or two fossil fuel supplies will be depleted leaving only alternative renewable energy sources to fulfill the world's energy needs. Solar energy is an ultimate renewable energy source due to the large magnitude of its availability and harvesting can be accomplished by building molecularly engineered donor-acceptor hybrids that undergo efficient electron transfer. Converting solar energy into electricity or fuel is particularly important due to limited fossil energy resources and the environmental problems they cause. It is hypothesized that utilization of these molecular systems in building donor-acceptor assemblies will generate supramolecular systems that will yield the much desired long-lived charge separated states. Of such systems, calix[4]pyrroles make up a class of compounds that have been intensively studied for purposes of anion binding because of simple, high-yielding synthetic procedures including a wide range of modifications, which can be used to improve anion binding selectivity or connected to donor-acceptor assemblies for more efficient electron transfer. Porphyrin analogues synthesized by NIMS collaborators: Dr. Jonathan Hill and Dr. Thien H. Ngo are analyzed at the University of North Texas in the United States where a variety of physico-chemical methods including optical absorbance and emission, guest binding, electrochemistry, and spectroelectrochemistry are performed. Photoinduced electron transfer of these systems are also investigated using time-resolved emission, and transient absorption techniques operating under varying time scales.

7. Research implementation and results under the program

Title of your research plan:

Anion Binding Directed Supramolecular Donor-Acceptor Assemblies for Photoinduced Charge Separation

Description of the research activities:

Two porphyrin compounds, bis-porphyrin-substituted-1,1-binaphthyl, that are enantiomers (mirror images of the same compound) were analyzed this summer using electronic absorbance and circular dichroism (CD) spectrophotometry. By adding small amounts of chiral acid guests to each of these enantiomers until completion of reaction, changes in the absorption wavelengths spectrum and chirality could be observed. The chiral acid guest protonates the chiral porphyrins and the titration was observed in the wavelength range 250 – 800 nm. Differences in acidity of the chiral guest resulted in different phenomena in the CD spectra. These results lay the groundwork for studies of the role of chirality in photoinduced charge separated states of related complexes of these compounds.

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

Working at NIMS has been a wonderful opportunity. The labs consist of many different nationalities and working with people of different cultures has been a unique experience that will aid to my future endeavors. Working directly with a collaborator has provided me with unique techniques I will be able to bring back to America and teach my own lab. Learning about Japan`s culture through language class, staying with a host family, all of the class opportunities provided by my apartment complex (Ninomiya House), and traveling on the weekends and Obon have led to a one of a kind experience that I will never forget.

9. Advisor’s remarks (if any):

This is a challenging project in both conceptual and experimental terms. The work performed this summer provides important in depth basic data about the systems studied

,RESEARCH REPORT

1. Name: Misa YASUMIISHI （ID No.: SP16065）

2. Current affiliation: University at Buffalo, New York

3. Research fields and specialties:

Environment and Globe (that was my poster session category. Otherwise, Social Science or Interdisciplinary and Frontier Sciences)

4. Host institution: University of Tokyo

5. Host researcher: Dr. Taku NISHIMURA

6. Description of your current research

The primary purpose of my current research is to understand the interaction between radioactive cesium levels in the environment and the land management practices following a nuclear plant accident, specifically in Fukushima, Japan in 2011. Understanding the interaction requires various data including solid field data, topological and climatic data, the background of policy decisions, and the residents' quality of life afterwards. Human interventions to mitigate radiation contamination in the fluid and vast natural environment face tremendous challenges in terms of their effectiveness. Proceeding with such mitigation measures while cooperating with local residents is another challenge. Still we need to figure out the best way possible to assess the effectiveness of those measures to learn from this accident.

For scientific data, GIS is one of the tools which we can utilize to analyze this kind of complicated scenarios comprised of environmental processes and human interventions. However, there are areas which technology is not able to assess – for example, a loss of permanent housing or a loss of lifetime work and policy limitations. My goal is to merge both aspects, scientific data and 'non-calculable' aspect, with the help of GIS and ontology. Hopefully, the result of my research will contribute to mitigate the future environmental and social challenges following a similar disaster.

7. Research implementation and results under the program

Title of your research plan:

Radioactive cesium levels in the environment and their interactions with post-disaster land management.

Description of the research activities:

As a first stage of my research, I aimed to conduct field work to measure the current cesium levels in the affected areas. Also, I aimed to conduct information gathering by interviewing local officials who have been involved in the post-accident policies. Observing how Japanese researchers are conducting environmental research in Fukushima after the accident as well as observing the current situation in the affected areas were another important objects during my stay. Although I was stationed in Tokyo, thanks to the cooperation by my host and other researchers, I could visit Fukushima more frequently than I had expected and could collect many soil samples. In addition to soil sampling, they kindly arranged meetings with the local government officials as well as informal visits to local farmers. The cesium levels of collected samples were tested for radiation level at a facility on the host campus and the additional data was obtained in their lab. Although the collected data is yet fully analyzed, preliminary results indicate that I will be able to obtain meaningful insights for my research.

8. Advisor's remarks (if any):

Ms. Yasumiishi had put a lot of effort in preparing and executing the tasks during her field trip. About half way through her visit, I had a teleconference with her joined by the two local professors collaborating closely with her: Dr. Osawa and Dr. Nishimura. The meeting was very productive and we all four are looking forward to continue our collaboration and efforts to find continued funding. Without Ms. Yasumiishi's efforts this international collaboration would have not been possible. Chris S. Renschler, University at Buffalo (advisor).

RESEARCH REPORT

1. Name: Kellie BINDER （ID No.: SP16 101）

2. Current affiliation: University of Cambridge

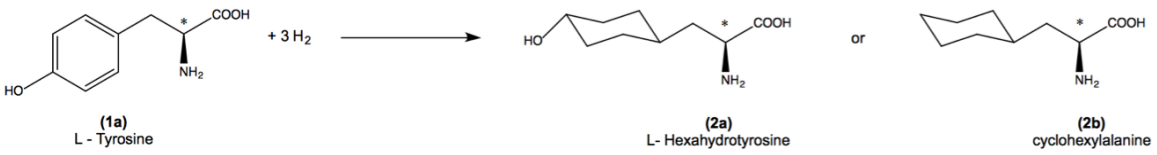
3. Research fields and specialties: Chemistry

4. Host institution: Nagoya University

5. Host researcher: Prof. Ryoji NOYORI

6. Description of your current research

Unnatural amino acids are of growing importance in pharmaceuticals and peptide chemistry for the modification of biopolymers. Of the aromatic amino acids, phenyl alanine, tryptophan and tyrosine; the latter (**1a**) is the most challenging for aromatic hydrogenation to give **2a** as the benzylic alcohol is often lost (~ 50%) giving significant impurities that are hard to separate (**2b)**. Furthermore, the stereochemistry of amino acids is crucial to its functionality, catalytic reactions where stereochemistry is maintained is often achieved with enzymatic or molecular catalysts.



(1a) L - Tyrosine **(2a)** L- Hexahydrotyrosine **(2b)** cyclohexylalanine

When considering industrial scale synthesis, enzymatic or molecular catalysts are not suitable due to poor recyclability and separation. Therefore, the screening of new solid (heterogenous) catalysts is of crucial importance in spite of them often needing harsher reaction conditions and longer reaction times. Studies have shown that the mixing of two metals to form an alloy nanoparticle can have superior properties than the equivalent mono-metallic counterparts but to our knowledge, bimetallic alloys have not been used for the hydrogenation of tyrosine. Work we have previously done has shown ruthenium nanoparticles on a chitin support to be a promising catalyst for the hydrogenation of aromatic species in water. I have spent my time at Nagoya and with the JSPS trying to tackle this issue with Ruthenium and ruthenium metal alloy particles on various support materials.

7. Research implementation and results under the program

Title of your research plan:

The application of metal alloy nanoparticles on solid supports for the aqueous phase selective aromatic hydrogenation of L-Tyrosine.

Description of the research activities:

Throughout my time at Nagoya I have synthesized mixed metal nanoparticles, focusing on ruthenium and rhodium on chitin, Al_2O_3, SiO_2, graphene oxide and activated carbon. I have screened these individual catalysts for their activity and selectivity for the hydrogenation of L-tyrosine under acidic, basic and neutral reaction conditions. Using H^1 NMR of the crude product it is possible to estimate how much of the alcohol remains and the extent of conversion to the hydrogenated product. Preliminary work has shown conversions and selectivites exceeding values reported in literature, however additional techniques are needed to support this claim. In addition, activity and selectivity is shown to be dependent on the composition of the metals and the support used. As an example; Ru/chitin shows a conversion of ~70%, however $Ru_{0.9}Rh_{0.1}$/chitin is improved to >95% under the same conditions. The increase in activity can be taken advantage of to either shorten reaction duration and reducing cost or to use milder reaction conditions; improving the likelihood to retain stereochemistry.

I plan to continue this work in Cambridge to study the structural variations between successful catalysts of various compositions in addition to developing new methods for the purification and analysis of products.

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

During my homestay experience I was fortunate to stay with a young family, I have learnt a lot about traditional living, Japanese cooking, and used my time to practice Japanese with my host parents. I participated in HIPPO language classes, I met so many friendly people and enjoyed helping adults and children learn English. I have a black belt in taekwondo and have enjoyed learning the subtle differences and rich history with karate in the local dojo. The atmosphere of a research group in Japan is a unique experience, they are driven and helpful, I look forward to coming back soon.

RESEARCH REPORT

1. Name: Elizabeth M. BYRNE （ID No.: SP16102）

2. Current affiliation: MRC Cognition and Brain Sciences Unit; University of Cambridge

3. Research fields and specialties:

Social Sciences (Psychology)

4. Host institution: Graduate School of Education; Kyoto University

5. Host researcher: Prof. Satoru SAITO

6. Description of your current research

Working memory (WM) is a key cognitive function that allows individuals to temporarily store and manipulate information during the course of ongoing mental activities. It plays an important role in learning and is crucial for many everyday tasks. Impairments in WM are common in many developmental disorders and poor WM is associated with slow academic progress in school. Therefore, identification and remediation of WM problems is increasing in clinical and educational practice. A number of studies have shown that intensive and adaptive training on computerized WM tasks boosts performance on trained and untrained WM measures. However, gains on untrained tasks are only found when there is substantial overlap in the processes involved with the training and transfer tasks. There is little evidence that these training-related gains generalize to WM tasks that involve different processes to the training activities, or extend beyond laboratory-style WM tasks to improvements in everyday functioning. For WM training to be considered an effective therapeutic tool for enhancing WM performance in everyday tasks, it is necessary to establish methods that promote the transfer of training gains. My current research in Cambridge focuses on the development of interventions which can enhance transfer of the learning observed during training to other WM paradigms. A commonly used WM measure and training task is N-back. In this task, individuals are presented with a continuous list of items (e.g. digits) one at a time and must report whether the current item matches the one that was presented *N* items ago in the sequence. During N-back information must be continuously updated as it is being presented, and performance requires flexible and rapid binding and unbinding of items to their position in the sequence. Although often viewed as the ‘gold-standard’ WM measure within the fields of psychology and cognitive neuroscience, very little research has been conducted to investigate the underlying mechanisms involved in N-back performance. In order to develop more effective interventions, it is important to establish what mechanisms are involved in different WM tasks so we can isolate the specific cognitive processes that might be important for learning, or be amenable to training.

7. Research implementation and results under the program

Title of your research plan:

Investigating the contribution of familiarity and recollection for item recognition during a visual N-back task using feature lures

Description of the research activities:

Recently, it has been proposed that two separate processes operate during item recognition in N-back. The first is familiarity, a fast automatic process which provides information on whether an item has been encountered before. The second is recollection, a controlled process which also provides contextual information. During my time at working in Prof. Saito's lab at Kyoto University we have been investigating the contribution of these two processes to N-back performance using feature lure trials in a visual 2-back task. The stimuli used in the task were visual objects made up of a combination of two features (colour and shape). Feature lures shared one component feature with the current item (i.e. an object with the same colour but different shape, or vice versa) and were presented at either N+1, N or N-1 position. We developed an N-back paradigm run by Matlab and have collected data from 40 participants. We are currently analysing the data and preparing the study for publication. We have also made plans to run further follow-up studies and I am keen to continue my collaboration with Prof. Saito on my return to Cambridge.

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

I have really enjoyed my time in Japan and it has been a pleasure to work in Prof. Saito's lab. In my spare time I had the opportunity to visit many of the temples and shrines in and around Kyoto, my favourite being Fushimi Inari Shrine. I also experienced festivals such as Gion Matsuri and Toro Nagashi, and have travelled to other parts of Japan including Nara, Osaka, Himeji, Hiroshima, Miyajima Island, Kamakura and Tokyo.

9. Advisor's remarks (if any):

It was real pleasure for us to host Ms Byrne's visit to Kyoto. She attended our weekly lab meetings and participated enthusiastically in academic discussions. We also held regular meetings on Tuesday and occasional additional meetings for her research project, which progressed to a level of a remarkable achievement. I would like to note that the presence of her stimulated our members and certainly had positive influences to our lab activities.

RESEARCH REPORT

1. Name: Jonathan Farmer （ID No.: SP16 103）

2. Current affiliation: Wolfson School of Mechanical, Electrical and Manufacturing Engineering; Loughborough University

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Yusuke Miyazaki

6. Description of your current research

My research area is concerned with brain injuries arising from impacts within sports. Specifically, I am interested in the mechanism of injuries and the personal protective equipment, such as helmets, used to reduce or mitigate the risk of sustaining them. Current testing of this equipment is limited and is not externally valid, i.e. it does not suitably represent the conditions that the equipment will be subjected to during use by the athlete.

The test methods typically employ a human surrogate dummy (Hybrid III) that was originally designed for frontal car crash experiments. It is known that this dummy is unsuitable for the complex, multi-degrees of freedom impact scenarios typically witnessed within many sports. The methodology currently requires the helmet to reduce the peak linear acceleration by some value that is related to the risk of sustaining an injury. Whilst peak linear acceleration has been well linked to traumatic brain injuries such as skull fractures, it has recently been proposed that a combination of rotational and linear accelerations are responsible for mild traumatic brain injuries such as concussions. It is therefore imperative that the fundamental mechanism of the traumatic brain injuries that the equipment is protecting against are understood, in order that the equipment can offer full protection to the athlete.

My research aims to understand the relationship between the neck and the response of the brain to typical impact scenarios. The main outcome is expected to be a superior human surrogate neck that is more biofidelic in nature than that currently used.

7. Research implementation and results under the program

Title of your research plan: The response of a novel surrogate head when combined with a novel surrogate neck and a commercially available surrogate neck

Description of the research activities: Miyazaki-sensai of Tokyo Institute of Technology previously developed a novel surrogate head. The head has the capability of direct visualization of relative brain-skull motion. A novel surrogate neck was developed at Loughborough University with varying range of motion, matched to published data from recent radiographic studies.

The head was combined with the new neck and also the commercially available, Hybrid III neck to experimentally represent the backward break fall technique used within Judo. This technique, when performed incorrectly, is known to present risks of severe traumatic brain injuries such as acute subdural hematomas to the athletes.

Three dimensional trajectory of the brain and skull markers gathered with two high speed video cameras will be analysed. It is hypothesized that the relative displacement will increase with increased range of motion of the neck. A six degree of freedom accelerometer was also mounted to the surrogate head. It is hypothesized that the rotational velocity of the head will increase with the range of motion of the neck.

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

My experience in Japan has been one of the most memorable of my life to date; not only due to the impressive attractions but also because of the kind and welcoming nature of the Japanese people, both inside the work environment and outside. As an obsessed road cyclist, the climb to the 5^{th} station of Fuji-san has always been a dream. This summer I achieved that dream! Thank you very much to everybody involved with the program, you did a fantastic job.

RESEARCH REPORT

1. Name: Amelia Jane Gully （ID No.: SP16104 ）

2. Current affiliation: University of York

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Nagoya Institute of Technology

5. Host researcher: Prof. Keiichi TOKUDA

6. Description of your current research

Synthetic speech is becoming more and more prevalent, and while its naturalness is improving, synthesized speech has yet to be mistaken for a real human speaking. This has important consequences for assistive and communication technologies and human-computer interaction.

In my work I make use of magnetic resonance imaging (MRI) data of the head and neck to establish the shape of the vocal tract during the production of speech sounds. These shapes are converted to detailed, three-dimensional grids and a numerical acoustic modelling technique called the digital waveguide mesh (DWM) is used to model acoustic wave propagation through the vocal tract, resulting in synthesized output speech that is highly natural sounding. In particular, my work has focused on techniques allowing this model to move, creating elements of running speech with the natural properties of real speech. However, at present, the nature of these movements is not clearly known and must be painstakingly programmed by hand.

At Nagoya Institute of Technology, models have been developed that determine the dynamic acoustic properties of output speech based solely on statistical parameters of input text. These models therefore represent a potential control system for the acoustic model of the vocal tract, and this project aims to investigate this relationship.

7. Research implementation and results under the program

Title of your research plan:

Improving the naturalness of statistical parametric speech synthesis using MRI-based vocal tract models

Description of the research activities:

Research has focused on the possibility of using machine learning techniques to directly estimate the parameters of the numerical acoustic model from written text, doing away with costly and time-consuming MRI scans altogether. To this end I have developed my programming skills in Python, and particularly the TensorFlow machine learning library, in making my existing models fit within the machine learning framework. Not only has this helped me to see my own work in a new way, but the models we have created show great potential to improve synthetic speech, and the collaboration will continue as we develop and fine-tune the combined model.

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

I have very much enjoyed my stay in Japan. I have visited Kyoto, Nara, Kobe, and Tokyo several times. I have attended a small festival with a local family, and a large festival in Kyoto, done martial arts training with a Grandmaster, and visited many beautiful castles and shrines. I have also had the opportunity to make an academic visit to Konan University. In particular, I have enjoyed trying all the different kinds of delicious Japanese food. I am so grateful for this opportunity, and cannot wait to return to Japan in the future.

9. Advisor’s remarks (if any):

The research topic was really challenging but Amelia enthusiastically tackled on the problem and we could build a base of the new approach. I hope that it would progress to a future collaborative project.

RESEARCH REPORT

1. Name: Harry M. O'Brien （ID No: SP16106）

2. Current affiliation: University of Bristol

3. Research fields and specialties:

Chemistry

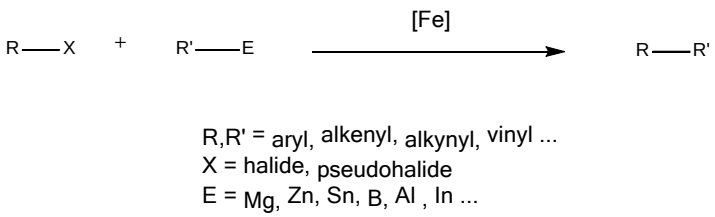
4. Host institution: Kyoto University

5. Host researcher: Professor Masaharu Nakamura

6. Description of your current research

Transition-metal catalysed cross-coupling reactions are ubiquitous in modern day synthesis. Many chemical transformations of this type rely on precious metal architectures, with palladium in particular having a dominant presence. It has become clear however that cheaper and more practical alternatives to this precious metal are required as palladium is both a finite resource and toxic. This poses a particular problem in the industrial synthesis of pharmaceutical compounds where the drug has to be extensively purified make sure no heavy metals are present in the final product. In response, iron has arisen from a period of dormancy to be seen as a prospective alternative since it is cheap, abundant and inherently less toxic.

At the University of Bristol, I focus on the development of new iron-catalysed C—C bond forming reactions:



The basic premise of these types of reaction involves the coupling of an organometallic nucleophile with and organic electrophile (in my case a moiety with a carbon-halide bond) in the

presence of a small amount of iron pre-catalyst. We also utilise mechanistic studies to help guide our research which often provides important insight into new transformations.

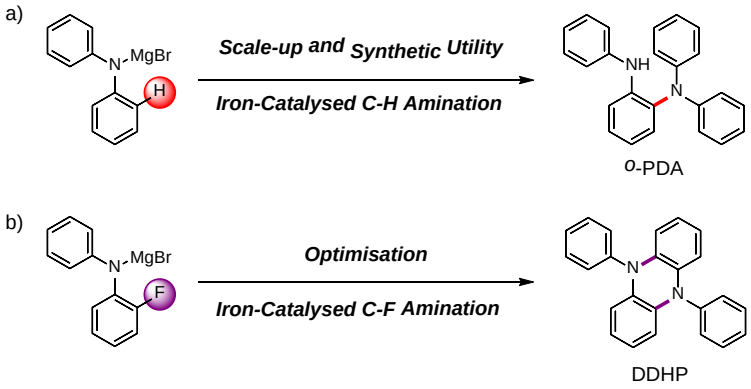
7. Research implementation and results under the program

Title of your research plan:

Iron-Catalysed C-H and C-F Amination of Diarylamines.

Description of the research activities:

During my stay in Japan, I had two main research objectives. The first was to develop a facile multi-gram scale synthesis of *o*-PDA (which shows promise as an antibiotic and photoluminescent) *via* an iron-catalysed C-H amination reaction. The second objective was to optimise an iron-catalysed C-F amination reaction affording DDHP, a type of compound showing huge promise as a hole-injection material in the field of organic electronics.



