RESEARCH REPORT

1. Name: Guillermo Amador
（ID No.: SP14 001 ）

2. Current affiliation: Georgia Institute of Technology

3. Research fields and specialties:

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

4. Host institution: University of Tokyo

5. Host researcher: Isao Shimoyama

6. Description of your current research

My current research considers a physical perspective into an insect's maintenance of a clean body surface. Flying insects are faced with a barrage of particles in their environment, including dust, pollen, pollutants, and parasitic mites, the last of which is responsible for spread of disease in honey bees, of critical importance to agriculture around the world. Through combined experimental and theoretical studies, we elucidate the mechanisms by which insects stay clean. These mechanisms all rely on the insect's coverage by a dense array of bristles. We show that these bristles divert incoming flow, reducing deposition of particles, especially onto the eyes. Additionally, during grooming, the bristles are triggered like miniature catapults, driving particles at over 1000 gravities.

This work is a continuation of my previous work on mammalian eyelashes. In that study, we found a similar aerodynamic phenomenon through which eyelashes divert incoming flow away from the ocular surface. By diverting incoming airflow, eyelashes can protect the ocular tear film from evaporation and contamination by airborne particles. Technologies in manufacturing contending with micron-scaled particles can draw inspiration from the biological systems studied in this work. Bristle-like structures surrounding mammalian eyes and interspersed throughout insect compound eyes act as a new type of 'filter' by diverting incoming particle-laden flows and facilitating cleaning through stored elastic energy.

7. Research implementation and results under the program

Title of your research plan: Arrayed bristles reduce soiling of compound eyes

Description of the research activities:

While the presence of bristle arrays on insect compound eyes has been known for quite some time, there hasn't been a study analyzing the effect of bristles on airborne particle deposition. The hypothesis is that setae affect incoming airflows to reduce airborne particle deposition to the eye surface. Through collaboration with Dr. Isao Shimoyama's lab, micron-scaled sensors are used to probe the effect of bristle arrays on incoming airflows. The sensors are comprised of piezo-resistive cantilevers that deflect when acted upon by the dynamic pressure exerted by flowing air. When deflected, the electrical resistance of the cantilever is changed. The change in resistance of the cantilever is proportional to the dynamic pressure exerted by the airflow; therefore, the change in resistance can be used as a metric for the intensity of the airflow.

Before exposing the sensors to airflow, they are calibrated using a small pressure chamber that imparts a pressure difference between the top and bottom surfaces of the sensor. The pressure difference is varied between -60 and 60 Pa with increments of 10 Pa and the change in resistance measured for each pressure difference. From these experiments we can obtain the proportionality constant for each sensor to convert from change in resistance to pressure difference.

The 10μm-by-10μm cantilevers are fabricated in the middle of a 2mm-by-2mm silicone chip with an array of pillars interspersed throughout. The cantilevers and silicone chip surface represent an insect's eye and the pillars represent the typical bristle arrays found on insects. The sensors are placed inside of a small wind tunnel and exposed to airflow velocities representing those experienced by insects during flight. The direction of the flow relative to the simulated ocular surface is varied between normally incident to parallel, shearing flow. More emphasis is focused on shearing, and near shearing, flow as previous experiments failed to capture the effects at these flow directions.

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

During one weekend, I participated in a lab outing to Mt. Fuji. We climbed the mountain and watched the sunrise from the peak. I also went to the beach with some of members from my host lab during Umi no Hi (Sea Day). We stayed in a traditional Japanese vacation house, enjoyed traditional Japanese fare, and set off fireworks at night.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Coralie Backlund （ID No.: SP14002 ）

2. Current affiliation: University of Massachusetts Amherst

3. Research fields and specialties:

Chemistry Engineering Sciences Biological Sciences

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

5. Host researcher: Professor Shiroh Futaki

6. Description of your current research

Biotherapeutics are an emerging field in the treatment of cancer and debilitating genetic disorders. They are currently limited to extracellular targets because the cell membrane is a highly selective barrier. By facilitating the delivery of biotherapeutics across this barrier, the quantities of drug needed, and the resulting side effects on healthy tissues can be significantly reduced. Cell penetrating peptides (CPPs) enable biotherapeutics and other biologically active materials to cross the cell membrane. The mechanism of cellular entry of these CPPs remains a topic of debate. The Futaki lab at Kyoto University has a long history of researching uptake mechanisms of CPPs to develop novel, efficient, and effective means for drug delivery.