Development of the multi-gram scale C-H amination reaction was a success, achieving a high isolated yield of the intended product on a 10 g scale, showing the synthetic utility of this highly desired transformation.

The optimisation of the iron-catalysed C-F amination reaction to obtain DDHP in synthetically viable yields was also achieved. Also, reactions were carried out to probe the involvement of certain materials in the transformation, the results of which have opened up new avenues for further exploration which will undoubtedly be investigated in the future.

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

The JSPS Summer Program has been a fantastic experience which I would heartily recommend. Professor Masaharu Nakamura and his group have been extremely welcoming and have entertained me with many activities and trips including dinners, drinks, festivals, aikido lessons and various adventures in the wonderful city that is Kyoto. I also look forward to seeing one of the group members again who intends to carry out a short research project with my group in Bristol.

RESEARCH REPORT

1. Name: David Webb （ID No.: SP16107）

2. Current affiliation: School of Marine Science and Technology, Newcastle University

3. Research fields and specialties:

Biological Sciences

4. Host institution: Akita Prefectural University

5. Host researcher: Professor Keiju Okano

6. Description of your current research

My current research in Newcastle relates to the biochemical characterisation and heterologous expression of the permanent adhesive of barnacle cypris larvae (cyprids). This bioadhesive is used by free swimming barnacle larvae to attach permanently in their adult location and adopt a sessile lifestyle. The mechanism of this bioadhesive is of significant interest in the development of synthetic barnacle-inspired adhesives and improved non-toxic marine antifouling coatings to prevent barnacle settlement on artificial surfaces such as ship hulls. The gene (and corresponding protein) sequences that I am investigating have been provided by Prof Okano and so to collaborate with him directly as part of this programme has been invaluable for me.

7. Research implementation and results under the program

Title of your research plan:

Investigation of barnacle cyprid permanent adhesive

Description of the research activities:

The research I have undertaken has principally focused on cloning putative barnacle adhesive genes from cyprid cDNA samples. Several adhesive protein candidates have been previously identified through next generation transcriptome sequencing. With these sequences I firstly designed a cloning strategy for isolating clones (physical DNA copies) of the desired genes and incorporating them into bacteria. This involved designing primers for a 'fastcloning strategy', which were used to PCR the desired genes from a cDNA pool with overhangs for homologous recombination into a bacterial plasmid. Through this method I have successfully cloned three of the genes (lcp60k, plcp19k and plcp22k) into the pUC19 vector which was confirmed by sequencing. The three clones of lcp60k that were sequenced showed some single nucleotide differences and one has a deletion although it is not clear if these are biological differences such as SNPs and alternate transcript splicing or artefacts. I was unsuccessful in cloning full length lcp110k, a much larger gene, which may highlight limitations of the fastcloning method. All the plasmids created can now be taken back to Newcastle for further study.

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

Along with its scientific merits this programme has been an amazing cultural experience. A special thanks to Okano-sensei and Tim for showing me many of Japan's customs. A particular highlight for me was being able to take an active part in the Akita kanto festival.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Jessica A.S WHITBURN （ID No.: SP16108）

2. Current affiliation: Nuffield Department of Surgical Sciences, University of Oxford

3. Research fields and specialties:

Medical, Dental and Pharmaceutical Sciences

4. Host institution: Institute for Advanced Biosciences, Keio University, Tsuruoka, Japan

5. Host researcher: Professor T Soga, Dr A Hirayama, Dr S Tabata

6. Description of your current research

Prostate cancer (PCa) remains the most commonly diagnosed male cancer in the Western world and is among the leading cause of cancer related deaths in men. While treatment of localised disease is very effective, metastatic disease most commonly to bone remain incurable. Prostate cancer cells are known to have abnormal metabolism compared to healthy prostate cells, and this is known as the Warburg effect. Recent evidence has suggested that prostate cancer metabolism is affected by the stromal cells that surround them leading to a reverse Warburg effect, however as yet this has not been investigated with regards to the bone stromal cells that surround metastases. The aim of my research is to better understand the metabolic changes that occur when prostate cancer and bone cells interact. It is hoped that by understanding the metabolic relationship that may develop between prostate cancer and bone stromal cells we might be able to identify novel drug targets for this currently incurable disease.

7. Research implementation and results under the program

Title of your research plan: Evaluating the metabolic relationship in the prostate cancer bone microenvironment

Description of the research activities:

We have analyzed the metabolite changes induced by co-culture of a human bone metastatic prostate cancer cell line (PC-3) with bone stromal cells lines (HS5: human bone stromal cell line; ST-2: mouse bone pre-adipocyte cell lines; 2T3: mouse pre-osteoblast cell line) using capillary electrophoresis time-of-flight mass spectrometry (CE-TOFMS). Cells were co-cultured using a trans-well model enabling characterization of the individual cell lines.

We found that co-culture increases the proliferation of prostate cancer cells compared to control (single culture), whilst having no significant effect on the proliferation of bone stromal cells. The metabolomic profiles of all cells lines were altered after 24 hours co-culture compared to control. In particular metabolites of a glycolytic pathway, known as the pentose phosphate pathway (PPP), were found to be significantly increased in all cell lines following co-culture. There was a corresponding increase in NADPH, a molecule important in managing cellular response to oxidative stress. The PPP plays an important role in providing the reducing power to fuel the biosynthesis of lipids, an energy pathway known to be important in prostate cancer metabolism. It also provides the nucleotides necessary for the rapid cellular proliferation seen in malignancy, and sustains antioxidant responses enabling cancer cells to better respond to the oxidative stress cause by radiotherapy and chemotherapy. Therefore, targeting this pathway alone, or in combination with currently used treatments, could have the potential to provide benefit to patients with incurable bone metastatic prostate cancer.

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: Andrew Wilkinson （ID No.: SP16109）

2. Current affiliation: University of Birmingham

3. Research fields and specialties: Chemistry & Biological Sciences

4. Host institution: University of Tsukuba

5. Host researcher: Professor Yukio Nagasaki

6. Description of your current research:

My PhD is based around the development of a new gene delivery technique that can overcome some of the issues faced with current non-viral methods. The main areas we are interested in addressing, are cytotoxicity and transfection efficiency. These issues commonly arise when using current vectors.
My research project involves modifying plasmid DNA using methyltransferase enzymes. This can be done successfully using s-adenosyl-L-methionine analogues as cofactors. For this project we synthesize cofactors with a built in reversible binding site that can be placed onto the DNA. Following DNA modification, we will attach polymers at the binding site. The attachment of water insoluble polymer side chains to DNA will then cause complexation into a micelle-like structure in aqueous solution. This complexation will occur due to the amphiphilic nature that has now been introduced into the complex. Due to the reversible binding site, nanoparticle formation will be stimuli responsive. The stimulus of particular interest here is a pH responsive system.

7. Research implementation and results under the program

Title of your research plan: Development of a novel siRNA delivery agent with the ability to scavenge reactive oxygen species.

Description of the research activities: Whilst at the University of Tsukuba I attempted to develop a new siRNA delivery agent. This was done by adapting a polymer that is commonly used within the Nagasaki laboratory. I altered the structure of this polymer so that it could electrostatically interact with siRNA and self-assemble to form a PEG micelle (Figure 1). Creating an siRNA delivery agent is of interest as it gives the ability to silence gene expression within cells which could be therapeutically beneficial when applied to diseases like cancer to slow cell proliferation. The structure of the polymers that I created can be seen in Figure 1, I created 3 different polymers with alternating ratios of diethanol amine and TEMPO within the backbone. Inclusion of diethanol amine within the polymeric backbone was done to increase the overall hydrophilicity of the polymer thus decreasing the stability of the micelle that is formed in the presence of siRNA. It is important to investigate a relation between stability-expression of the complexes.

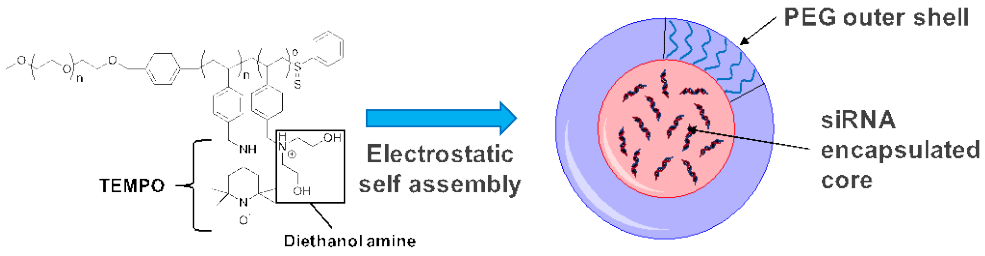


Figure 1 - schematic diagram of the micelle created in Tsukuba.

After successful synthesis and characteristaion, the 3 polymers described above were used to create micelles with siRNA. The positive charge present in diethanol amine allows for electrostatic interaction with siRNA which is negatively charged. Doing this lead to the creation of nanoparticles approximately 25 nm in diameter.

Having successfully created a nanoparticle that had encapsulated siRNA we moved on to biological studies of these nanoparticles. It was found that the nanoparticles created showed almost no toxicity at therapeutic concentrations and that gene silencing can be achieved with this nanoparticle.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):The JSPS programme was very interesting as it gave me the opportunity to experience things that I would not have got the chance to experience through just a trip to Japan. During the homestay and research project you are truly immersed in Japanese culture by your incredibly welcome hosts. I have experienced lots of things that will stay with me for a very long time.

9. Advisor's remarks (if any): Andrew did a lot of experimental works including polymer synthesis, analysis, preparation of comlex of siRNA with polymers, which he synthesized, their physicochemical analysis and evaluation in vitro. We also discuss quite a lot with us and improve understandings of this work. He is fantastic and I hope that he will become good scientist future.

RESEARCH REPORT

1. Name: Rhys James WILLIAMS （ID No.: SP16110）

2. Current affiliation: University College London

3. Research fields and specialties:

Medical engineering and prosthetics

4. Host institution: National Rehabilitation Centre for Person's with Disabilities

5. Host researcher: Dr. Toru Ogata MD, PhD.

6. Description of your current research

Prosthetic technology has dramatically improved over the past thirty years, thanks to the continued development of mechatronics and improved limb attachment techniques. However, it is still common place for prosthesis wearers to experience discomfort and skin degradation due to excessive heat retention and perspiration at the limb-prosthesis interface. The topic of my PhD is to explore how temperature influences the prosthesis wearing experience and the role it plays in secondary issues such as prosthesis slippage, excess sweating and limb shrinkage. The project focuses on lower-limb prostheses wearer's and employs qualitative and quantitative research methods. Using this approach, this research will be able to define from a quantitative standpoint the temperature changes that affect the prosthesis wearing experience, but also take into account the human aspect of wearing a prosthesis. Over the next two years, a significant portion of my PhD will be spent developing a wearable device dubbed the 'UbiSleeve.' This device will be manufactured using a novel 3D printing technique and contain integrated temperature, humidity and strain sensors. Once manufactured, the UbiSleeve will be used to collect data in the wild to quantify how environmental temperature change alters prosthesis slippage and sweating. This data set will be shared with the prosthetic community in the hope that it can be used to develop new prosthetics that prevent temperature related discomfort. In addition, this data will be used to trial a number of different data visualizations to explore if this may be of benefit to prosthesis wearers.

The summer fellowship has been an excellent opportunity to collect a novel data set that explores temperature behavior both in a controlled setting and temperature behavior during every day prosthesis wear. Japan's hot and humid summer climate has provided an excellent environment for the research and the guidance and resources at the National Rehabilitation Centre for Persons with Disability has facilitated a successful research project.

7. Research implementation and results under the program

Title of your research plan:

Exploring the relationship between heat and perspiration in reduced prosthesis comfort.

Description of the research activities:

The experimental protocol was split into two phases. Initially, 12 thermistors were attached to participants underneath their prosthesis, on both the anterior and posterior of their residual limb. Participants were then asked to rest for 15 minutes, followed by 10 minutes walking on a treadmill at a self-selected pace. The experiment finished after another 30 minutes of seated rest. Phase two of the protocol was conducted on a separate day to the initial phase. Participants were instrumented with 12 thermistors, but were free to continue with their day, away from the lab. Whilst out of the lab, participants were asked to use an electronic device to record on a 0-5 Likert scale their current level of thermal discomfort due to wearing their prosthesis. In total, 4 male participants were recruited. This data set provides the first insight into how temperature changes (both at the prosthesis interface and environment) alter prosthesis comfort both in a controlled and a realistic setting.

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

The fellowship has provided an excellent opportunity to collect a data set that will act as a solid foundation to the rest of my PhD work. It has been a pleasure to work under the supervision of Dr. Ogata and I am pleased that we are exploring ways to keep the collaboration going after I leave Japan. In addition, seeing the sun rise from the summit of Mt. Fuji is a memory that will stay with me for the rest of my life. It has been a privilege to meet and work alongside extraordinary people and I would recommend the fellowship experience without hesitation.

9. Advisor’s remarks (if any):

We accepted the fellow in the collaboration with Dr. Saito, The Univ. of Tokyo. Although the lodging place was not near to our institute, it did not seem to interfere the project. Mr. Williams had well prepared for the experiments before coming to Japan and carried out most part of what he had planned. We had some difficulties to perform human data collection, in terms of ethical approval and recruitment of subjects. Still, I am satisfied with getting reliable data with a novel device which the fellow made. This was also a good occasion to proceed the international collaboration with the department where the fellow belongs to. We are willing to accept future fellow through this program in future.

RESEARCH REPORT

1. Name: Jonathan Robertson （ID No.: SP16111 ）

2. Current affiliation: University of Sussex

3. Research fields and specialties:

Biological Sciences

4. Host institution: Kyoto University

5. Host researcher: Professor Takatoshi Hikida

6. Description of your current research

Addiction to both legal and illicit drugs contributes to a significant portion of global disease burden. There are currently very few pharmaceutical treatments available for addiction and they are not commonly used. Understanding how drugs of abuse affect the brain is critical for the development of treatments.

My research focuses on the 'mesolimbic/dopaminergic reward system' which mediates motivational behavior and is aberrantly affected by drugs of abuse. As these brain structures are conserved between humans and rodents we can manipulate them by various genetic or pharmacological methods and study the behavioural effects.

I study the role of specific $GABA_A$ neurotransmitter receptors in these systems. We use a variety of genetic techniques to manipulate these receptors in mice and behavioral tests to examine motivation to seek cocaine or alcohol.

Neurons in this system can be divided into two classes based on their expression of either D1 or D2-type dopamine receptors. D1 and D2 neurons form two distinct pathways within the striatum and are sometimes referred to as the 'Go' and 'No-go' pathways respectively. Activation of D1 neurons is associated with increased movement and drug seeking behaviors whereas activation of D2 neurons is associated with decreased movement and reduced drug seeking behavior.

We have found that specifically manipulating $GABA_A$ receptors in those populations have

different effects on cocaine conditioned behaviour in mice.

7. Research implementation and results under the program

Title of your research plan:

Using targeted ‘Reversible Neurotransmission Blocking’ in mice to investigate the role of ‘Direct’ and ‘Indirect’ striatal neural ensembles in motivation and cocaine conditioning.

Description of the research activities:

My project focused on a brain region called the Ventral Palidum (VP) which is known to be involved in reward learning and addiction.

Previously the VP was thought to only receive input from dopamine neurons of the D2 however recent studies found that it also receives input from dopamine neurons of the D1 Pathway. These newly discovered inputs indicate the VP may play a more significant and nuanced role in reward learning and addiction.

To gather preliminary data I lesioned the VP in mice and examined the behavioural effects associated with reward learning and motivation. I anaesthetized mice and performed surgery to inject ibotenic acid into the VP to lesion the area. Ibotenic acid causes an excessive influx of calcium ions into neurons resulting in apoptosis (programmed cell death). As a control I injected phosphate buffered saline (PBS) into the VP of another group of mice which should not damage the area. I then used these mice in a series of behavioural tests. Firstly I examined operant conditioning using chambers with a touchscreen interface (Campden Instruments).

Mice were placed in chambers and on the screen we presented two visual stimuli on the right and left. By touching one of the stimuli they earned a reward of sweetened milk (the conditioned stimulus or CS+) but touching the other stimulus did not earn a reward (the unconditioned stimulus or CS-).

In a ‘fixed ratio’ experiment mice receive one reward per a fixed number of responses, we used an FR4 schedule whereby four touches of the CS+ earns a reward. VP lesioned mice were slower to learn the association of CS+ with

rewards and initially touched both the CS+ and CS- equally. Following training they were able to respond more for the CS+ but responded less in total than the control group.

In a ‘progressive ratio’ experiment the number of responses required for a reward increases after each reward. This measure the maximum amount the will continue responding for a reward. VP leasioned mice made significantly less responses and had a lower ‘break-point’ at which they stopped responding.

Since lesion of the VP decreased responses made to earn natural rewards we wanted to examine whether the VP would also mediate conditioning to drugs of abuse. We used an experimental paradigm called conditioned place preference (CPP). During a conditioning phase mice are placed in two physically distinct environments; one following administration of cocaine (drug paired) and the other following administration of saline as a control (saline paired). On the test day mice are given free access to both chambers and we record the time spent in each. Mice will spend more time in the drug paired environment.

We examine CPP to cocaine by conditioning mice in chambers (MedAssociates) over five days (two sessions per day) using a 10mg/kg dose of cocaine (session 1) or similar volume of saline (session 2). On the test day we measured time spent in each chamber. VP lesion did not reduce cocaine CPP and both groups spent significantly longer in the cocaine paired chamber.

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

Japan is a beautiful country and I had time every weekend to visit important cultural sites and the hike in the countryside. During the summer there are many festivals which I went to with my labmates and other JSPS summer students (Gion Matsuri, Obon, Diamonji etc.).

I was also able to attend Japan's largest neuroscience conference (JNSS annual meeting) in Yokohama which included talks from world famous Japanese and foreign scientists.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Pablo Arnault （ID No.: SP16201）

2. Current affiliation: LERMA, Pierre and Marie Curie University and Observatoire de Paris, Paris, France

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution:

Institute for Molecular Science, National Institutes of Natural Sciences, Japan

5. Host researcher: Yutaka Shikano

6. Description of your current research:

I am currently working on three projects. The first one is carried out with my director in Paris, Fabrice Debbasch. We have found an alternate two-dimensional (2D) discrete-time quantum walk (DTQW) with spacetime-dependent coin angles, whose formal continuous limit coincides with the dynamics of a massive Dirac fermion propagating in a two-dimensional curved spacetime. To complete this work, we would like to perform a numerical simulation that confirms our analytical computations and shows how the trajectories of the quantum walker matches the relativistic geodesics.

The second project is carried out with Muhammad Sajid, Andrea Alberti and his team, from the IAP, in Bonn. We have found an alternate 2D magnetic DTQW whose coin parameters define, through their space dependency, two so-called “topological” phases. We have exhibited magnetic topological edge states, i.e. eigenstates of the DTQW whose probability density is localized along the topological edge boundary, and which disappear when the magnetic field is set to zero. When the wave function of an initial walker has a substantial overlap with such eigenstates, it propagates along the boundary. We still need to find how to impose the direction of propagation along the boundary, and to propose an experimental setup to observe such topological edge states.

The third project is conducted with Yutaka Shikano. Our aim is to prove analytically the main result of the paper he coauthored on the 1D feed-forward (FF) DTQW, which is numerical. This result is that the large-wavelength modes of the FF DTQW follow, in the long-time limit, the porous-medium equation with exponent m=1.5. To fulfill such a purpose, we need to analyze the interference terms which were neglected in this work. Our idea is that the zeroth-order contribution of this terms, which is local, might account for the sharp spikes that are still present in the long-time limit, and that the first-order contribution, which is non-local, might lower the exponent m=2 of the associated Markovian process down to m=1.5.

7. Research implementation and results under the program

Title of your research plan:

Interacting quantum walks in synthetic gauge fields.

Description of the research activities:

My stay has been mainly divided into two periods. I first worked on the generalized (G) FF DTQW, whose local version was first studied by Giuseppe Di Molfetta two years ago under the same program. I checked several analytical results regarding this model, adding only a few precisions. The continuous limit of this local G FF DTQW is that of a Dirac fermion propagating in a self-induced curved metric, which has, to the best of our knowledge, no interpretation in the current theories of gravity. I computed the continuous limit of additional non-local terms, and tried to interpret them physically. I tried to find them an interpretation within the Einstein-Cartan theory of gravitation, which treats possible torsion of spacetime. For such a way to yield results, we need at least to embed this 1D G FF DTQW into a higher-dimensional space, otherwise the non-linear coupling between the spin angular momentum and torsion vanishes. This way has still yielded no result. Another possible way to follow is that of non-linear metric perturbations in cosmology. I finally decided to put aside the attempt of interpreting the continuous limit of the 1D G FF DTQW.

The second part of my stay has been devoted to the project I describe in the third paragraph of item 6.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I thank Yutaka Shikano wamfully for his supervision, and for providing me all I needed to carry out research at the IMS. I also express my gratitude to Mayuko Kato and Sayuri Suzuki for their careful administration, and great sympathy.

9. Advisor’s remarks (if any): During Pablo Arnault’s visit to our group, another short-term visitor, Ms. Sristy Agrawal, from India joined our group. He might take the experience on the inter-cultural exchange. Therefore, I strongly recommend to JSPS that several internship students should be hosted from different countries. On his internship research project, unfortunately, he did not finish it. However, from his research technique, we received the new insight to solve the problem on 1D FF DTQW. Hopefully, when he come back to his home institute, I want to continue on the collaborative project. Also, since our institute has several internship students from the different funding, they did not only make a good relationship in our group including the one- or two-days visitor but also outside our group. However, during this community, there is no Japanese graduated student as far as I know while our institute is one of the basic institutes of SOKENDAI. I did not give him more chances to the conversation to Japanese students and researches in my group. Finally, since Pablo Arnault’s research ability is high and active, I sincerely thank him to come to our group. Furthermore, I strongly hope that he might come back our group under the support of BRIDGE program etc.

RESEARCH REPORT

1. Name: Blachon Florence (ID No.:SP16202)

2. Current affiliation: PHD Student

3. Research fields and specialties:

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

4. Host institution: Center for Information Technology in Education, Tohoku University,Kawauchi 41, Aoba-ku, Sendai, Japan, 980-8576

5. Host researcher: : HAYAKAWA Yoshinori

6. Description of your current research

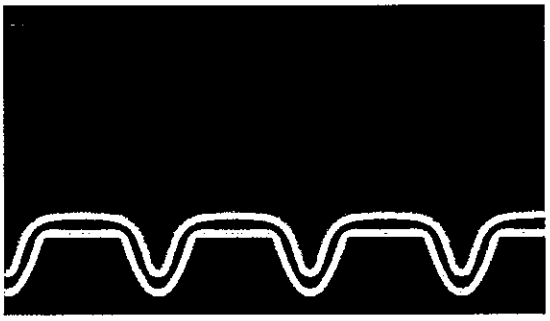
Supported lipid bilayers have been extensively used as model systems for cell membranes offering the possibility of applying surface sensitive techniques such as atomic force microscopy (AFM), fluorescence microscopy or X-rays and neutron scattering techniques. Most of these techniques require atomically flat surfaces. But in vivo, the surfaces to which lipid layers interact are generally not flat. For example, the cartilage surface is very rough although it presents perfect tribological properties. In addition to fluid synovial, it was for instance proposed that phospholipid multi-bilayers which are found on the cartilage surface may explain the exceptional lubricant properties of joints. The purpose of my PhD thesis is to study lipid bilayer properties of rough surface, in order to understand the lipid impact on synovial joint tribology.At first, I had performed a non-contacting-technique, namely Fluorescence Recovery after Patterned Photobleaching (FRAPP) in order to measure the apparent diffusion coefficient D of phospholipids in bilayers deposited on rough surface. Main parameters of this first study are rms roughness and phase state of lipids on supported-bilayer (gel or fluid). Indeed, results are totally opposed in gel phase and in fluid phase: interestingly, diffusion coefficient presents a roughness independent character in gel phase in pure water whereas diffusion coefficient in fluid phase depends strongly on substrate roughness (we measure a factor of five between smoother and rougher surfaces). Very recently, we performed neutron reflectometry at the Institut Laue-Langevin (ILL) to observe bilayer conformations on rough surface.

7. Research implementation and results under the program

Title of your research plan: Structure of lipid layer on rough surfaces

Description of the research activities:

We have construct a numerical model to mimic a lipid layer separate by a rough surface by a thin water layer in 2 dimensions. This model is inspired by Gomper and Kraus, 1993. We can control curvature radius and height of four walls on surface, and so we can study different configurations with peaks or/holes. Besides, lipid concentration in the system and water thickness between lipids and surface are fixed to have the same ratio between developed area of rough surface Ad/ projected area Ap (flat surface), lipid concentration for Ad/lipid concentration for Ap and water thickness for Ad/ water thickness for Ap.



Now we want to fixed bilayer rigidity to correspond at experimental conditions and to study layer sturcture in fluid and gel phase.

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

9. Advisor's remarks (if any):

Your research report will be complied with those of the other participants into a PDF file, which will be

posted on JSPS's website. We need the research reports to be prepared in MS-Word or PDF format. Keep the length of your report within 2 pages and leave enough lower margins (for page numbers). Your report should be submitted by August19th.
First e-mail your report to: **ecc5-05@or.knt.co.jp** and then fax its printout to:
+81-(0)3-6891-9409

RESEARCH REPORT

1. Name: Sandy BLIN (ID No.: SP16203)

2. Current affiliation: CNRS – Université de Nice Sophia Antipolis

3. Research fields and specialties:
Biological Sciences

4. Host institution: National Institute for Physiological Sciences, Okazaki, Aichi

5. Host researcher: Pr Yoshihiro KUBO

6. Description of your current research

Ion channels are transmembrane proteins which permit the flow of ion across the cell membrane. They are expressed in all cell types from bacteria to humans where they are involved in a wide spectrum of physiological processes such as action potentials, cardiac rhythm, muscle contraction and hormone secretion. They actually represent a major class of drug targets. Structure of ion channels is a key feature for the development of new drugs but little is known about their mechanisms and regulations.

During my PhD, I focused on two-pore domain potassium channel (K_{2P}). These channels produce background K^+ conductance that control resting membrane potential and influence cell excitability. They are involved in functions as diverse as cell volume regulation, thermosensation, breathing and fluid balance. Recently, K_{2P} channels have emerged as promising targets for the development of new classes of anesthetics, analgesics and antidepressants.

K_{2P} channels are active as dimers of subunits each containing 4 transmembrane segments and 2 pore-domains. The K_{2P} channel family contains 15 members grouped in 6 subfamilies according to their sequence homology, electrophysiological and pharmacological regulation. However, we demonstrated that K_{2P} channels, and particularly THIK and TREK subfamilies, can also assemble and form active heterodimeric channels. We combined biochemistry, immunocytochemistry, FRET as well as electrophysiology to prove physical interaction among subunits. Interestingly, heterodimers exhibit unitary conductances, pharmacology and regulations different of those of the corresponding homodimers. These results unveil a previously unexpected diversity of K_{2P} channels that will be challenging to analyze *in vivo*, but which opens new perspectives for the development of clinically relevant drugs targeting these channels.

7. Research implementation and results under the program

Title of your research plan: Structure-function of TPC3 channels

Description of the research activities:

Since I am interested in the structure-function of ion channels in general, I decided to focus on two-pore Na^+ channels (TPC). TPC have been implicated in calcium release from intracellular organelles. Very recently, one study demonstrated that they play a role in Ebola virus infection and thus represent new therapeutic targets for virus infection treatment. TPCs are 2-repeat type of ion channels and function as dimer, similarly to the case of K_{2P} channels. These channels are voltage-sensitive: each repeat of 6TM contains a voltage sensor (S4) and a pore domain. Voltage-Clamp Fluorometry (VCF) is a technique which relies on both electrophysiology and fluorescence and is currently employed to study structural rearrangements of membrane proteins. In this technique, a cysteine is introduced in a specific location of the channel by mutagenesis and can be selectively bound to a fluorescent probe. That way, structural rearrangements of the channel upon activation are monitored by fluorescence measurements after excitation of the probe. Using this technique, we wanted to determine the movement of S4 segment during the induction of TPC by voltage application. During these two months, I introduced cysteine residues at different locations into the S4 segment and I measured fluorescence changes using VCF. We could obtain significant increase or decrease of fluorescence depending on the location of the residues which provide new insights of structural rearrangement of TPC upon activation.

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

I really enjoyed working in a Japanese laboratory. I could discover the working habits but besides the experiments, my colleagues also teached me about cultural habits. They took time to explain me history of Japan, kanjis, politics and Japanese cuisine. I really appreciated spending time with them, as Japanese people in general. This experience was very fruitful on both scientific and cultural points of view.

9. Advisor's remarks (if any):

I would like to thank JSPS for providing me with a chance to work with Ms. Sandy Blin, a highly motivated and talented scientist. Also, my lab members were stimulated by her and enjoyed fruitful international communication very much. I hope JSPS will continue and expand this meaningful and beneficial program. Yoshihiro Kubo

RESEARCH REPORT

1. Name: Cédric Bourgès （ID No.: SP16204 ）

2. Current affiliation: University of Caen, NORMANDIE

3. Research fields and specialties:
Chemistry

4. Host institution: Graduate School of Engineering, Tohoku University

5. Host researcher: Prof. Yuzuru MIYAZAKI

6. Description of your current research

Currently pursuing second year of PhD at CRISMAT's laboratory and this summer program in Miyazaki's laboratory, I work on the development of **complex sulphide-based thermoelectric (TE) materials** and particularly the Cu-Sn-S system.

My work in the group of Pr. Miyazaki will be mainly focused on the powder and single crystal x-ray diffraction (XRD) of complex-sulphides, such as $Cu_4Sn_7S_{16}$ and $Cu_{26}V_2Sn_6S_{32}$. Preliminary results have shown the interest of low thermal conductivity in $Cu_4Sn_7S_{16}$ complex structure for improving the TE efficiency. Nevertheless, recent investigations have highlighted a metastable form of this phase, which is characterized by different conduction type (N or P type). The neutron diffraction measurements performed last summer revealed different structural models according to the observed conduction-type. Different single crystal samples have been prepared in CRISMAT's laboratory based on these models for trying to obtain mainly N type (sulphur-poor) or P type (sulphur-rich). For $Cu_{26}V_2Sn_6S_{32}$, the first structural resolution of this phase has been performed on natural colusite mineral like $Cu_{26}M_8S_{32}$ (with M= As, V, Ge, Sn, Sb and Fe). The aim of the single crystal study is to confirm the colusite structure only with V and Sn contents. Previous results (powder x-ray/neutron diffraction), highlighted significant correspondence with natural colusite structure. However, visible exsolution (separation of colusite phase in two colusites phases with different cell parameters) is exhibited at room temperature. The single crystal x-ray diffraction acuity could allow to confirm the structure and explain the exsolution phenomena of Sn-colusite.

Meanwhile, we have identified strategic TE materials due to their structural complexities and metallic/semi-conductor behaviour. It includes Cu_2SnS_3 and thiospinel type CuM_2S_4 (M=Ti, Co, Sn and V) phases. I have conducted in Japan the synthesis of polycrystalline materials by using local method the CS_2 sulfurization and in parallel the conventional sealed tube. The approach allows to maximize the possibility of obtaining a single phase in short time.

7. Research implementation and results under the program

Title of your research plan:

Synthesis and structural analysis of complex sulphide-based TE materials

Description of the research activities:

1. The single crystal x-ray diffraction of $Cu_4Sn_7S_{16}$, performed in Miyazaki's laboratory, tends to confirm the structural models extracted from previous analysis. Large sampling of single crystal measurement revealed slight deviant structure between sulphur-rich and sulphur-poor content. The structure resolution is in progress but further investigation need to be performed. For instance, the properties measurement is required to confirm the real conduction type of the collect single crystal and subsequently will be performed a correlation with structural models.

2. The first result of single crystal analysis of $Cu_{26}V_2Sn_6S_{32}$ exhibits a high natural colusite structure's reliabilty. Hence, the precession image analysis tend to show a modulation of the structure. Further investigation is in progress to propose some structural models.

3. All of the thiospinel phases are obtained by conventional way. However, only $CuTiVS_4$ and Cu_2SnS_3 single phases are successfully synthetized by CS_2 sulfurization. The measurements of their thermoelectric properties are in progress.

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

During my experience in Japan, I have discovered a spiritually and culturally rich country. People I got acquainted with in the laboratory had highly developed skills and were willing to make a headway in the research. In my leisure time, I have met only kind people and visited many beautiful places. I noticed a surprising contrast between advanced technology and traditions. Every second of my stay in Japan was remarkable. What I wish for is to come back to this unique country in my close future.

9. Advisor's remarks (if any):

Mr. Cédric Bourgès has intensively worked during the stay and brought lots of significant results within a short period of the JSPS project. He is indeed a role model for our lab students. Everyone in the lab really likes his personality and wants to continue his/her lifetime friendship. His stay will definitely be a good opportunity to strengthen the collaborative researches between CRISMAT and our lab.

RESEARCH REPORT

1. Name: Florencia Andrea DI ROCCO VALDECANTOS （ID No.: SP16205）

2. Current affiliation: Université Paris I – Panthéon-Sorbonne

3. Research fields and specialties:

Humanities

4. Host institution: Global Research Center for Logic and Sensibility, Department of Philosophy, Keio University

5. Host researcher: Professor Mitsuhiro Okada

6. Description of your current research:

To go deeper into some features of Borges' fictional languages grammar I aim in my PhD dissertation, I propose an analytical approach to three Japanese language games: counting games, games on colour and games drawing a layout between the "inner" and the "outer".

7. Research implementation and results under the program:

"Japanese Language Games : a Wittgensteinian Approach"

I: "Logic and Mathematics of Japanese Counters": enlightening assumptions and problems in philosophy of language and mathematics involved in the use of counters from a classical approach, I've proposed a deconstruction from a contextualist position, built upon Wittgenstein's refutation of the "myth of the given" and David Lewis' "rules for a well-run conversation", mainly through the analysis of 畳, 面.

II : "Historical-analytical approach of "青い/緑": I've shown a possible deconstruction of Yasuo Kitahara's theory of Japanese ancient colours as levels of "brightness" -明度- and of 青い as an "indistinct colour" -不鮮明色- from Wittgenstein's *Remarks on colour*. Reworking Wittgenstein's primitive notion of "continuity" in order to define the binary relation "to be a hue of"-色相-, I sketched arguments to neutralize linguists' claim of ancient 緑 as a hue of 青い. Considering the link between colour and spatial notions in late Wittgenstein, I've presented ancient 緑

as a “transparent 青い”. Upon historiographical material, I’ve extended the history of 緑 between 1630-1950 and ended by the “trivialization” of “classical colours” since Japan’s “modernization”.
III : “Japanese private objects”: comparing English and Japanese grammar of Wittgenstein’s “private objects”, and analyzing Japanese grammar of “pain” by the “beetle” analogy and prefix/suffix 出す, I’ve shown inconveniences of Japanese translations of some of Wittgenstein’s propositions, and the irrelevance of a layout between the “inner” and the “outer” in some Japanese language games.
Description of the research activities:

This work is my first practice on reading and translating Japanese academic texts. Regarding counters, I have acknowledged contrasts in their presentation in Japanese as a native or as a foreign language, and explained them by adjusting some propositions from analytical philosophy. In order to understand the “Japanese” theory of ancient colours, I have been introduced to the use of electronic dictionaries as a tool for translating into English the eponymous chapter of Kitahara’s 青葉は青いか 日本語を歩く. Attending to seminars and reading the story of 青い, I got familiar with Japanese technical vocabulary involved in linguists and analytical philosophy and with major Japanese “classical” works (万葉集, 日葡辞書, あら野). Under my host’s advice and exchange with other members of the laboratory, I could give a “logical frame” to a primitive notion from Wittgenstein’s RC, which let a frontal discussion with Kitahara. This section required supports for the 1630-1950 period and constituted thus an experience in “historiographical” research (National Diet Library, Kyoukasho Library). Last section aimed to get a “perspective” on Japanese translation and comments on Wittgenstein. I’ve pointed out “artificial locutions” and shown how some features of German grammar could be rendered by features of ordinary Japanese.

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

I would like to thank Okada Sensei for his constant, accurate and kind advise and for welcoming my work in the framework of his seminar on Logics.

Among other cultural experiences, I had the opportunity to participate in Asagaya’s Matsuri Festival, have been introduced to the tea ceremony together with my host family and went to a temple for the occasion of a Japanese wedding. I also shared a

weekly language exchange and joined an informal discussion group on Philosophy.

9. Advisor's remarks (if any):

During her staying in Japan, Ms. Florencia Di Rocco made a very good academic achievement on her "Japanese language games" project. She has been very serious, and active in research during the whole period in Japan. She chose three significant Japanese language games and made important Wittgensteinian analysis on them, as reported above. Her work is of high quality and of high originality.

RESEARCH REPORT

1. Name: Quentin GRIETTE （ID No.: SP16 206 ）

2. Current affiliation: Université de Montpellier

3. Research fields and specialties:

Mathematical and Physical Sciences

Biological Sciences

4. Host institution: Tokyo University

5. Host researcher: Prof. Hiroshi MATANO

6. Description of your current research

I am interested in the interaction between mathematics and evolution theory. My current research concerns the interplay between invasion and evolutionary dynamics. More precisely, I am studying reaction-diffusion models of the form:

(1)

where u, v represent the densities of two genotypes of e.g. some pathogen with a large mutation rate. The intended application of such a model is the prediction of epidemic spread of a pathogen for which the propagation dynamics and the evolutionary dynamics occur on the same time scale. However, such model can also be applied to a broader set of biological phenomena, such as mutualistic interaction between two species.

In my past research, I studied traveling waves for model (1) in the spatial homogeneous case, i.e. when the coefficients do not depend on the x variable (in collaboration with G. Raoul and S. Gandon). Traveling wave are particular solutions of equation (1) which consist on a fixed profile moving at the constant speed. Such solutions are known to characterize the long-time behaviour of equations similar to (1) in a large class of model. We managed to prove the existence of traveling waves, and established an analytical formula for the minimal speed of those waves. We also established some qualitative properties on the profile of the waves.

More recently, in collaboration wih M. Alfaro, we studied the spatial periodic case of (1),

i.e. when the coefficients are periodic functions of the space. We managed to prove the existence of pulsating traveling waves, which are the equivalent to traveling waves in a periodic setting.

7. Research implementation and results under the program

Title of your research plan:

Pulsating fronts in a reaction-diffusion system modeling the propagation of a mutating pathogen in a heterogeneous environment : a closer look at steady states

Description of the research activities:

We extended the results obtained for equation (1) in a periodic setting. One important question that was left open in my previous work is the link between the minimal speed of traveling waves and the spreading speed of solutions to (1). In my collaboration with Prof. Matano, we made huge progress on this question. We understand now that those speeds are in fact the same (which was expected, but unclear) and we have established a way to compute it using the linearized problem at the edge of the front. This greatly strengthen the results obtained in my past work.

We also looked at the stability of stationary solutions to (1) in the spatial homogeneous case. It appears that under realistic hypothesis on the coefficients, there exists a unique positive zero to the zero-order term, which is locally stable in the sense of ODE. We conjecture that any realistic solution to (1) converge to this steady state and have some leads to prove it, though this is still work in progress.

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

I consider that this program was a great achievement for me, both on the professional and personal levels. I am especially thankful to Matano sensei and the team of the Matano lab, for their welcoming and their kindness. I had a unique opportunity to experience life in Japan, and to know a culture that is very different from my own from the inside.

9. Advisor’s remarks (if any):Mr. Griette and I had intensive mathematical discussions on the problem related to his Ph.D research and were able to make significant progress on this subject. Mr. Griette also attended the student seminars and other programs in my research group regularly and were able to get integrated into my group smoothly. This gave a good stimulus to mygraduate students. Summarizing, his visit was a great success both for him and for my research group.

RESEARCH REPORT

1. Name: GROSSETTI Quentin

（ID No.: SP16207）

2. Current affiliation: Conservatoire des Arts et Métiers 75003 Paris FRANCE

3. Research fields and specialties:

Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Fujio Toriumi

6. Description of your current research

During the last decade, we saw the emergence of many microblogging platforms such as Twitter, Pinterest, Instagram, Weibo or Tumblr. They all have their specific audience and features but all have known unprecedented growth and are sharing this mechanism of selecting interesting people to follow and being followed by other users which is now well established into the Internet culture. But with this new success, microblogging platforms began to be very crowded and users started having issues to keep up with all the content available. The adaptation of traditional recommender system to microblogging platform is an emerging field of study where in contrary to traditional recommender systems, microblogging users are mostly interested into fresh content and rarely interact with any item. In this context, fighting the data sparsity is one of the key challenges to build very accurate recommender system.

By clustering the microblogging messages before computing user similarity we can fight efficiently this data sparsity. Fujio Toriumi developed a method allowing to cluster messages by inferring messages that have been shared by the same persons are very close and therefore could be grouped together. However, this method does not scale very well for the size of our data that needed to be preprocessed. Our idea was to improve the method by looking into other dimensions such as hashtags and the text of the messages during this preprocessing in order to find a cluster for messages having very low number of retweets. This task is difficult because we needed to find a good tradeoff between the number of dimensions considered and time taken to cluster one message.

7. Research implementation and results under the program

Title of your research plan:

Multidimensional and Scalable Clustering on Microblogging Messages

Description of the research activities:

The idea behind multidimensional clustering is that by using different dimensions the clustering method would provide more accurate and stable results. This is even more true for tweets where the text is very short (140 characters). We first grouped messages sharing the same hashtag together, but only 25% of tweets actually have a hashtag so we needed to go further. We used the Stanford Named Entity Recognizer method to extract named entities from every messages, we then merged hashtag clusters having lot of named entity in common and added messages without hashtag. In order to do this work we had to develop a highly parallelized streaming clustering technique. This preprocessing allowed us to use the Fujio Toriumi clustering method improved by looking into other dimensions.

Our result showed that we substantially reduced the number of items by grouping messages together. We also showed that it was possible to scale this clustering method up to high volume data.

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

The whole JSPS summer exchange experience was extremely valuable and I would like to thank Fujio Toriumi and all the people from the lab that have been so welcoming and nice. I would also like to thank my hosting family for their kindness and their efforts.

RESEARCH REPORT

1. Name: Marc GUERRE （ID No.: SP16208）

2. Current affiliation: Ph.D Student at Ecole Nationale Supérieure de Chimie de Montpellier, Institut Charles Gerhardt de Montpellier – Engineering and Macromolecular Architectures

3. Research fields and specialties:

Polymer Chemistry

4. Host institution: Department of Applied Chemistry, Nagoya University

5. Host researcher: Prof. Masami KAMIGAITO

6. Description of your current research

I am currently undertaking research as a PhD student in the field of fluorinated polymers (i.e. polymers bearing fluorine atom on their backbone, such as polyvinylidene fluoride of polychlrotrifluoroethylene for example), and the provisional title of my PhD is: “Synthesis and Self-Assembly of Amphiphilic Fluorinated polymer architectures”. When I started my PhD, very few research reports described the synthesis of well-defined fluorinated polymer architectures. RAFT or MADIX polymerizations were nonetheless promising techniques. I thus carried out exhaustive investigations of the MADIX polymerization of vinylidene fluoride (VDF) and demonstrated that MADIX polymerization could be used to polymerize VDF with some degree of control. The key feature of MADIX polymerization of VDF lies in the accumulation of -CF_2-CH_2-xanthate end groups due to reverse addition followed by transfer to the chain transfer agent. I showed the extent and the rate of this reaction and I have carefully examined the reactivity of these -CF_2-CH_2-xanthate end groups, thought not to be able to reinitiate polymerization, and found out that they could reinitiated the polymerization of vinyl acetate (VAc) in a controlled manner. I am now preparing one additional article dealing with the unexpected synthesis of these PVDF-*b*-PVAc block copolymers and focusing of the mechanistic aspect of the polymerization. Furthermore, these diblock copolymers were hydrolyzed into PVDF-*b*-PVA amphiphilic diblock copolymers and I am currently preparing another article describing the self-assembly in water of these novel PVDF-based architectures. Finally, In the course of this first year of PhD, I prepared a number of PVDF-based architectures such as methacrylate PVDF macromonomers, PVDF-star polymers and

PVDF-derived dendrimers; and initiated a number of research collaborations with researchers from other institutions in France and abroad.

7. Research implementation and results under the program

Title of your research plan:

Synthesis of fluorinated block copolymers combining radical RAFT polymerization of fluoroolefins and RAFT cationic polymerization of vinyl ether.

Description of the research activities:

The present project thus proposes to combine the unique expertise of Professor Kamigaito's laboratory in the field of cationic RAFT and the expertise of ICGM-IAM laboratory (which I largely contributed to develop) in the domain of the RAFT polymerization of fluoroolefins, to synthesize novel fluorinated polymer architectures, and study their properties. During my research activities I synthesized a large range of poly(VE) via cationic RAFT polymerization, to name but a few : P(IBVE)-Diethylcarbamate, P(EVE)- Diethylcarbamate, P(EVE)-Xantahte … The next step of this research is to study the chain extension of these polymers under radical RAFT polymerization using fluoroolefins. This lest study will be carried out in Montpellier. A second research axis was the chain extension of alternating copolymers of chlorotrifluoroethylene (CTFE) and vinyl ethers, Poly(CTFE-*alt*-VE), prepared in Montpellier, using Vinyl ether under cationic RAFT polymerization. This promising study displays good results but will require deeper investigations in Montpellier.

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

The JSPS summer program gave me the opportunity to discover the traditional Japanese culture through an intensive work experience in a fame laboratory. For my first international experience I recognized the importance of international network and the enrichment that it brought me whether for the technical part, or with a view of future collaborations.

9. Advisor’s remarks (if any):

The research during this summer program was well done owing to the diligent contribution by the participant. It definitely opens up the future collaborative research between Montpellier and Nagoya and will lead to developments of new polymeric materials based on controlled polymer structures.

RESEARCH REPORT

1. Name: Titouan JAUNET-LAHARY （ID No.: SP16209）

2. Current affiliation:

CEISAM laboratory, University of Nantes, Nantes, France

3. Research fields and specialties:

Chemistry

4. Host institution: Fukui Institute for Fundamental Chemistry (FIFC), Kyoto University, Kyoto

5. Host researcher: Prof. Shigeyoshi Sakaki

6. Description of your current research

The first main objective of my PhD is to describe the interactions between the 4,4’-Diisothiocyano-2,2'-stilbenedisulfonic acid (DIDS) ligand and the Human Serum Albumin (HSA) protein . It is known that DIDS can inhibit Rad51, a protein essential for the reparation of DNA. However, the overexpression of Rad51 activity within tumors has been observed and its modulation by such anticancer drug is crucial. This inhibition opens a new way for anti-cancer medicine. The important question whether HSA can be a carrier protein for DIDS has been investigated recently. However, to the best of our knowledge, no crystallographic data is availale for this complex, though such date is fundamentally important. Therefore, the computational research is indispensable to provide such fundamental knowledge of structure, as well as the characteristic features of the interaction. My research is to elucidate the interaction between DIDS and HSA, using theoretical and computational method.

7. Research implementation and results under the program

Title of your research plan:

" Simulation of enzymatic reaction in red algae"

Description of the research activities:

Pcya (Phycocyanobilin:Ferredoxin Oxidoreductase) is the unique enzyme that converts BV(Biliverdin) into PCB (3Z/3E-phycocyanobilin). The latter molecule plays a critical role in photosynthetic organisms acting as a light sensor and/or light-harvesting antennae. A recent publication proposed a reduction mecanism based on neutron diffraction data. Several residue are identified to have a key role during reduction process and especially the presence of hydronium ion close to actif site. My purpose is to investigate the first step of the proposed mecanism by electronic structure theory.

Firstly, the stability of each protonation form of BV was investigated by high level electronic structure theory with a single point calculation, where the neutron diffraction structure (4QCD) was employed. One form was calculated to be more stable than the others by about 15 kcal/mol. This result was explained by the formation of a new hydrogen bond between the ligand and his surrounding residues (Asp 105). This first structure analysis successfully identified a major role of the latter residues. Then, the mechanism of the rotation of this residue, which enhances the probability to protonate BV into BVH+ by proton transfer, was investigated. Energy barrier of 20 kcal/mol appears to put Asp 105 in the best condition for a proton transfer process.

Using this structure, proton transfer process between Asp 105 and BV was studied by the GRRM method, where we used a semi-empirical method (PM6) to explore some equilibrium state and transition state of the potential energy surface. We applied some artificial force between one nitrogen and hydrogen atom to reproduce proton transfer process. Thus-optimized equilibrium state and transition state were re-optimized by DFT, in order to improve the results and explain mechanism pathway.

These results are promising and in the future. In a near future, we will try to investigate the larger size of the system to improve the description of this enzymatic reaction.

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

9. Advisor's remarks (if any):

He worked well and succeeded the first stage of this research. I believe that these results are useful for the further work.

RESEARCH REPORT

1. Name: Laure MIGNEROT （ID No.: SP16 210）

2. Current affiliation:
Sorbonne Université, UPMC Université Paris 06, CNRS,Algal Genetics Group,
UMR 8227, Integrative Biology of Marine Models, Station Biologique de Roscoff,
CS 90074, F-29688, Roscoff, France

3. Research fields and specialties: Biological Sciences

4. Host institution: Muroran Marine Station, Field Science Center for Northern Biosphere, Hokkaido University, Muroran 051-0013, Japan

5. Host researcher: Associate Professor Chikako NAGASATO

6. Description of your current research

Parthenogenesis can be defined as the development of an adult organism directly from gametes in absence of fertilisation. The resulting offspring are exact genetic replicates of the parent and therefore this process may be used in selection programs to produce a large number of individuals genetically homogenous. *Ectocarpus*, an emerging brown algae model system, is very interesting because of its parthenogenetic cycle. Usually, female gametes can undergo parthenogenesis in absence of fertilization but some parthenogenetic (P+) males were found in a segregating population. The main aim of my PhD is to localize and characterize the locus involved in parthenogenesis and investigate the phenotypic effect of this locus. P+ male gametes present a decrease fitness, such as a decrease in gamete fusion success and in zygote growth. A hypothesis to explain these reduced fitness of the zygotes is the fact that mitochondria from the male parent are maintained in the zygote (male mitochondria are usually destroyed during zygote formation) causing fitness decrease due to cytoplasmic conflict between male and female mitochondria. At Muroran station, I planned to use cell biology tools to characterise mitochondria in parthenogenetic gametes and follow their stability and inheritance during gamete fusions involving both parthenogenetic and non-parthenogenetic gametes.

7. Research implementation and results under the program

Title of your research plan:

" Cellular characterization of mitochondria in parthenogenetic and non parthenogenetic male gametes from the brow alga *Ectocarpus*"

Description of the research activities:

The number of mitochondria in *Ectocarpus* was investigated and performed by Mitotracker, specific probes that stained only mitochondria‘s membrane.In order to to count mitochondria in gametes, confocal microscopy was used. The preliminary results showed a large difference of number of mitochondria in gametes. Indeed, in female gametes, the average number of mitochondria was higher than in males. Moreover, differences were also found in males with a number of mitochondria a little bit higher in parthenogenetic (P+) male gametes than non-parthenogenetic (P-) males. Furthermore, the mitochondria from P+ male gametes seemed smaller than those from P- male or female. This observation was investigated using Transmitted Electron Microscopy (TEM) to (i) detect any difference in size or shape between male and female mitochondria and (ii) confirm the average number of mitochondria previously counted. The TEM analysis revealed no differences in size or shape of mitochondria from the 3 kinds of gametes (female P+, male P+ and male P-). However, the number of mitochondria counted with TEM images were higher than those observed with the confocal microscopy. This difference could be due to the signal intensity from the Mitotracker. Indeed sometimes it is difficult to discern all mitochondria especially if there are close. Nevertheless, despite this difference, these results confirmed the fact that there seems to be a difference of number of mitochondria between the parthenogenetic and non-parthenogenetic male gamete. Other experiments were conducted such as following the stability of mitochondria in zygotes and the time for gamete to settled. The protocol need to be adjusted and these experiments will be carried on in Roscoff marine station.

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

It was a wonderful stay, everyone was kind, helpful and eager to show me Hokkaido. They took me to different restaurant so I tried a lot of different Japanese food. They also took me to visit Sapporo, lake Toya, Noboribetsu hot springs, Shikotsu lake and Ainu Museum and local festival.

9. Advisor’s remarks (if any):

She achieved one purpose, which was to count mitochondrial number in three kinds of gametes. This is an essential data in order to elucidate mitochondrial inheritance during fertilization.

RESEARCH REPORT

1. Name: MOUTERDE Timothée （ID No.: SP16211 ）

2. Current affiliation: Physique et Mécanique des Milieux Hétérogènes, UMR 7636 du CNRS, ESPCI, 75005 Paris, France.

LadHyX, UMR 7646 du CNRS, École Polytechnique, 91128 Palaiseau, France.

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Department of Mechano-Informatics, Graduate School of Information Science and Technology, The University of Tokyo

5. Host researcher: Isao SHIMOYAMA

6. Description of your current research

Surfaces decorated with sufficiently small hydrophobic pillars are known to exhibit superhydrophobic property. On such highly water-repellent materials, drops exhibit a high contact angle and low hysteresis due to the air entrapped in the roughness of the material. These two factors are at the origin of the spectacular mobility of water on such surfaces. One of the most impressive demonstrations of this low adhesion can be observe with condensation droplets. At the scale of a few tens of microns condensation droplets have been observed to jump off the surface when merging. This self-removing process is at the origin of a high heat transfer increase in dropwise condensation on superhydrophobic surfaces. This phenomenon can be observed at a larger scale with millimetre-size drops merging. During my PhD, I am focusing on the condition under which a surface resists to fogging and how to achieve the best antifogging properties.

One of the questions raised by my PhD work is to understand how and why merging droplets can jump of a surface. Although it is clear that the surface energy gain during coalescence drives the jumping motion, some questions about that mechanism are still open: How the interaction force distribution between the droplets and the surface changes during the coalescence? How could the released Laplace pressure propagates on the liquid surface and converts into the lift forces that make the droplet detach from the surface?

7. Research implementation and results under the program

Title of your research plan:

Investigating the physics of jumping droplets

When two droplets merge the surface energy released is converted in both kinetic energy and in droplet oscillations. The difficulty to estimate the stored energy in oscillations makes the energy balance prediction far from the experimental results. To solve this problem we used the strength of Shimoyama Lab.: MEMS sensors,

those sensors can measure with high accuracy the force due to the droplet jumping.

Description of the research activities:

Our research activities can be divided in three main parts:

1. We designed, fabricated and optimized a MEMS Sensor that is able to detect and measure efficiently the forces generated by jumping droplets. The difficulty of this step is to find a good balance between sensor size, force sensitivity and time accuracy.
2. We conducted various experiments making water droplet of different size to merge and eventually to jump of the surface. We used high-speed imaging to record the motion and our MEMS sensor to measure the force exerted on the surface. We also changed the viscosity of the liquid by doing experiments with water/glycerol mixtures.
3. We analyzed the raw data in order to get the good physical information. With those processed data, we built a physical model that can explain our experimental results and also other literature results. We are now planning to publish those results.

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

It was two incredible months; I had the opportunity to discover the life in a Japanese high level Laboratory. All the lab members have really warmly welcomed me. On the scientific side, the really good teamwork and complementarity has been quite efficient. I had also the chance to go around Japan and to discover all the various delicious food and splendid landscape and temples. I enjoyed learning Japanese, and been amazed by Tokyo by night.

9. Advisor’s remarks (if any)

RESEARCH REPORT

1. Name: Alexey PODKOVSKIY (ID No.: SP16212)

2. Current affiliation: Acoustic Laboratory of the University of Le Mans, France

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Kansai University, Faculty of Engineering Science, Department of Pure and Applied Physics

5. Host researcher: Professor Nobumasa SUGIMOTO

6. Description of your current research

The emergence of new microfabrication techniques as well as general trends of electronic component miniaturization promote recent progresses in development of small-sized acoustic sensors. The study of such sensors influences many companies and research institutions around the world, including Acoustic Laboratory of the University of Le Mans.

During my PhD and one year after the defense I had concentrated on the development, modeling, experimental characterization and improvement of new geometry capacitive miniature acoustic sensor. The unusual configuration of this sensor offers the benefits of having a significant performance. At the same time, the simple shape can be easily realized by standard MEMS process (Micro-Electro-Mechanical-Systems) and thus such sensor will be successively commercialized in perspective.

Deep theoretical investigation of this sensor was firstly done. This study is based up on mathematically independent two approaches (analytical and numerical ones) whose results show a high convergence. After modeling, the transducer dimensions were determined and first prototype was made using hybrid technology (MEMS process associated with conventional printed circuit manufacturing techniques). Then developed prototype is characterized experimentally and the measured results were accurately analyzed and compared to the ones predicted by theoretical models. Collected information, which describes behavior of studied transducer, allows us to better understand how to improve sensor structure as well as certain MEMS fabrication steps.

Enhanced prototype of this sensor is currently under development.

7. Research implementation and results under the program

Title of your research plan:

Shock-wave annihilation in thermoacoustic heat engines by means of electroacoustic absorbers network

Description of the research activities:

To increase both efficiency and power of thermoacoustic heat engines, pressure oscillations of higher amplitude are required to be generated. However, nonlinear effects of various origins come into play to hider higher oscillations. Among them, the most pronounced phenomenon is wave deformation and eventually formation of shock waves, i.e., emergence of discontinuity in pressure and velocity.

During this summer program, I deeply studied a physical process of formation of shock waves in a resonance tube by improving a driving system, made several years ago in the frame of the previous research projects by Pr. Sugimoto but a behavior of the resonance tube was never investigated before. Some technical issues on the system were found and successfully fixed, which allows correct functioning. Suppression of higher harmonics in the pressure profile by Helmholtz resonators was experimentally observed and theoretical bases of this phenomenon were understood. Future constructive changes of the set-up were pointed out. These should highly increase generated pressure level and improve total machine efficiency.

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

I am very pleased to participate in the JSPS summer program and to have visited Japan. During my stay here, I discovered for myself not only Japanese academic life (orientation session at SOKENDAI, stay at Kansai University and participation in Thermoacoustic group meeting organized in Tokyo by Tohoku University) but also I got a great cultural experience (sightseeing and trips in Yokohama, Fujikawaguchiko, Osaka, Tokyo, Nagoya, Kyoto etc., Japanese cuisine, karate trainings and meeting new people, of course).

9. Advisor's remarks (if any):

Dr. Alexey Podkovskiy concentrated intensively on the academic work on weekdays and enjoyed socially as well on weekends by visiting many places to meet many people. Thanks to his efforts, I am very pleased that he has not only attained the initial goal of the program but also made useful suggestions on a further research.

RESEARCH REPORT

1. Name: Melina Ribaud （ID No.: SP16213）

2. Current affiliation: Ecole Centrale de Lyon

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Tohoku University

5. Host researcher: Prof. Koji Shimoyama

6. Description of your current research

In the context of design computer experiments, metamodels are largely used to represent the output of computer codes. Metamodels employed are usually non-parametric, such as kriging approach, radial basis function, polynomial chaos and so on.

The aim of my Ph.D research work is to improve metamodels implications within optimization loop. More precisely, the three main goals are the following :

- Providing metamodels that incorporate additional information like the partial derivatives of the 1st and 2nd order
- Improvement of robust multi criteria optimization based on kriging in high dimension
- Improvement of Sensitivity Analysis techniques based on metamodels when dimension is high.

These techniques will be tested and validated on concrete examples provided by the industrial partner.

My ongoing research work is to build efficient metamodels based on specific kriging approaches. First of all, I have to study the theory of kriging with the different approaches; geostatistics [1] and probabilist [2]. Kriging is a statistical technique for interpolating between points in space. We use kriging with the aim of predicting data. The package DiceKriging is useful to apply kriging on data, this is a R package for estimation, validation and prediction of kriging models described in the article [3]. Kriging allow to construct a model considering a single output. Therefore, we study an extension of kriging which takes into account multiple outputs. This extension called co-kriging uses the covariance between outputs. In addition, kriging and cokriging work well for sets with a reasonable number of parameters. Indeed, we work on processes for increasing this number. The objective is to provide an effective metamodel which is jointly modeling outputs for a high number of factors.

References

[1] Santner, T. J., Williams, B. J., & Notz, W. I. (2013). *The design and analysis of computer experiments*. Springer Science & Business Media.

[2] Le Gratiet, L. (2013). *Multi-fidelity Gaussian process regression for computer experiments* (Doctoral dissertation, Université Paris-Diderot-Paris VII).

[3] Roustant, O., Ginsbourger, D., & Deville, Y. (2012). DiceKriging, DiceOptim: Two R packages for the analysis of computer experiments by kriging-based metamodeling and optimization.

7. Research implementation and results under the program

Title of your research plan: Multi-objectives robust optimization

- Bibliography
- Application of method already used
- Application of new methodology

Description of the research activities:

In Japan, we focus on the optimization part of the problem. We only use the ordinary kriging and we build a method of optimization.

In a first time, we read and understand some articles about methods used for this kind of problem, the method is described in paper [4]. The aim of these paper is to optimize function in the context of time consuming simulation and in high dimension.

The new idea is to construct a method for robust optimization not only optimization. Robust optimization means that the optimum is a stable one. For example, all point near the optimum are good points. We need a robust optimum because in the production line context it is difficult to build exactly the same product all the time. So, we need to be close to the optimum even if it is not exactly the product with the right dimensions. Then we represent it by a standard deviation attached to each outputs.

We use a test function which answer to the criterion: many objectives (outputs), high dimension and robust optimum. This function is called DTLZ2 and described in the paper [5].

We implement the new method for robust optimization. This method is close to the method without robust optimization. The difference is we optimize the expected improvement of functions and standard deviation of functions.

The results are promising, we continue of improving the methodology with new methods using probability of improvement and distance of nearest neighbor. In addition, we use a modified kriging adapted in high dimension.

References

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[5] Deb, K., Thiele, L., Laumanns, M., & Zitzler, E. (2002, May). Scalable multi-objective optimization test problems. In *Evolutionary Computation, 2002. CEC'02. Proceedings of the 2002 Congress on* (Vol. 1, pp. 825-830). IEEE.

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

My journey in Japan was really interesting to discover the behavior in a research laboratory and the Japanese habits in general. In addition, I travelled around Japan and I visited amazing places like museum, temples, cat Island, Natural park, beautiful archipelago. I really enjoy my journey in Japan and if I have the possibility I would like to come back to work again with professor Shimoyama and visit new places.

RESEARCH REPORT

1. Name: Ruth EFFINOWICZ （ID No.: SP16301 ）

2. Current affiliation: University of Cologne (Köln), Germany

3. Research fields and specialties:

Law (Social Sciences)

4. Host institution: Keio University

5. Host researcher: Professor Dr Philipp OSTEN

6. Description of your current research

The *ius ad bellum* and Japanese law

Today, public international law prohibits the use of force by states across international borders. This principle has been enshrined in Article 2(4) of the UN Charter. Only in very restricted circumstances is it permissible under international law to send military abroad.

As a consequence, many states have introduced provisions into their domestic legal systems to incorporate these restrictions while also accommodating their own culturally and historically shaped approaches to the *ius ad bellum* (i.e. the law setting out the criteria that must be met for the recourse to force to be lawful under international law). This also holds true for Japan, where the Constitution currently leaves minimal room for any form of military mission. My research focuses on the conditions that must be met under Japanese and international law before troops may be lawfully sent abroad, including material and procedural requirements. This topic is rendered all the more important by recent Japanese legislation and the even more ambitious plan to reform the relevant provision in the Japanese Constitution.

7. Research implementation and results under the program

Title of your research plan:

History and development of the *ius ad bellum* in Japan
Scope, limits, and practice under the current constitutional and regulatory framework

Description of the research activities:

My research consisted mainly in analyzing the complex legal framework of the Japanese legislation concerning the *ius ad bellum* as well as the academic and political debates associated with it.

For that I have primarily conducted research based on the Japanese academic literature on the topic. I have also consulted experts of the field and, thus, broadened my network within Japan and gained invaluable insights. The discussions with professors and colleagues have also proven to be very fruitful and will guide me in my further research that will build largely on the information I have gathered and analyzed during my two months in Tokyo.

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

I have enjoyed my time at Keio University very much and I am very grateful for the hospitality with which I was greeted. Attending a number of lectures and seminars, having the opportunity of giving a talk about my research in front of a group of distinguished law professors and academics, and participating at a *nomikai* have all been very enriching experiences.

The experience of climbing Mount Fuji and a second visit to my JSPS host family to enjoy a shrine festival with them have been some of the non-academic highlights of my stay.

RESEARCH REPORT

1. Name: Valentin Hertz （ID No.: SP16302）

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 the context of my PhD project, I investigate the properties of polycyclic aromatic hydrocarbons (PAHs) containing boron atoms. These compounds are currently receiving considerable attention in the field of material science. The long-term goal of this branch of science is to develop new, purely organic compounds for the next generation of electronic devices, such as organic light emitting diode displays and photovoltaic cells. It is therefore essential to investigate new classes of organic molecules and assess if they are suitable to replace the state-of-the-art metal-based materials, which have certain disadvantages.

Boron is an element of the second period and, in terms of its properties, the natural counterpart of the element nitrogen. Whereas nitrogen-containing PAHs are already well-established in the field of organic electronics, the systematic investigation of their boron-doped congeners has only recently gained momentum. The main reason lies in the low stability of most boron-containing molecules at ambient conditions (oxygen and water can induce decomposition). The synthesis and investigation of air-stable boron-containing molecules is the focus of my research under the supervision of Professor Matthias Wagner. Our group and the group of Professor Shigehiro Yamaguchi have published numerous significant scientific articles about this topic, on which my research project is based. Recently, we have accomplished to combine high stability against oxygen and water, efficient fluorescence, and reversible electrochemical behavior in several new boron-containing PAHs. We now aim to achieve these valuable properties in a molecule featuring a planar framework and assess if it is suitable for use in organic electronic materials.

7. Research implementation and results under the program

Title of your research plan:

Synthesis and investigation of a planar boron-containing polycyclic aromatic hydrocarbon stabilized by structural constraint.

Description of the research activities:

My research activities mainly consisted of organometallic synthesis. I worked in a chemical laboratory, in close cooperation with PhD students of the Yamaguchi group. The key transformations were a silicon-boron exchange reaction followed by the nucleophilic addition of a protecting group and a cyclisation reaction catalyzed by scandium triflate. During these reactions, intrusion of air and moisture had to be avoided carefully. We succeeded to perform an eight-step synthesis and obtained a novel boron-containing polycyclic aromatic hydrocarbon (PAH). Subsequently, I carried out a detailed investigation of its chemical and photophysical properties. The analytical techniques employed include elemental analysis, NMR spectroscopy, UV-vis spectroscopy, photoluminescence spectroscopy, exited state lifetime determination, fluorescence quantum yield determination, and X-ray crystallography. This new compound turned out to exhibit a rare combination of favorable properties and we will continue to investigate its performance in optoelectronic applications.

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

I experienced my Japanese colleagues as very hard-working scientists. Leisure time was sparse but I went on trips to Tokyo and Kyoto. I have seen busy cities, beautiful Japanese gardens, quiet shrines and temples, and amazing firework displays. I have also made new acquaintances and even friendships to international students. We have spent a splendid time together exploring the city of Nagoya and hiking a mountain close by.

9. Advisor’s remarks (if any):

Mr. Hertz has gotten used to the life in our laboratory smoothly. His research proceeded well during the last one month. He has already succeeded in not only obtaining a target molecule, but also gaining several important insights into the boron-containing pi-electron materials. He also talked a lot with the students in the laboratory and stimulated them. I wish he would fully enjoy during the remaining period and make this stay a valuable time for his academic life.

RESEARCH REPORT

1. Name: Felix Jawinski （ID No.: SP16303）

2. Current affiliation:
Department for Japan Studies, East Asian Institute, University of Leipzig, Germany

3. Research fields and specialties:
Social Sciences

4. Host institution:
The Ōhara Institute for Social Research, Hōsei University

5. Host researcher: Prof. Akira SUZUKI

6. Description of your current research

The key element for producing a 'bright life' in Post-war Japan was energy and its production. The working and living conditions of dispatched workers, contract service workers, day laborers and many other forms of employment, which continue to exist beside the hegemonic and supposed almighty salaryman, have been recognized by social research on Japan in the past in a general way. Connecting these things to the labor market of the nuclear energy sector is nevertheless not common (yet). Using the Sociology of Knowledge Approach to Discourse (SKAD) this research focuses therefore on the following questions: What kind of subjective significations do NPP workers in Japan apply concerning their own self during different periods of the atomic age and how do they relate to themselves by doing this? How do they perceive themselves as working beings? How do NPP workers handle the ambivalence that their work is indispensable in the construction and maintenance of the nuclear power industry while on the other hand, their work lacks social appreciation and they are even labeled "disposable workers"? At the Ōhara Institute, I plan to conduct interviews with experts on NPP workers and additionally interview NPP workers themselves while doing field research in Iwaki.

7. Research implementation and results under the program

Title of your research plan:
NPP Workers in Japan: Applying the Sociology of Knowledge Approach to Discourse (SKAD) to Elucidate Different Processes of the Construction of Workers' Selves

Description of the research activities:

During my fantastic stay in Japan I managed to achieve most of the goals I did set before coming. With great thanks to many scientists, activists and journalists I have met, I was able to interview about twenty (former) workers who are/were employed in the nuclear industry or in the decontamination business. The stories about their lives and the circumstances under which they worked, enabled me to get a close inside perspective. Not only that I talked to interviewees who work for TEPCO and in the NPP Fukushima Daiichi, but I also got the chance to talk to people who would be normally considered as the margins of the Japanese society and who work under extreme and sometimes even cruel labor conditions.

The second main task for this stay was to go to different archives and libraries, such as the Hosei University library, the fantastic archive of the Ōhara Institute but also the National Diet Library, and search for literature *written about* nuclear labor(ers) by journalists, researchers, labor union members and even lawyers. Additionally, I focused on texts *written by* laborers who work (mostly published by a pen name) or used to work in the nuclear industry at different levels of the subcontractor system. The material I found for the second group was mainly written by two groups. One could be described as the group of engineers or specialist who mainly work for the energy companies (such as TEPCO) or the prime contractors, while the second group consists of those who work at the margins of this system and are employed e.g. as dispatched laborers in subsubsubcontract companies.

The third major task for this research was to get to see the places and the surrounding living environment of the workers. Therefore I went to different place near to the NPP of Onagawa and also NPP Fukushima Daiichi and also NPP Fukushima Daini. Even though I couldn't get the permission to get into the buildings of the J-Village, it was a very nice experience to see this place firsthand. One trip I will probably always remember was the one day tour to different place within the exclusion zone in the city of Futaba. Even though there are uncountable pictures taken from these places, I understand once more, that it is indeed very important for social researchers to go these places and experience them with ones whole body.

RESEARCH REPORT

1. Name: Dominik KOEPPL （ID No.: SP16305 ）

2. Current affiliation:

TU Dortmund, Germany

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Kyushu University

5. Host researcher: Prof. Shunsuke INENAGA

6. Description of your current research

Understanding the structure of text is main focus of my research. On a low level, we think about text as a concatenation of characters. The study and search for patterns in texts like repetitions or palindromes brings new insights in several practical applications like text compression and text indexing.

7. Research implementation and results under the program

We devised a new algorithm that computes all distinct tandem repeats of a given text. A tandem repeat is a string that contains two replicas of the same string. For instance, the DNA-string “ATTCGATTCG” contains “ATTCG” twice (we think about text as an arbitrary sequence of characters like DNA). The devised algorithm is, to the best of our knowledge, asymptotically faster than other known algorithms.

Description of the research activities:

Prof. Inenaga and Prof. Bannai worked with me on the algorithm described above. We had multiple meetings during a week. In the meetings we studied various problems and found partial results. These results emerged into the algorithm described above.

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

The working group consisting of three professors, four PhD students and several master and bachelor students warmly welcomed me. Besides research and work, we occasionally arranged several social activities like having a monthly regulars' table.

9. Advisor’s remarks (if any):

As mentioned above, Mr. Koeppl has been very active in joint research with us. We will continue our collaboration even after his departure from Japan, and I strongly believe that the achieved results will result in a joint publication. Also, he regularly attends our weekly seminars where our students give talks on their research, and gives some advices to the students. Finally, it seems that he has been enjoying social activities etc. during his stay in Japan.

RESEARCH REPORT

1. Name: Waldemar Kohl （ID No.: SP16306 ）

2. Current affiliation: Department of Psychiatry and Psychotherapy, Muenster, Germany

3. Research fields and specialties:

Social Sciences

4. Host institution: Department of Neuropsychiatry, Kyoto University

5. Host researcher: Prof. Toshiya Murai

6. Description of your current research

The research project covers a cross-cultural approach in investigating and comparing the brain structure in Japanese and German patients with schizophrenia. By making use of modern brain imaging and analysis methods the influence of the socio-cultural background on brain development of patients with schizophrenia is to be determined. The project combines data of participants in studies on schizophrenia gathered in two centers with clinical and research experience in the field of schizophrenia and neuroimaging. Samples of about 100 patients as well as healthy control subjects per group, matched by age, gender and IQ, were included in the analysis.

We employed the voxel-based morphometry method (VBM) in *Statistical Parametrical Mapping* (SPM, Wellcome Trust Centre for Imaging) for analysis as well as the *freesurfer* program (FMRIB Software Library (FSL)), for the analysis of cortical grey matter surface, thickness, volume and asymmetries. Results will be correlated using with psychopathological measures (e.g. symptom scales, questionnaire and test scores, personality traits, biographical data like family status, duration of the disorder, years of education) and clinical data (e.g. medication).

7. Research implementation and results under the program

Title of your research plan:

"Cross-cultural investigation of brain asymmetry in patients with schizophrenia"

Description of the research activities:

1) Harmonization of the combined patient database by finding and completing missing data and double featured data.
2) Preparation of the neuro imaging data for the analysis.
   - Writing an automated script for processing multiple data sets
   - Checking the compatibility, orientation and quality of the brain images
   - Converting the brain images into an appropriate file format
3) Image analysis and processing
4) Extraction of results

The results of the correlational analysis and cross-cultural comparison of cortical measures will be a subject to a planned publication.

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

Kyoto revealed itself as a terrific cultural treasure. There are many famous temples worth a visit, like the famous Kyomizu Dera, the Ginkakuji with its beautiful Zen Garden and the "hidden" and graceful Honan temple. Especially with the many different festivals and holydays during the summer, the Kyoto was very atmospheric with many people wearing traditional clothes and performing traditional arts. The relaxing Kamo river was a public magnet with musicians playing across the river bank on many days. Uji, famous for its marvelous tea and Nara with the biggest Buddha statue can be reached within 40 min. The gastronomy of Kyoto was a further highlight which will be hard to forget.

9. Advisor's remarks (if any)

RESEARCH REPORT

1. Name: Szymon Parzniewski （ID No.: SP16307）

2. Current affiliation: University of Birmingham (UK)

3. Research fields and specialties:

Social Sciences

4. Host institution: Center for Far Eastern Studies (University of Toyama)

5. Host researcher: Prof. Norio HORIE

6. Description of your current research

Issues surrounding migration and labour shortage, for example immigration quotas, highly-skilled migration, student migration, undocumented migration, migrant integration that coalesce around cultural/national identity are increasingly discussed in both the academic and policy contexts. My PhD doctoral research at the University of Birmingham looks at the role of intra-state actors in the processes of immigration policy-making. It aims to analyse how states address the contemporary immigration problems deriving from the rising role of new actors, through a comparison of different state models and decision-making cultures. At the University of Toyama, I explore the role of policy entrepreneurial activity in immigration policy-making at the local and national levels. This can not only shed a great deal of light on the nuanced and multi-layered environment of immigration policy-making, but also point to the challenges that local communities are facing in the implementation of immigration policy objectives. This research aims to outline the main characteristics of entrepreneurial activity in immigration policy field in Japan; describe the various tools available to the policy entrepreneur and propose a model for successful and effective policy entrepreneurial activity in the migration policy field. Although, the role of 'policy entrepreneurs' has been broadly recognised in the contexts of environmental policy-making (Braun, 2009; Huitema and Meijerink, 2009; Meijerink and Huitema, 2010; Jordan and Huitema, 2014), it is still a rather unexplored concept in migration research (Paquet, 2015). Therefore, this research project addresses a clear gap within migration literature.

7. Research implementation and results under the program

Title of your research plan: '*The role of policy entrepreneurs at the local and national levels in immigration policy-making in Japan*'.

Description of the research activities: My research fieldwork activities included interviews, meetings and discussions with practitioners and policy makers in the field of migration, including visits to city and prefectural level organizations contributing to the wellbeing of foreign residents in Japan. For instance, the Niigata International Association and Miyagi International Association. I explored the role of policy entrepreneurship in migrants support and foreign residents counseling activities at the local level, including some key areas such as: healthcare, education and disaster prevention. By participation in the International Resident Support and Disaster Prevention Training in Ishikawa, I had an opportunity to experience how foreign resident support should be implemented in practice. In addition to the research activities directly linked to my project, I also had an opportunity to strengthen the existing research collaborations and build new ones. From July 25-28, 2016 I participated in the Summer School in Border Studies hosted by the Slavic Eurasian Research Center as part of the Hokkaido Summer Institute. I also had a chance to present my research during research lectures and events at the CFES. These opportunities established research links in Japan that can contribute greatly to my research career.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): Beyond the great environment to conduct research, this program gave me a unique opportunity to partake in a wide range of Japanese cultural activities, including among others: Gion Matsuri Festival in Kyoto and a visit to the Tobiu Art Community. Moreover, I had a chance to experience the Ainu culture of the indigenous people of northern Japan and practice playing the traditional mukkuri musical instrument. I also participated in events that foster mutual understanding, such as the Speech of the German Ambassador to Japan Dr. Hans Carl von Werthern. I have been invited to deliver two lectures at the Toyama Cosmopolitan Association, which gave me a good chance to contribute to the cultural bridging between Japan and European nations.

9. Advisor’s remarks (if any): Mr. Szymon Parzniewski actively engaged in participant observation in the activities at several organizations supporting migrants in local cities, and I believe these experiences widened his perspective on the research of immigration policy-making in Japan. His good commitment to local community was highly appreciated by Toyama City International Center.

RESEARCH REPORT

1. Name: Petra REDEKOP （ID No.: SP16308）

2. Current affiliation: University of Duesseldorf

3. Research fields and specialties:

Biological Sciences

4. Host institution: National Institute for Basic Biology (NIBB)

5. Host researcher: Prof. Jun MINAGAWA

6. Description of my current research

Non-photochemical quenching (NPQ) of excess energy represents an important photoprotective mechanism in photosynthetic organisms. In land plants, the PsbS protein plays a major role as a pH-dependent regulator of NPQ in photosystem II (PSII). It´s pH sensing function is well studied in the model organism *Arabidopsis thaliana*. In green algae, another protein (LHCSR3) fulfills the pH-sensing function, while the role of PsbS is unknown. I am currently studying at Heinrich Heine University Duesseldorf. My research field is focused on the role of PsbS in the green algae *Chlamydomonas reinhardtii.* Using a specific antibody that recognizes PsbS of *C. reinhardtii,* I was able to demonstrate PsbS accumulation during high light acclimation and activation of high NPQ capacity by using immunoblot analysis. Accumulation of PsbS occurred in parallel with the accumulation of LHCSR3 and the establishment of a high NPQ capacity.

7. Research implementation and results under the program

Title of my research plan: Protein accumulation and localization of the PsbS protein in the green algae *Chlamydomonas reinhardtii* depending on light and carbon availability

To find out more about PsbS protein accumulation patterns in the green algae *Chlamydomonas reinhardtii*, light experiments were carried out. Cells were illuminated for up to 48 hours with high light (HL) and grown at three different carbon conditions (high, ambient and low CO_2). Cell samples were collected for further protein analyses. In addition to protein analyses of cells that were illuminated with HL for several hours, chlorophyll fluorescence analyses were performed on the same samples to analyze the light response and acclimation patterns on the

chlorophyll fluorescence level.

Description of the research activities:

- Cells were pre-cultivated on agar plates and liquid media in low light until cells reached their exponential growth phase.
- Wild-type cells and three different mutants (PsbS knock out, PsbS knock down and LHCSR3 deficient) were transferred into (a) high light with either (b_1) low carbon, (b_2) ambient carbon or (b_3) high carbon conditions and illuminated under each growth condition for up to 48 hours. Samples were taken after 0.5, 1, 4, 6, 10, 24, 48 hours for protein analyses and Chlorophyll fluorescence analyses to estimate the non- photochemical quenching and PSII activity.
- For protein analyses, a protein extraction was performed according to either the common technique used by the host institution or according to a protocol that I have developed in Germany for a more efficient membrane protein extraction. In the next step, the protein concentration was measured to set all samples to the same protein concentration. Furthermore, an immunoblot analysis was performed to detect the PsbS and LHCSR proteins. This critical step identifies the growth condition which leads to the highest protein accumulation.
- After identification of the optimal light treatment for the highest protein accumulation, sucrose gradient fractionation (SDG) was performed to separate different photosystem complexes. Each fraction from sucrose gradient was isolated and an immunoblot analysis was performed to detect the PsbS protein and to identify its association partner.

Results: The higher the stress conditions for *C. reinhardtii*, the stronger PsbS accumulates. In this case, higher stress conditions mean less CO_2 and higher light intensities. Interestingly, PsbS accumulates transiently and weakly under high CO_2 availability for a short period of time after high light exposure. The lower the CO_2 concentration, the more stable the PsbS level and the slower its degradation. Results of SDG revealed new insights about PsbS localization in thylakoid membrane of. *C. reinhardtii* and will help to identify it´s association partners.

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

During this efficient stay in the Minagawa laboratory, I have learned new methods and techniques that can be useful for my future projects in Germany. All experiments were successfully completed and built a great base for continued collaboration. Moreover, I had the opportunity to join the "17th International Conference on the Cell and Molecular Biology of Chlamydomonas" in Kyoto, which is the most important meeting for scientists on this topic, and present my current state of research which was recently published (Galvis and Redekop et al., 2016, JBC). Besides the scientific point of view, I have an amazing impression of Japan, it´s culture and it´s people. I have also had the chance to join the great Hanabi Festival and hike Mount Fuji.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Benjamin Schaefer （ID No.: SP16309）

2. Current affiliation: Network Dynamics, Max Planck Institute for Dynamics and Self-Organization (MPIDS), GERMANY

3. Research fields and specialties:

Mathematical and Physical Sciences

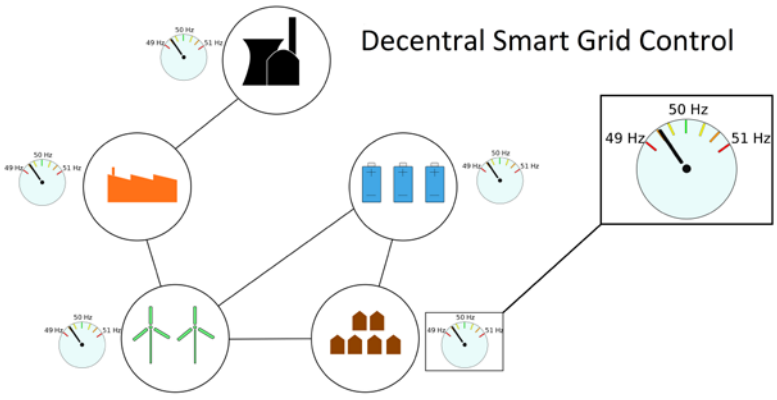
4. Host institution: University of Tokyo, Institute for Industrial Science

5. Host researcher: Prof. Dr. Kazuyuki Aihara

6. Description of your current research

The ongoing climate change is forcing us to shift our power generation from fossil power plants towards renewable generation. With more renewable power sources entering, the grid topologies become more decentralized and more recurrent due to the distributed generation. Furthermore, renewables introduce additional fluctuations into the power grid which needs to have balanced supply and demand at all times to be in the stable operating state. In my Ph.D. project I aim to gain a deeper insight into the dynamic phenomena in complex, decentrally organized supply networks with the main application being power grids. Understanding how to design and control power grids to ensure maximal security of supply, forms the main goal. The interplay of economic and physical aspects in designing a network also have to be considered.

Recently, together with co-workers, I proposes the concept of “Decentral Smart Grid Control” (see figure), where the price is directly linked to the local grid frequency at each customer. The grid frequency provides all necessary information about the current power balance such that it is sufficient to match supply and demand without the need for a centralized IT infrastructure. To assess the reliability of our proposal, we performed a (linear) stability analysis as well as numerical simulations confirming that a decentrally controlled power grid can indeed be stable. Before implementing such a decentralized control, we need to gain more basic understanding of the dynamics of the power grid frequency. This set me up for this summer project.

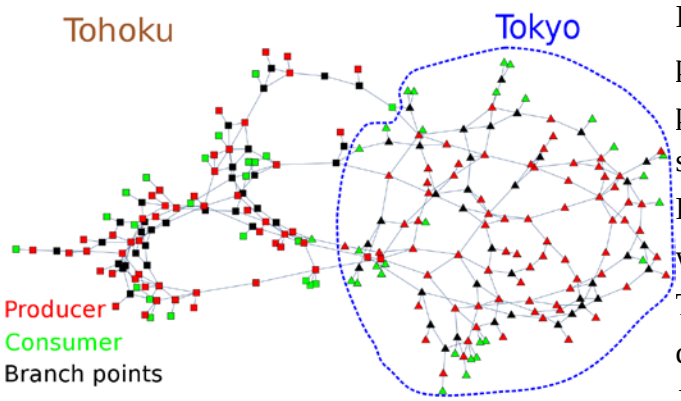


7. Research implementation and results under the program

Title of your research plan:

Self-organized and decentrally controlled power grids

Description of the research activities:



I already had access to European power grid frequency data as well as power grid topologies but wanted to supplement this with additional data. Prof. Aihara kindly provided me with the power grid topology of the Tokyo-Tohoku region and I got in contact with "OCCTO" for Japanese power grid frequency data. I compared the fluctuations occurring in the Japanese and the European grids and found a similarity: large fluctuations are more common than anticipated by the commonly used Gaussian distribution. Hence, I applied "stable distributions" which are a good description of the observed data. Furthermore, I formulated a generalized Fokker-Planck equation that can predict the probability of events in a stochastic system subject to non-Gaussian noise. I validated the equation using small artificial networks and the Tokyo-Tohoku power grid topology in Monte-Carlo simulations. Now I am able to describe and predict frequency fluctuations in power grids. One major insight is that (decentrally) organized damping reduces fluctuation risks.

8. Please add your comments, including any cultural experience during your stay in Japan: Generally I was very impressed by the kindness of all Japanese people I encountered. Everybody tried to be as helpful as they could even if we did not share a common language. This was especially true for my host family during the home stay. Furthermore, I enjoyed attending fireworks (hanabi) and kabuki theater (play "RYUSEI") as well as the peacefulness of Japanese temples and shrines, e.g. in Asakusa or Kamakura. Finally, climbing mount Fuji with hundreds of Japanese was another highlight.

9. Advisor's remarks (if any):

Benjamin Schaefer has studied very hard during his stay in our laboratory. He has also been very much active to attend and discuss in the seminars of our laboratory. His analysis of frequency fluctuations in power grids including the Japanese one is excellent, and we are going to write a joined paper on the topics in near future.

RESEARCH REPORT

1. Name: Erik SCHAEFER （ID No.: SP16310）

2. Current affiliation: Johannes Gutenberg-Universität Mainz

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Hiroshima University

5. Host researcher: Prof. Taichi OKUDA

6. Description of your current research

Spin- and angular resolved photoemission spectroscopy has become a key technique in materials science. With this technique, electrons inside a crystal are excited by a monochromatic light source and subsequently analyzed regarding their kinetic energy, their momentum and spin. These measured values represent the electronic structure of a crystalline sample. A precise knowledge of electronic properties is generally important to discover and develop new applications.

Generally, an effective spin analysis is difficult and time-consuming. Through a massive parallelization of the spin detection process, the performance of the spin-resolved spectroscopy can be increased by several orders of magnitude. The newly developed multichannel spin-detection system is capable of delivering high performance in terms of resolution and measurement speed. A detailed characterization of the constructed system was performed and first spectroscopic measurements on thin iron films illustrate the enormous capabilities of this technique.

With this system, we want to analyze metal-organic interfaces. These materials are potential spintronic candidates. Spintronics is a novel alternative to conventional electronics. Instead of the electron charge, the spin of the electron is used to process information. A detailed spin-resolved investigation of electronic properties is therefore essential.

7. Research implementation and results under the program

Title of your research plan:

Spin-resolved photoemission spectroscopy of metal-organic interfaces

Description of the research activities:

The fabrication of pristine metal-organic interfaces requires ultra-high vacuum conditions. The samples were therefore produced in a vacuum chamber at the Hiroshima synchrotron radiation center. To produce metal-organic interfaces on our tungsten substrate, a molecule evaporator containing H_2TPP was brought to Japan and attached to the experimental chamber. In a first step, special heating procedures were determined to obtain verifiable atomically clean surfaces of the tungsten substrate. Iron films between 2 and 25 monolayers were subsequently grown onto this substrate. A precise calibration of the iron evaporator was performed by using a micro balance which is able to detect coverages in the submonolayer range. Correct annealing temperatures of the produced iron-tungsten sample lead to atomically smooth surfaces. The overall surface quality was analyzed by using Auger electron spectroscopy and low-energy electron diffraction. Finally, the molecules were evaporated in different thicknesses to produce the metal-organic interface. The spin-resolved photoemission spectroscopy revealed a pronounced thickness dependent influence of the organic molecules on the spin-related electronic properties of the iron.

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: Justin Schieven （ID No.: SP16311）

2. Current affiliation: Faculty of Chemistry and Chemical Biology, Dortmund University of Technology, Germany

3. Research fields and specialties:
Chemistry

4. Host institution: Kyoto University

5. Host researcher: Dr. Hiroaki Ohno

6. Description of your current research

In homogeneous gold catalysis, a recycling of the precious catalyst is difficult because it is usually reduced to (catalytically inactive) metallic gold under the reaction conditions. One solution for this problem is the use of micellar catalysis. Micelles serve a nonpolar reaction chamber for gold-catalyzed transformations in bulk water as the external reaction medium.

In the experimental work for my projected PhD thesis, I am working on the optimization of the one pot spirocyclization of aldehydes, alkynols and protected hydrazines to the corresponding pyrazolidines as well as other gold-catalyzed transformations under micellar catalysis.

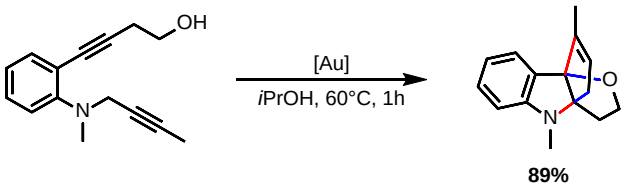
7. Research implementation and results under the program

Title of your research plan:

Gold-catalyzed synthesis of 2-Alkynyl-*N*-propargylanilines in micellar systems.

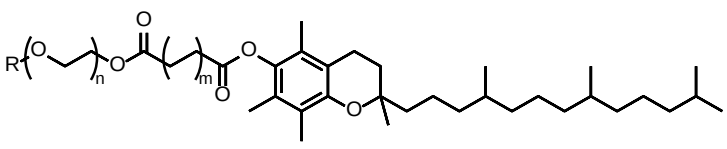
Description of the research activities:

In this research project, the gold-catalyzed cascade cyclization of a 2-Alkynyl-*N*-propargylaniline (Scheme 1), developed by Dr. OHNO, was performed under micellar catalysis. Therefore, different kind of amphiphiles and different reaction conditions have been investigated.



Scheme 1: Gold-catalyzed cascade cyclization of a 2-Alkynyl-N-propargylaniline.

The reaction was performed in four different amphiphile-solutions. In Figure 1 the four used polymers Polyoxyethanyl-α-tocopherylsebacate (PTS), D-α-Tocopherol-polyethylenglycol-750-succinate monomethyl ether (TPGS-750-M), P2 and P3 are shown.



(**PTS**): n≈13, m=4, R=H (**TPGS**-750-M): n≈17, m=1, R=Me

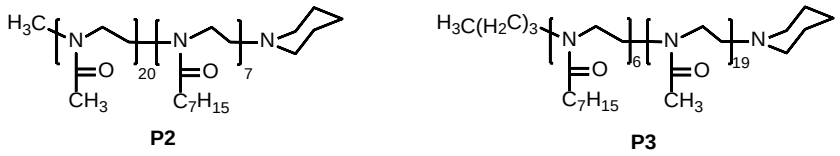
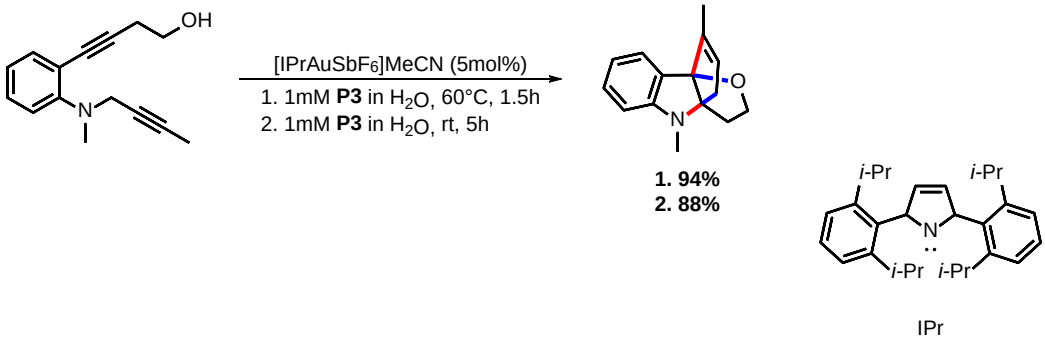


Figure 1: Used amphiphiles for micellar catalysis.

To optimize the reaction-conditions, different amphiphile concentrations, catalysts, temperatures and reaction-times have been investigated. As a result, a yield of 94% of the product could be isolated. It was also possible to carry out the reaction at room temperature (Scheme 2).



Scheme 2: Optimized conditions for the micellar catalysis.

With this optimized conditions a catalyst-recycling experiment has been investigated (Table 1).

Table 1: Catalyst-recycling experiment.

Run[a]	Time [min]	Yield[b] [%]
1	90	88
2	120	87
3	160	85
4	180	85
5	240	79

[a] 1mM P3, [IPrAuSbF$_6$]MeCN, 60°C
[b] isolated yield

In this experiment could be shown, that the recycling of the catalyst is possible.

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

I really enjoyed being part of this Japanese research group. Dr. Ohno was very interested in my work and assisted me a lot with my research. I could not think of a better way to be introduced to Japanese culture. Through the JSPS Summer Program socialized with researchers and professors and I have also made some friends.

9. Advisor’s remarks (if any)

RESEARCH REPORT

1. Name: Jakob Schluck （ID No.: SP16312）

2. Current affiliation: Heinrich Heine University Düsseldorf

3. Research fields and specialties: Mathematical and Physical Sciences

4. Host institution: Tokyo University

5. Host researcher: Professor Shingo Katsumoto

6. Description of your current research

The rapid progress in semiconductor electronics over the last decades has profoundly affected everyday life for all of us. The downscaling of electronic devices must eventually come to an end, when their size gets to the dimension of a single atom. But, long before that point, the character of electronic transport undergoes a transition from the classical to the so called mesoscopic regime. In this regime, theories, which work well for describing macroscopic objects, fail. Electrons in some cases need to be treated as billiard balls, which can travel within a device without experiencing scattering, while in other cases a full quantum mechanical treatment is appropriate. Understanding the range of validity and the limitations of these models is not only fundamentally interesting, but also of great technological importance.

Within my PhD-project at the University of Düsseldorf, I study experimentally the properties of electrons in artificially structured environments. Semiconductor heterostructures are patterned with a resolution below 100 nm and subsequently measured at temperatures close to absolute zero. This allows for precise testing of theoretical predictions.

We could show, how transport is tuned by a combination of a periodic magnetic field and a regular arrangement of strong scatterers. Within this project we could also demonstrate the possibility of deducing the strength of a localized magnetic field in the so called ballistic regime by transport measurements.

7. Research implementation and results under the program

Title of your research plan:

Nonlinear electronic transport in semiconductor ring arrays

Description of the research activities:

Prior to my visit, researchers in my advisors group discovered a hitherto unreported nonlinear response of a regular array of mesoscopic rings within a semiconductor at low temperatures. Electron-electron interaction was proposed as a potential origin. We agreed on the need for clarifying experiments, which should be conducted during my visit.

For the first part of my stay, I was trained to use the local microfabrication facilities. With the help of the skills acquired during this, I was able to produce several samples, suitable for studying the origin of before mentioned effect.

The second part consisted mainly of experiments with these samples. They were introduced into a so called dilution refrigerator, where the electron temperature is reduced to below 100 mK, and characterized by electronic transport measurements. Our results could reproduce the previous ones and eliminated some of the former ambiguities. The wish to further improve our understanding of the observed effect, made it necessary to produce a new set of samples. This was done by me and first results can be expected within the near future.

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

I really enjoyed working at my advisors group. My colleagues were very supportive and thanks to their help I managed to find my way in an unknown lab environment. They also gave helpful advice regarding everyday life in Japan and recommendations for weekend activities. I enjoyed trips to Kyoto, Nikko and Hakone, saw the sunrise on top of Mount Fuji and explored the neighborhoods of Tokyo.

9. Advisor’s remarks (if any):

It was very nice to work with Mr. Jakob Schluck. I am a bit sorry that my health problem prevented me to work with him in the laboratory, which kind of work I actually love to do.

RESEARCH REPORT

1. Name: Katharina Marie WENZ （ID No.: SP16313）

2. Current affiliation:

Albert-Ludwigs-Universität Freiburg

3. Research fields and specialties:

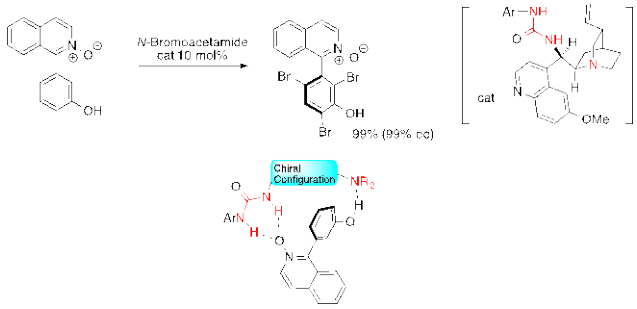
Chemistry

4. Host institution: Kyoto University

5. Host researcher: Prof. Seijiro MATSUBARA

6. Description of your current research

During this research project we investigate the mechanism of an asymmetric bromination reaction by computational and experimental methods. (R. Miyaji, K. Asano, and S. Matsubara, *J. Am. Chem. Soc.* **2015**, *137*, 6766). As shown in Scheme 1, the isoquinoline *N*-oxide was brominated in the presence of a chincona alkaloid derived bifunctional catalyst with high enantioselectivity. The transformation gives an axially chiral isoquinoline *N*-oxide product, which is a promising chiral ligand. It was previously shown that the first bromination occurs at the 2-position of the phenol ring with high enantioselectivity.



We conduct mechanistic studies of the asymmetric bromination by a synergy of computational and experimental methods. The main focus is to understand the asymmetric induction caused by the catalyst. Through it's bifunctional coordination to the substrate via hydrogen bridge bonds, the catalyst fixes the configuration of the substrate axis. The preferential conformation in the product developing transition state leads to the formation

of the obtained enantiomer.

7. Research implementation and results under the program

Title of your research plan:

Mechanistic studies on an asymmetric bromination reaction using a bifunctional organocatalyst

Description of the research activities:

I started the mechanistic studies of the asymmetric bromination reaction by DFT calculations. First I investigated the rotational barrier around the biaryl axis of the reaction substrate and monobromination product. After the bromination the rotational barrier changes from 16.8 kcal /mol to 36.8 kcal/mol, so after the reaction there is no free rotation around this bond at room temperature. This fits with the experiment showing that the enantioselectivity of the reaction is achieved in the first bromination step. Next I proceed to investigate the conformation of the free chincona alkaloid catalyst and the substrate-catalyst complex. The catalyst binds the substrate in an anti-open conformation and the most stable complex (ΔG -6.4 kcal/mol) involves a bindetate substrate binding via hydrogen bridge-bonds. We also started to investigate the mechanism of the bromination reaction with NBA and conclude that the active reagent is probably Br_2 formed in the reaction by slow radical and thermal degradation of NBA. We try to clarify this by comparative experimental studies with Br_2 as bromination reagent.

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

I had a lovely stay in Kyoto and I enjoyed my time here very much. My coworkers at Kyoto University were very nice and helpful and also introduced me to Japanese culture. I hope that we will continue joint research in the future.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Christopher John Frederick CAMERON （ID No.: SP16401）

2. Current affiliation: McGill University[1, 2], Montréal, Québec, Canada
[1]School of Computer Science and Center for Bioinformatics
[2]Department of Biochemistry and Goodman Cancer Center

3. Research fields and specialties:
Biological Sciences

4. Host institution: Division of Genomic Technologies, RIKEN Center for Life Science Technologies, 1-7-22 Suehiro-cho, Tsurumi-ku, Yokohama City, Kanagawa, 230-0045, Japan

5. Host researcher: Dr. Michiel Jan Laurens De Hoon, Genomic Algorithms Development Unit Leader

6. Description of your current research

In the early 2000s, the first assembly of the human genome was sequenced and since then researchers have striven to understand the genetic code. With recent advancements in DNA sequencing and the creation of novel biochemical techniques, we are now able to observe changes in chromatin architecture (the three-dimensional [3D] organization of DNA) at relatively high resolutions (1,000-5,000 base pairs).

My PhD dissertation focuses on Bioinformatics approaches that identify the link between genomic landscapes (the presence or absence of elements along the genome) and chromatin's higher-order structures (such as Topologically Associating Domains [TADs] – regions of the genome that are found to interact preferentially with themselves). In particular, my work aims to improve our understanding of the 3D DNA-DNA contacts quantified by a family of novel biochemical techniques, Chromosome Conformation Capture (3C); targeted on the genome-wide derivative (Hi-C). All 3C techniques result in pair-end reads (a chimeric DNA sequence, where two subsequences are ligated together and originate from different genomic regions) that may be aggregated into pair-wise interaction matrices. These matrices provide the relative proximity interactions between different loci of the genome and allow for high-order trends to be derived (i.e., TADs).

Correlations between chromatin architecture and certain cellular activities may be further derived by combining Hi-C interaction matrices with data from other novel biochemical techniques, such as: 1) gene expression (measured by Cap Analysis Gene Expression [CAGE] or RNA-seq), 2) transcription factor binding, and 3) DNA-protein interactions (observed by Chromatin Immunoprecipitation Sequencing [ChIP-seq]). These discovered trends help to provide an understanding of how cells regulate the expression of their genes

by changes in chromatin architecture.

The JSPS fellowship enabled me to learn from researchers at RIKEN, who specialize on genomic data integration, and improve the work being completed for my PhD thesis.

7. Research implementation and results under the program

Title of your research plan:

Identifying Drivers of Architectural Change in Chromatin

Christopher JF CAMERON[1, 2], Mathieu BLANCHETTE[1], Josée DOSTIE[2], and Michiel DE HOON[3]

[1]School of Computer Science and McGill Center for Bioinformatics, McGill University, Canada

[2]Department of Biochemistry and Goodman Cancer Research Center, McGill University, Canada

[3]Division of Genomic Technologies, RIKEN Center for Life Science Technologies, Japan

Description of the research activities:

At the international RNA2016 conference in Kyoto, a poster outlining the JSPS project was presented to garner feedback on our proposed method for integrating data from two novel biochemical techniques; Cap Analysis Gene Expression (CAGE) and genome-wide chromosome conformation capture (Hi-C). CAGE measures gene expression within a cell, while Hi-C quantifies chromatin's three-dimensional (3D) DNA-DNA interactions. The poster's positive reception earned me an invitation from the Beijing Institute of Genomics (Chinese Academy of Sciences) to present a seminar talk in late August. While interning at RIKEN CLST, I contributed to Functional Annotation of the Mammalian Genome (FANTOM) meetings (an international collaboration lead by RIKEN) and expanded my understanding of many different types of genomic data (in addition to CAGE). Using Bioinformatics approaches, we discovered a potential link between gene expression and chromatin's 3D structures by integrating data from both CAGE and Hi-C. A review paper summarizing my work is being prepared for publication.

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

The internship was a very demanding, but rewarding, experience that helped me improve my skills as a scientific researcher. While sometimes difficult to accomplish, with the limited time available outside of the internship, I was able to explore many of Japan's historic temples and sightseeing attractions (including the famous Fushimi Inari shrine and Shin-kyo bridge in Kyoto and Nikko, respectively). My cultural highlight was indulging my gluttony with the many varieties of Japanese food. Every meal was delicious, even

though I didn’t always know what contributed to the dish.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Mitchell CANHAM
（ID No.: SP16402）

2. Current affiliation: University of Alberta

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Takashi HIKIHARA

6. Description of your current research

My current research involves studying the dynamics of hollow flexible tubes conducting a fast moving fluid, also known as the “garden hose instability”. This system becomes unstable when the fluid moving through the pipe reaches a critical flow rate. The instability can be seen in the erratic and seemingly chaotic motion of the tube. This nonlinear dynamical system involves complex fluid-structure interactions. As the fluid travels down the pipe it can cause deformations to the pipe structure, which consequently changes the flow dynamics. Research into this system began in 1950 through the work of Ashley and Haviland, who were attempting to explain vibrations which show up in pipelines. It has since garnered considerable interest in scientific literature as it has numerous practical applications. It can be used to model biomechanical systems such as blood flow through arteries or airflow through alveoli in the lungs. It also has applications to aerospace designs as early stage rocket engines require rapid transfer of enormous quantities of fuel through pipes.

My current methods involve using stereoscopic cameras to capture the 3D shape of a vertically suspended tube and spectral analysis using the Koopman operator. This analysis generates structures known as Koopman modes which can be used to understand the underlying dynamics of the system.

7. Research implementation and results under the program

Title of your research plan:

Broadband energy harvesting from complex mechanical structures

Description of the research activities:

I began my research developing a computer program in Mathematica to simulate the dynamics of a flexible tree-like structure blowing in the wind. I am extremely grateful for the weekly meetings with M. KIMURA and T. HIKIHARA to help me develop and understand this simulation, as my previous experience using Mathematica was virtually non-existent. A simple inverted cantilever was used in place of the tree to simplify the calculations and reduce computing time. The forcing of the wind on the tree was modelled by a sinusoidal wave. After finding the correct parameters to match the simulation with a previous experiment performed at the University of Alberta, we began to investigate the appearance of stochastic resonance in the system. A pink noise signal was added to the sinusoidal forcing wave and the appearance of stochastic resonance was observed. Because of setbacks in developing the simulation I couldn't complete all the goals I had set out to accomplish. I hope to continue working on this project in the future.

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

I greatly enjoyed every part of my stay in Japan. The Japanese people are wonderful, kind, and very generous. The country itself is absolutely beautiful, and is rich in culture and delicious food. The highlights of my trip were seeing all the temples and shrines around Kyoto, Uji, and Nara, as well as climbing Mt. Fuji. I was very lucky to live in Kyoto for the summer to experience all of the festivals and ceremonies that took place here. I am grateful for the friends and colleagues I made, both Japanese and other JSPS fellows, and I plan on staying in touch and visiting in the future.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Peter Crockford （ID No.: SP16403 ）

2. Current affiliation: McGill University

3. Research fields and specialties:

Mathematical and Physical Sciences　Chemistry　Biological Sciences
Interdisciplinary and Frontier Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Dr. Yuichiro Ueno

6. Description of your current research

My Current research focuses on the chemistry of the atmosphere and ocean throughout Earth history. Examples of specific questions my research addresses include: how did the sulfur cycle respond to Neoproterozoic Snowball Earth glaciations (Crockford et al., 2016)? What was the biological productivity of the oceans during the mid-Proterozoic and how did this impact atmospheric O_2 concentrations? I seek out answers to these questions through isotopic analyses of sulfate deposited in evaporative settings from rocks spanning 3.5 billion years of Earth history. Sulfate is a robust molecule that retains its oxygen and sulfur isotopic composition even under conditions that will alter compositions of other molecules and minerals. With recent advances in the sensitivity of instrumentation and sample preparation I have constructed the largest triple oxygen and multiple sulfur isotopic dataset to date. Through these analyses I am uncovering how sulfur cycling has evolved through Earth history. Work at the Tokyo Institute of Technology through the JSPS program adds to this progress by extending my focus into some of Earth's earliest history making the first direct measurements of 3.5 billion year old microbial waste products discussed below.

7. Research implementation and results under the program

Title of your research plan:

The nature of the Archean environment revealed through micro-analyses of fluid inclusions

Description of the research activities:

Our current understanding of the Archean sulfur cycle is based on analyses of sulfate and pyrite within Archean aged rocks, which is calibrated with modern experiments. Modern experiments include measuring isotopic fractionations of different sulfur metabolisms and abiotic processes and it is the combination of this information that is used to interrogate the geologic record. In experiments reactants and microbial waste products can be directly monitored, however the geologic record to date has only offered reactant sulfate which also bears what is interpreted to be the isotopic signature of microbial waste products in coexisting pyrite. My summer project aimed to make the first direct measurements of microbially derived H_2S preserved within fluid inclusions in 3.5 billion year old rocks. To achieve this we needed to develop methods to both extract H_2S from samples, as well as develop new techniques to handle such small quantities of gas. We believe we have results that illuminates the Archean sulfur cycle and provide a new method to revisit the sulfur record through Earth history.

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

My stay in Japan has been nothing short of fantastic. People have been incredibly welcoming and generous and I have enjoyed exploring both the Tokyo Institute of Technology as well as other parts of Japan. This experience has motivated me to actively pursue post-doctoral opportunities in Japan upon completing my PhD.

9. Advisor’s remarks (if any):

1. Name: Amanda Godbold （ID No.: SP16404）

2. Current affiliation: Department of Geoscience, University of Calgary

3. Research fields and specialties:

Physical Sciences: Earth Science, Paleoecology

4. Host institution: University of Tokyo

5. Host researcher: Professor Yukio Isozaki

6. Description of your current research

Of the four billion species that are estimated to have evolved on Earth over the last 3.5 billion years, 99% are extinct. This illustrates just how common extinction events are in Earth's history. The end-Permian extinction (252 million years ago) is the largest extinction event to have occurred, resulting in the elimination of over 70% of oceanic species. This event represents a major ecologic collapse, the cause of which is still unknown. However, it is thought that temperature change, ocean acidification, and a reduction in ocean circulation played a critical role. These environmental stresses persisted during the immediate aftermath of the extinction. Thus, marine refugia were important for the recovery of organisms during the Triassic. A refuge is loosely defined as an ecosystem that acts as a sanctuary for organisms during times of environmental stress.

My research focuses on the development of marine refugia following the end-Permian extinction. This includes understanding the biologic and/or environmental relationships necessary for the occurrence of a refuge. A variety of methods will be used to reconstruct the paleo-environment of four Early Triassic localities spread across Canada, China and Japan. The fossil density and diversity will be measured to assess the sustainability of each ecosystem, despite stressed environmental conditions. The aim of this study is to identify and describe the important ecologic relationships found within the sustainable ecosystems. By understanding these relationships, I hope to more concisely define what constitutes as a refuge during the most devastating event on Earth.

7. Research implementation and results under the program

Title of your research plan:

Understanding the development of marine refugia immediately following the end-Permian extinction.

Description of the research activities:

During my stay in Japan I completed fieldwork on the Hiraiso Formation located in Kesennuma and the Kamura Formation located in Kyushu. Each formation was measured and a detailed description was made, including: lithology, sedimentary structures, fossil and trace fossil assemblages, and GPS locations. In total I described 190 metres of rock and collected over 400 samples. Half of those samples will be used for geochemical analyses and the other half will be used to reconstruct the paleoecology of both formations. Using the facilities available at the University of Tokyo, I was able to cut each rock sample to the appropriate dimensions for geochemical analyses and for the production of thin-sections and polished-slabs. These samples will be sent to the University of Calgary where further processing will be done.

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

The expertise of my host researcher Isozaki-sensei was extremely valuable. Our conversations helped to expand my knowledge of the two-stage progression of the end-Permian extinction. In addition, Isozaki-sensei and his lab group helped to inspire new ideas and concepts that strengthen the quality of my research. I also had the opportunity to work with Oji-sensei and Dr. William Foster during fieldwork in Kesennuma. As a result, I gained advanced field skills and knowledge pertaining to paleoecology.

During my stay in Japan I was fortunate enough to travel to Kesennuma, Takachiho, Kawaguchiko, Nagoya, and Kyoto. All of which have their own unique beauty and traditional food. I really enjoyed learning about the customs practiced in Japan. People in Japan are so mindful of others and a treasure to be around.

9. Advisor’s remarks (if any):

Besides, her scientific achievement, Amanda behaved very much properly in Japan, with her keen interests on almost everything, including academics, culture, and human nature. She has learned a lot through interaction with grad students in my lab, and vice versa she has stimulated the latter very much.

RESEARCH REPORT

1. Name: Valentin JOLY （ID No.: SP16405）

2. Current affiliation: Institut de Recherche en Biologie Végétale, Université de Montréal

3. Research fields and specialties:

Biological Sciences

4. Host institution: Institute for Transformative Bio-Molecules, Nagoya University

5. Host researcher: Prof. Tetsuya HIGASHIYAMA

6. Description of your current research

In flowering plants, pollen tubes (PTs) are highly specialized structures elongating in the pistil (female organ) to deliver the sperm cells to ovules. PT growth is controlled by a wide variety of male-female interactions, among which chemoattraction, a process consisting in the stimulation of PTs by female-emitted molecules, enabling them to precisely localize and reach the ovules. Prof. Higashiyama's research team from Nagoya University was the first one to describe the nature of these chemoattractants in *Torenia* and *Arabidopsis*: the LURE peptides. These small proteins secreted by ovules generate a gradient that precisely attract PTs toward the ovules to effect fertilization. In 2016, the same group was involved in the discovery of the first receptors for these proteins on the PT surface.

My research project aims at describing how similar interactions function in the *Solanaceae* (the potato family), especially in the context of reproductive isolation, i.e. why ovules preferentially attract PTs belonging to the same species. By performing high-throughput RNA sequencing on reproductive tissues from four closely related *Solanum* species, we have isolated a small list of 12 female cysteine-rich proteins potentially controlling chemoattraction of Solanaceous PTs in a species-preferential way. These candidate proteins must now be expressed, purified and tested one by one in the context of intra- and interspecific crosses. Further characterization of these proteins paves the way to a better understanding of speciation processes acting in the potato family.

7. Research implementation and results under the program

Title of your research plan:

Investigating species-specificity of pollen tube chemoattraction in wild potatoes

Description of the research activities:

During this summer program, I got familiar with several techniques developed at Prof. Higashiyama's laboratory and started to apply them to my species of interest:

- **PDMS microfluidic devices.** Microchannel devices were designed, fabricated and used to precisely quantify PT attraction by ovules or purified proteins from several species of interest in the context of intra- or interspecific crosses.
- **Bead assays.** One of our most promising candidate chemoattractants was successfully expressed and purified. We could then test the capacity of gelatin beads containing this protein to modify the trajectory of growing PTs.
- **Two-photon microscopy.** Deep imaging of PTs growing in the pistil was achieved for the first time in *Solanum* by using two-photon microscopy after fixation, clearing and aniline blue staining of pollinated pistils.
- **Antisense gene inhibition of PT trancripts.** I could also get trained about this technique allowing to inhibit expression of specific PT transcripts in *Arabidopsis*. This will allow me to screen for *Solanum* candidate receptors in the future.

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

This stay at Prof. Higashiyama's laboratory was an exceptional opportunity to learn state-of-the-art research techniques, receive extensive feedback on my project from expert scientists, and make multiple contacts in the community. I especially had the opportunity to visit two laboratories in Kyoto and Kanazawa, which allowed me to present our work to other Japanese researchers and plan for future collaborations.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Morgan Kennedy （ID No.: SP16406 ）

2. Current affiliation:

Concordia University, Montreal (Quebec) Canada

3. Research fields and specialties:

Humanities Social Sciences Interdisciplinary and Frontier Sciences

4. Host institution: Ritsumeikan University Center for Game Studies

5. Host researcher: Professor Dr. Akinori Nakamura

6. Description of your current research

My current research has two components: locating examples of narrative at the gameplay mechanic level in independent games developed in Japan and interviewing the developers responsible regarding their narrative process. After conducting a brief literature review on the subject starting with Consalvo's, *Atari to Zelda: Japan's Videogames in Global Contexts* (MIT Press, 2016), and including both volumes of Szczepaniak's, *Untold Stories of Japanese Videogame Developers* (SMG, 2014 & 2015), I quickly realized that this is an underrepresented area in the scholarly research available in English on Japanese independent games. Simultaneous to this, after I completed my preliminary research at the BitSummit Indie Games Festival in Kyoto,
I realized that many of the game developers present were either expatriate Western studios who had transplanted themselves to Northeast Asia or university students. Few had shipped titles on major platforms. Because of this I broadened the focus from these fledgling indies, also pursuing interviews with some of the famous Japanese game industry creators who've started their own studies, such as Tetsuya Mizuguchi of Q Games and Yukio Futatsugi of Grounding, inc. Shortly afterward, I was able to meet Hironobu Sakaguchi, the creator of the Final Fantasy series at Square before he left to start his own small studio about ten years ago, who is arguably the most famous example of this phenomenon. Currently I'm following this parallel line of inquiry through my association with 17-BIT, one of the aforementioned Western studios, who have been my main point of contact with this group of Japanese AAA turned independents and have received positive replies from several of these veteran developers.

7. Research implementation and results under the program

Title of your research plan: Narratives of Japanese Independent Videogame Developers

Description of the research activities:

In addition to theoretical and historical research enabled by the Ritsumeikan Center for Game Studies, I've met with many independent developers from studios in Japan, including 17-BIT Games in Kyoto, where I've been doing on-site research. I secured in-person and web interviews with independent developers through contacts made there, as well as via the Tokyo Indies group and have also begun to reach out to developers in Osaka by similar means. I also conducted research trips to Akihabara and Den Den Town, attended Ritsumeikan Center for Game Studies meetings (where I met the inventor of the Famicom, Masayuki Uemura, as well as other students doing games research.) I was a guest lecturer in Professor Nakamura's class, attended the BitSummit 2016 Independent Games Festival, gave a RCGC Research Session Talk on Game Narrative and Pokemon Go Phenomenon as well as a talk on indie usability testing at 17-BIT Games.

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

Thanks to my Professor, Dr. Nakamura, I had the honor of participating in Gion Matsuri Festival (photo attached), which was the cultural highlight of my trip. I also toured temples in Kamakura, learned how to make matcha and do calligraphy. I visited the Kyoto Manga Museum and Peace Museums and attended a Geiko performance in Gion. During my stay in Kyoto I was able to visit many shrines and temples, including Ginkaju-ji and Ryoan-ji, and attended Daimonji Gozan Okuribi.

9. Advisor’s remarks (if any)

In spite of a relatively short visit in Japan, Mr. Morgan Kennedy had managed to meet and conduct semi-structured interviews to multiple Japanese indie developers regarding their approaches to interweave narratives and game mechanics. Since such efforts had not been done in the past, his work, although it is still at the preliminary stage, will shed the light to an undisclosed area of studies on Japanese video games.

RESEARCH REPORT

1. Name: Samantha A. LEE （ID No.: SP16407 ）

2. Current affiliation: University of Manitoba

3. Research fields and specialties:

Biological Sciences

4. Host institution: Jichi Medical University

5. Host researcher: Dr. Toshihiko Yada

6. Description of your current research

The hypothalamus is the most important central nervous system centre in regulating homeostasis. The paraventricular nucleus of the hypothalamus (PVH) is well known to play a key role in maintaining energy balance. In particular, PVN neurons that contain oxytocin (OXT) appear to contribute to feelings of satiety. Dr. Suyama and Dr. Yada previously demonstrated that a 24 hour fast in rats results in reduced frequency and amplitude of mini excitatory post-synaptic currents (mEPSCs) in OXT neurons. Neuropeptide Y (NPY) is increased after fasting and contributes to increased food intake. Neurons of the PVN receive input from NPY-containing neurons in the hypothalamus and brainstem. Thus, we chose to investigate if the effects of NPY on mEPSCs in PVN OXT neurons are similar to the effects of a 24-hour fast. Briefly, OXT-mRFP rats were anesthetized, brain slices made and then either incubated in artificial cerebrospinal fluid containing (ACSF) or ACSF containing NPY for 3 hours before patch clamp recording. OXT neurons were identified based on fluorescence before being subjected to whole cell patch clamp. We found that NPY treatment reduced the amplitude but not the frequency of mEPSCs onto OXT neurons, suggesting that effects of NPY may be direct on OXT neurons, rather than indirect. To ascertain whether the observed effects of NPY are direct or indirect we are currently repeating the above experiments with the addition of tetrodotoxin to inhibit action potentials thus preventing synaptic activity between neurons. If the effects of NPY are direct on PVN OXT neurons then we expect to see the same results as incubating in NPY alone. Preliminary The results from these experiments indicate the direct effects of NPY include reduced mEPSC amplitude and frequency. More

experiments will be needed to determine significance. Further electrophysiological experiments will be carried out to determine if the reduced mEPSC amplitude is due to a reduction in AMPA receptor/NMDA receptor excitatory current ratio.

7. Research implementation and results under the program

Title of your research plan:

Effects of NPY on mini post-synaptic currents in oxytocin-containing paraventricular hypothalamic neurons.

Description of the research activities:

The neurohormone oxytocin (OXT) contributes to regulating food intake. Recently, it was demonstrated that in rats a 24 hour fast reduces the amplitude and frequency of mini excitatory post-synaptic currents (mEPSCs) in OXT neurons in the paraventricular nucleus (PVN) of the hypothalamus. However, it is currently unknown what peptide mediates this response. Neuropeptide Y (NPY) is increased following periods of fasting and increases food intake. PVN neurons receive NPY signals from other areas of the brain. Using the patch clamp technique, we measured electrophysiological changes in brain slices treated with NPY for 3 hours versus controls and found that NPY treatment results in reduced amplitude and frequency mEPSCs in PVN OXT and these effects appear to be due to NPY acting directly on PVN OXT neurons. These results suggest that NPY signalling contributes to the reduction in mEPSCs in PVN OXT neurons following a 24 hour fast.

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

I enjoyed my time conducting research at Jichi Medical University. I was impressed with the infrastructure and the organization of the lab and the university as a whole. My host supervisor, Dr. Yada, provided wonderful experimental and personal guidance during my stay. The students in the lab were incredibly friendly and ensured that I was invited to events and had a chance to experience life in Japan. They were very supportive and made my time much more enjoyable. I am disappointed that I will not be staying to see final

results of the experiments I have been working on, but am excited to see the final results.

9. Advisor’s remarks (if any):

Samantha was very motivated student for the project. I was so impressive that she learned slice patch clamp quickly. Her findings will be important in our project. Her personality also gave good influence for our lab members.

RESEARCH REPORT

1. Name: Sharifun Nahar （ID No.: SP16 408）

2. Curent affiliation: Institut National de la Recherche Scientifique
Research centre: Énergie Matériaux Télécommunications (INRS-EMT)

3. Research fields and specialties:
Biological Sciences

4. Host institution: Okayama University

5. Host researcher: Prof. Toshihiko KIWA

6. Description of your current research

Terahertz chemical microscopy (TCM) has been devised by Prof. Toshihiko Kiwa to measure the distribution of the chemical or electric potential shift on a sensing plate. On the detection stage of the TCM, there is a sensing plate made of sapphire, silicon and silicon dioxide layers. When femtosecond laser is irradiated the silicon layer of the sensing plate, the electron in this layer is excited which produce current. This current emits terahertz wave.

Any chemical change on the sensing plate modifies the speed of the excited electron. As a result, the current and consequently the amplitude of THz wave are also changed. Differences between before and after the variation on the sensing plate and consequently of THz wave potentially give information on the reaction that happened on the sensing plate. Subsequently, scanning the laser across the sensing plate produces a map, or image, of the spatial details of the chemical reaction.

Thus the TCM is able to image changes of chemical potential, such as those associated with a chemical reaction without the need for a chromophore, fluorophore, etc., on the surface of a sensing plate. It is thus a unique tool to visualize chemical reactions, which could potentially allow us to visualize the reactivity of individual members of an enzyme-library spread on the sensing plate.

7. Research implementation and results under the program

Title of your research plan:

Ultra high throughput selection of enzyme by Terahertz Chemical Microscope (TCM).

Description of the research activities:

My objective for JSPS summer program was to optimize the conditions to observe enzymatic reactions with a TCM, and relate the signal to the catalytic properties of the enzymes. On the basis of the principle of operation of the TCM, a chemical reaction with the enzyme lipase was repeatedly followed on the sensing plate. Since enzymes catalyze chemical reactions very categorically, I used specific substrate molecules and assay buffers to see the catalytic reaction. The following steps were accomplished:

1) Different parameters, e.g., reaction volume, concentration of the substrate and enzyme, reaction time, resolution of camera for imaging, etc. were optimized.
2) The interference of other elements present at the reaction to the sensing plate was also verified. More specifically, the effects of assay buffer, substrate, product and phage particle were checked separately.
3) The complete enzymatic reaction in the presence of all ingredients (assay buffer, substrate and enzyme) was observed.
4) Both single-point measurements and imaging of the entire plate was done.
5) Each experiment was repeated several times to see the reproducibility.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): During this internship at the host institute, I have learned TCM more meticulously. I have visited the department of Agricultural Engineering of Kyoto University, where I learned about a variety of applications of THz waves in the field of agricultural research. The knowledge I gained during my summer internship will help my next level of research once I am back to Canada.

9. Advisor's remarks (if any): Though Sharifun is aiming at very 'ambitious' applications of our TCM, she has studied hard and got excellent results, which clearly shows many possibilities of TCM. Not only about her studies, she has kindly and well communicated with Japanese students. As a result, she could touch with the different way of thinking, which, I believe, can help a lot when she will work out the 'strategy' of her own project in the future. I also believe that she will act as an excellent bridge between Japan and Canada.

RESEARCH REPORT

1. Name: Santa VINERTE （ID No.: SP16409）

2. Current affiliation:

University of Ottawa

3. Research fields and specialties:

Social Sciences (Linguistics)

4. Host institution: Konan University

5. Host researcher: Dr. Nigel DUFFIELD

6. Description of your current research

My research investigates how bilingualism affects executive functions such as paying attention, ignoring distracting information, multitasking, and task-switching. Previous research has shown that both of a bilingual's languages are active at the same time, even if just one language is being used. Therefore, executive functions are needed to control interference from the language not in use, and the bilingual must pay attention to the language environment to use the correct language. The neural processes for this language control and general executive functions have been shown to overlap, and because bilinguals constantly exercise these processes for language control, it has been suggested that bilingualism results in overall better general executive functioning. However, these benefits are modulated by factors such as second language proficiency, the age at which the second language was acquired, the manner in which the second language was learned, and the linguistic environment in which both languages are used.

My current research project at Konan University specifically investigates the role of the linguistic environment in developing executive functions. I use a linguistic Stroop task, in which information from irrelevant words must be ignored, and an Attention Network Test (ANT), which measures different facets of attention using non-linguistic stimuli. As well as collecting computer-based reaction time measurements, I also gather data from a series of questionnaires to determine participants' language background, linguistic exposure, and relative proficiency in their second language. Of particular interest is the comparison of Japanese-English bilinguals in Japan to English-French bilinguals in Canada, as these two populations not only acquire and use their languages in vastly different environments, but

also Japanese-English bilinguals have the added challenge of multiple writing systems in their surroundings. I examine the effects of these different bilingual factors in the Japanese and Canadian groups to determine what impact each has on linguistic (both first and second language) processing, as well as on general executive functions.

7. Research implementation and results under the program

Title of your research plan:

Role of the Bilingual Environment and Orthography in Language Processing and Cognitive Control

Description of the research activities:

During my stay at Konan University, I used a computer-based Stroop task and ANT to collect reaction time and accuracy data, as well as language background data from 48 Japanese-English bilingual participants. The participants' linguistic environment was assessed and classified as a single-language one (i.e., Japanese and English each used in a separate environment, with little language-switching or mixing; single dominant language). Stroop task and ANT data were analyzed and compared to a Canadian group, classified as a dual-language and dense code-switching (i.e., both languages used in a single environment; language-switching and mixing present). Looking at language processing, the Japanese group showed better control of language interference. With respect to executive functions, the Canadian group showed significantly better attention and general executive functions. These result show larger impacts on general executive function by environments where 2 languages are equally present and used (dual-language environment), but also suggest faster processing of logographs (i.e., kanji) compared alphabetic script.

These results were submitted and have been accepted for presentation at the Pacific Second Language Research Forum 2016 conference in Tokyo, Japan and the Mental Lexicon 2016 conference in Ottawa, Canada.

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

Participating in the JSPS Summer Programme allowed me to collect valuable data and to network with linguistics researchers in Japan, as well as giving me the opportunity to improve my spoken Japanese by being immersed in the language. I was also able to visit many beautiful places, including Kamakura and the Great Buddha, Kinosaki Onsen and its hotsprings, and Matsue, where I visited the castle and went to a summer fireworks festival.

9. Advisor's remarks (if any):

I am pleased to report that Santa Vinerte achieved all of her research objectives during the visit: she was able to test a representative cohort of Japanese-English bilinguals, and to process and to analyze the resulting data in preparation for two upcoming international conferences. She also played a leading role in training two graduate students in relevant resesearch methods.

RESEARCH REPORT

1. Name: Edith Pui Cheung YEUNG （ID No.: SP16410）

2. Current affiliation: University of Western Ontario

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: University of Tsukuba

5. Host researcher: Prof. Yoshikazu SUZUKI

6. Description of your current research

Realizing the damaging effects of greenhouse gasses and depleting availability of fossil fuels, scientists have turned towards the research of alternative clean, sustainable forms of energy. One such option is sunlight – a clean energy source that will not run out within the span of human history. Perovskite solar cells (PSCs) are devices capable of harvesting the sun's light and converting it into usable energy in a similar fashion to that of plant leaves. PSCs contain five main components including a front and back electrode, an electron transport layer, a sensitizer, and a hole transport layer necessary for redox reactions. When light hits the sensitizer, an electron is given off and carried from one side of the cell to another, thus creating a current.

Although the overall fabrication of PSCs is inexpensive, the chemicals required can be quite costly to purchase. My research focuses on finding cheaper alternatives for making PSCs. A collaboration of Gilroy's and Fanchini's labs in Canada worked on the synthesis of oxoverdazyl radical polymers with unique properties theoretically useful in perovskite solar cells. This polymer is stable and can be reliably reproduced. One of its unique properties include its ability to change conductivity states depending on the voltage applied, making it useful in the assistance of charge transfer. The aim of my project here in Japan is to incorporate this radical polymer into the standard PSC as a hole transporter which takes electrons from one electrode and resupplying the perovskite with its missing electron known as a redox reaction.

7. Research implementation and results under the program

Title of your research plan:

Incorporation of radical polymer in perovskite solar cells as hole transport material

Description of the research activities:

During my stay at the University of Tsukuba, I started with learning how to make a standard perovskite solar cell from Prof. Suzuki's group. The first months focused on making quality standard PSCs with sufficient reproducibility and power conversion efficiency. When it came time to make my own cells that incorporated the oxoverdazyl radical polymers as the hole transport material, several problems were encountered, mainly involving the conductivity of the radical polymer layer. The remaining weeks of my stay were spent trying to make a functional cell using the polymer. Individual and weekly discussions with the supervisor and fellow group members whose projects focused on specific components of the PSC were helpful in better understanding what may have been hindering my own cells and what actions to take next. I intend to bring the knowledge and experiences gained here in Japan to my research back and continue where I have left off. Further studies using the equipment from my lab in Canada will be used to characterize the cells.

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

Of the five times I have been to Japan, I would say this was the most memorable. I was finally able to immerse myself in a culture I have been fascinated with since childhood and later studied in university. Fellow JSPS members in Tsukuba were great emotional support for my time overseas. Without them, I would not have tried the things I did nor gone the places we've gone. Just this past Obon holiday, a few of us took a backpacking trip to Aomori. We had a great time and were able to enjoy the lakes and rivers of Japan. The most exciting part was visiting the Sannai-Maruyama archeological site where we could walk through a reconstructed village of the Jomon period. Everyone in Japan had been so kind and helpful. I will definitely miss this country and all its beauty.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Valentina Fermanelli （ID No.: SP16501）

2. Current affiliation: Chalmers University of Technology

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Keio University, School of Medicine

5. Host researcher: Professor Yusuke Tanigawara

6. Description of your current research

My research is about Non Linear Mixed Effects Models.

Some dynamic processes, such as the absorption of a drug in the body or metabolism of lipids, can be translated in mathematical language as a system of differential equations. When data from clinical trials are available, it is possible to make inference on the properties of the system by using statistical methods. Even though extracting the information from each patient separately seems the most reasonable way to analyze data, considering each person as part of a population with a shared mean behavior and individual variability gives many advantages. This approach is called Non Linear Mixed Effects Models and its application in the study of lipid metabolism is my research interest at Chalmers University.

7. Research implementation and results under the program

Title of your research plan:

Pharmacokinetics and Pharmacodynamics analysis of Eribulin for Breast Cancer patients

Description of the research activities:

Clinical trials are very important to understand the efficacy of a drug. Chemotherapy has a strong effect on the immunity profile of the patient. It is important to understand how the neutrophil count is influenced by the effect of the drug. In this study, which is called pharmacodynamics, we need information on how the drug concentration changes after the injection. These data were not available for the Phase II patients of a clinical trial for Eribuline (an anticancer agent). Therefore we have used concentration profile parameters (corrected with laboratory data) as calculated in a published paper to obtain the population parameters for the immunity profile. We have successfully used a Monte Carlo simulation to test the robustness of the estimation.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): It has been a great honor to work with Tanigawara sensei and with the other colleagues in the lab.

I got the opportunity to visit Kyoto during Gyonmatsuri. Tanigawara sensei and I enjoyed the zen atmosphere in Tofukuji temple. I took part to the JSMO (Japanese society of Medical Onconology) conference in Kobe. Everything has been an incredible experience. I met amazing people within these two months.

Thank you so much!

9. Advisor’s remarks (if any)

RESEARCH REPORT

1. Name: Puren Guler （ID No.: SP16502 ）
2. Current affiliation: Ph.D. student
3. Research fields and specialties: Robotics
4. Host institution: University of Tokyo 5. Host researcher: Ishikawa Watanabe

6. Description of your current research

My Ph.D. thesis integrates mathematics, statistics, machine-learning and simulation techniques to solve the problem of manipulating of unknown objects. These objects can be rigid or deformable. Such properties affects the way that robot manipulates the object, i.e. deformable objects can show unpredictable behaviours while rigid objects have less degrees of freedom. However robot does not know such informations before hand and may not apply the proper manipulation. Hence I am investigating the usage of the visual and haptic sensors in the exploration of such information to
learn the object properties for better manipulation.

• A content in a container can affect the way we grasp the object, e.g. whether it is filled something granular or something liquid. We, as humans, usually have this information and utilise this information to prevent hazardous events such as spilling. However, this information is hidden to the robot. Hence, I explore the integration of visual and tactile sensory data to classify the contents of a container that is being squeezed by a robotic hand. The classification is done by observing the deformation occurring on the container using haptic
and visual sensory modalities of the robot. To quantify the object deformations visually, we measured the deviations from a rigid object model that we track while robot squeezes the container. For gathering haptic data, haptic readings coming from the robot hand are recorded during the squeezing action. Result of this work is presented at IROS 2014.

• Rigid object model used in the previous study is insufficient to represent the deformation on the object. To explicitly represent and estimate the deformability of elastic objects, the deformation is modelled using a deformable object simulator. To capture the real-world observations, motion information is recorded for each frame using a computer vision technique, i.e. optical flow. We match the observed motion to the simulated deformed shape of the object to estimate the deformability. A paper that consisted of this work is presented at Humanoids 2015.

7. Research implementation and results under the program

Title of your research plan:

Estimating elastic deformability based on meshless shape matching simulation by referencing FEM deformation computation

Description of the research activities:

Knowing deformability properties is important for robotic manipulation tasks to classify object types based on their deformability and to plan appropriate manipulation for the respective deformability.

However this information is usually hidden to the robots. Using a simulation environment, these properties can be modeled and the deformability behavior of the object under manipulation can be predicted.

In this paper, we model deformability using a meshless shape matching (MSM) simulation which is a widely used deformable object simulator in computer graphics field due its com- putational and memory-wise efficiency. While estimating the deformability, finite element methods (FEM) based deformation computations are used as reference deformation.

Our results show that an empirical relation can be established between the physical deformability property (poisson ratio) of FEM simulation and deformability parameter of MSM. Moreover, the pose of the real deformation is estimated with small error (~0.3 cm in average). We also propose a dataset that contains the reference FEM deformation which can be used for benchmarking purposes.

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

I really enjoyed living at Tokyo, especially the food. The city is great and very vivid. The campus of the university is beautiful.

Also staying with a host family during orientation was a great experience for me.

I wish I could to use the research money for buying hardware(to buy a faster computer) but university didn't allow me to spend more than 100000 yen per item. But it didn't cause any trouble for my research at the end.

What I didn't enjoy is insects:) but it's because I have a phobia.

I wish I could come to Japan soon and live here maybe a little longer and learn the language as well.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Shaden Ali Khalifa （ID No.: SP16503 ）

2. Current affiliation:

Department of Molecular Biosciences, The Wenner-Gren Institute, Stockholm University, S-106 91 Stockholm, Sweden

3. Research fields and specialties:

Biological Sciences

4. Host institution: Department of Otolaryngology-Head and Neck Surgery Kumamoto University. 1-1-1 Honjo, Kumamoto, Japan 860-8556

5. Host researcher: Ryosei Minoda, M.D., Ph.D. Associate Professor. E-mail: minoda@gpo.kumamoto-u.ac.jp. Tel: 81-96-373-5255 Fax: 81-96-373-5256

6. Description of your current research

Surface for nerve guidance was designed with extracellular proteins. Micro-contact imprinting provided a versatile and useful technique for patterning the guidance surface. A range of events followed the patterning including alignment, polarity and directionality was reported and observed by morphological and microscopic description. In summary, the dynamic microenvironment that results from the synergistic combination of extracellular guidance cues and Schwann cells selectively direct the terminal extension of neurons into uni- or bi-polar fate.

7. Research implementation and results under the program

Title of your research plan:

Investigating the functional auditory system in mutant mice

Description of the research activities:

Background:

TIS21 is a transcriptional cofactor that shows antiproliferative, antiapoptotic and preedifferentiative effects on neural progenitor cells. Some of the Cdk5rap1 modifications have been associated with the development of mitochondrial diseases.

Project 1 main goal:

To prove the functional role of TIS21 in the auditory system by testing the variation in the morphological structure and hearing sensation from adulthood to aging.

Animal model:

TIS21 KO mice: B6N(Cg)-Btg2<tm1b(KOMP)Mbp>/2J (homozygous, heterzygous) and wild type

Aims:

1) Study synaptogenesis (using pre-synaptic and post-synaptic markers) as a sign of differentiation in conjunction with the synaptic ribbons between spiral ganglion and hair cells.

2) Test the viability and number of type I spiral ganglion cells and type II cells in the old versus adult animals.

3) Check the possibility of age-wise degeneration/regeneration by visualizing the glia/Schwann cells relative to spiral ganglion cells.

Assessments:

☐ ABR measurement (approximately 2 weeks)

☐ Histological preparation and sectioning (approximately 1 week)

☐ Immunostaining and Fluorescent microscopy (approximately 2 weeks)

☐ Confocal microscopy, Western blot/electrophoresis (optional)

☐ Quantification of the data and writing the report (approximately 2 weeks)

Project 2 main goal:

To prove the functional role of CDK5RAP1 in the auditory system by testing the neuronal degeneration, apoptotic changes and mitochondrial dysfunction.

Animal model:

Cdk5rap1 KO mice: homozygous and wild type (3 weeks and 3 months old)

Aims:

1) Study neuronal degeneration in vitro by preparing auditory cells population. Dissecting and culturing spiral ganglion cells either as primary or organotypic cultures from young age (3 weeks) and older age (3 months).

2) Check the occurrence of apoptotic changes by visualizing DNA degradation, ROS accumulation, nuclear fragmentation, chromatin condensation, and rupture of the plasma membrane.

3) Investigate also the mitochondrial dysfunction in vitro if possible using some of the commercially available kits and the described assays.

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

Kumamoto Castle is a hilltop Japanese castle located in Kumamoto. Kumamoto Castle is considered one of the three premier castles in Japan, along with Himeji Castle and Matsumoto Castle. The walls supporting the main castle and wall defenses have all slipped away after the 2016 earthquake and it will be months if not years for the insides of the buildings to be accessed again. But I take a walk and many photos when around.

Suizenji Jojuen Park is a traditional Japanese garden landscaped around a natural spring pond and including the landscaping miniature of Mt. Fuji. Izumi Shrine is located on the north side of the park.

There are more than 90 other shrines where I visited about five of them.

Several of the attractions of Kumamoto can be reached easily by using this Tramway. So knowing this Tramway Network is a must, it was fun to ride it couple of times.

The Shimotori shopping arcade is a good point for getting a taste of the Kumamoto with a nice sampling of restaurants and shops. It's a typical Japanese street level covered mall and it's connected to the Sunroad Shotengai from the street leading to the Kumamoto Castle. You can find convenience stalls, pharmaceutical and toiletry shops, ABC Mart, Macs, KFC, shoes, handbags, grocery stores etc ...

Kumamoto zoo and Botanical Gardens is the only one zoo in Kumamoto. The scale is not very large, but they have elephants, giraffes, hippos and other animals which you can say are "most popular animals in

zoos".

Course Meal or Japanese sashimi that reproduces the Samurai Cuisine of Kumamoto using sketches from some valuable cooking secret notes from the Edo period. You can eat in the large kitchen that has been restored on Ninja and other traditional restaurants.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Paul Linjamaa （ID No.: SP16504）

2. Current affiliation:

Lund University

3. Research fields and specialties:

Humanities, History of Religions

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

5. Host researcher: Kenji TSUTSUI

6. Description of your current research

My main focus of research is the Early Christian and Valentinian text called "The Tripartite Tractate" (NHC I:V) (hence Tri.Trac.). My dissertation deals with the philosophical context and ethics of the text. I will attempt to answer questions like: who was the intended recipient? What sort of text is this? Genre? I investigate theological and philosophical issues and the text's relation to other early Christian authors, from the perspective of certain philosophical discussions. For example, I am very interested in the discussions on free will and I argue that Tri. Trac. presents one particular understanding of the question of free will which other Christians reacted against, in a sense rejecting the idea of free will. My dissertation will attempt to show that to get a better understanding of this early Christian text we need to pay close heed to Christian reception of Stoic and Platonic epistemology, theory of emotions and discussion on free will.

7. Research implementation and results under the program

Title of your research plan: “The philosophical background of the Tripartite Tractate”

Description of the research activities:

I have finished two chapters of my dissertation while in Japan. Chapter 2: “Emotions and the Tripartite Tractate” and Chapter 3: “Free Will and the Tripartite Tractate”. On the 5 August I presented my work at the *Ancient and Eastern Christianity Seminar* at Tokyo University, my presentation was entitled “Emotions in the Tripartite Tractate and Ancient Christianity”.

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

I enjoyed my stay very much and the time at Tokyo University was a very productive time for me. Apart from working on my dissertation at the University, I have spent time exploring what the great city of Tokyo has to offer. I have visited many parks, been to concerts, temples, sports events and explored the amazing food culture of Japan. During the last week and a half of my stay in Japan (10-21 August) I will spend traveling outside Tokyo. I plan to visit Kyoto, Nara, Hiroshima and Kobe.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Elisa Lopez (ID No.: SP16505)

2. Current affiliation: Department of Cultural Anthropology and Ethnology, Uppsala University, Sweden

3. Research fields and specialties:

Humanities X 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: Department of Anthropology, Osaka University

5. Host researcher: Dr. Atsuro Morita

6. Description of your current research

My current PhD research examines how people make meaning and deal with mining-based forced change of their environment, in and around the mining city of Kiruna. One hundred and twenty five years since Swedish explorers and geologists began arriving to what Sami reindeer herders used to call the “resting place” between the Luossavaara and Kirunavaara mountains during their seasonal migration has since been transformed into the world’s largest underground iron mine - the LKAB Kirunavaara mine. The Kiruna ore body is four kilometers long and 80 meters wide with an estimated underground depth of two kilometers, slanting at a 60 degree angle toward the city. In 2003, LKAB and its owner, Swedish state, began the planning process toward expand iron mining operations in the Kirunavaara mine by adding a new main level at a depth of 1,365 meters underground. This mine production level, called KUJ 1365, would allow for the continued ore mining in the Kiruna mine for the next twenty to thirty years, or the year 2033.

However, every shovel of earth removed or produced as waste rock or ore in the Kiruna mine has had corresponding physical effects on the earth surface above, causing the ground to sink, crack, and collapse. This subsidence will continue indefinitely (cite USGS), long after mining ceases at the LKAB Kiruna mine. Three thousand two hundred homes, Kiruna’s entire city center commercial district, the majority of public institutions including the city hall, upper secondary school, an elementary school, the hospital, library, the church and public pool will have to be evacuated and demolished within the next twenty to thirty years. At least thirty-three percent of central Kiruna’s population - approximately six thousand people - will be involuntarily displaced and resettled. Besides affecting the physical urban environment, this expansion of the mine will also destroy pasture land and migration routes for three indigenous Sami reindeer herding collectives, who have been slowly but increasingly dispossessed of their land by LKAB and the Swedish mining industry.

I have conducted approximately fourteen months of field research, interviews, and participant observation in Kiruna (2012-2015) in order to learn not only how people understand these changes and impending displacement, but to understand what and how social relations centered of nature and the environment in both Kiruna and Sweden as a whole have influenced this community in transition.

Title of your research plan: *Tending the "Corporate Forest": The Role of Nature in Corporate Social Responsibility Practices in Japan*

Description of the research activities:

On July 21, I conducted interviews at Nippon Steel Sumitomo Metals Corporation and Mitsubishi in Tokyo. On August 15th, I traveled to Wakayama Prefecture and did interviews with Wakayama Prefecture Forestry Maintenance Division about the "Enterprise Forest" initiative, which they pioneered in Japan. I also visited two sites in the UNESCO World Heritage area in the Kii Mountain Range, Koyasan and Takajiri-Oji. In Tanabe, I visited the Minamata Kumagusu Museum and Archives and spoke with a curator, where I learned about early 20th century science and conservation efforts in Japan.

Additionally, I had many informative conversations with students and staff from Osaka Anthropology - as both practicing anthropologists but also Japanese themselves - which provided invaluable insights into both my project design and the subject at hand.

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

I had an excellent time in Japan, not only working at the university but also living in Kyoto. I had the opportunity to sublet an apartment from a professor in the department adjacent to Kyoto City Hall on Teramachi Street. The central location and close knit community of the street were a welcome experience to live in a real neighborhood and get to know the neighbors, as well as enjoy many close by festivals like the Gion Matsuri throughout the month of July.

9. Advisor’s remarks (if any):