My current research is focused on comparing the transfection efficiency of our novel CPPMs in a variety of cell types using GFP as the cargo. By varying the ratio of guanadinium and hydrophobic moieties in the block copolymer CPP mimics, the predominant mode of translocation based on molecular structure was evaluated. Until now, the Tew group has been unable to perform further cellular analysis because of our limited exposure to mechanistic studies. This research will provide fundamental insight in design parameters that promote robust uptake and efficient biotherapeutic delivery.

To evaluate the importance of molecular architecture, I explored energy-dependent (endosomal) pathways for transfection by holding CPPM constant and by varying the ratio of guanadinium and hydrophobic moieties on the monomeric level. A comparison between our homopolymer and block copolymer systems will elucidate how structural differences impact membrane interaction. These polymers encompass structural and architectural variety for comparison between natural and synthetic CPPs.

Analysis of CPPM architecture and composition will promote higher understanding of the impact of structure on cellular delivery and allow for continued improvement of both CPPs and their mimics. Specific improvements to our CPPs will allow for higher efficiencies and broader accessibility to intracellular targets. In addition to furthering the field of CPPs, these advances will provide valuable tools to our collaborators in Veterinary and Animal Sciences at UMass and many others who are probing intricate cell signaling pathways.

7. Research implementation and results under the program

Title of your research plan:

Understanding How to Breach the Cell Membrane to Enhance Therapeutic Design

Description of the research activities:

The molecules of interest were synthesized in our labs UMass Amherst using previously reported methods from the Tew group to attach a fluorescent dye (FITC) onto the end of several of the molecules. Using the FITC molecules, I qualified internalization mechanism using a confocal scanning microscope in comparison to FITC-R8. Simultaneously I investigated concentration dependence to determine if the internalization mechanism would change. It did not, and higher concentrations proved to be cytotoxic.

Localization of internalization was determined using Lysotracker to stain the lysosomes while delivering the FITC labeled polymers. In most cases, they were colocalized indicating that some polymer is taken into lysosomes. To compare delivery of a real protein, GFP was delivered using both FITC labeled and unlabeled polymers. Cells were imaged and sorted (FACS) to determine efficacy. The block copolymer systems proved to have higher efficiency and displayed primarily endosomal uptake. Functional protein delivery of Cre was also attempted, but efficacy of the assay was only 20%, suggesting it needs improvement. I will follow up with this at UMass.

To determine the extent of nonspecific protein binding, a previously reported assay was used to calculate the amount of polymer bound to serum. Overall, my polymer series performed similarly to R8, suggesting high binding to serum proteins. To check if complexation with the desired protein was required, a native PAGE gel was used to investigate the complex size and stability. Protein delivery was compared in complexed and non-complexed samples using HeLa cells. The conclusion from both the native PAGE and the delivery assay is that complexation is required to get specific protein delivery.

Upon return to UMass, I will finish the functional protein delivery experiment and begin drafting a paper targeted toward the Journal of Controlled Release. I also plan to remain in contact with the Futaki laboratory as this collaboration has proven to be robust and sustainable. Continued work will support the advancement of our polymeric systems, while enhancing their understanding of polymer systems.

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

The cultural experience I enjoyed the most was my experience with my host family. They were extremely nice and accommodating. I thought it was a welcoming experience into Japanese culture and lifestyle. While traveling around as a tourist, I attained greater appreciation for the cultural history of Japan and its people, something I think that is lacking in the United States.

RESEARCH REPORT

1. Name: Shelly Bagchi （ID No.: SP14003 ）

2. Current affiliation: Georgia Tech (NSF)

3. Research fields and specialties:

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

4. Host institution: Tokyo Tech

5. Host researcher: Jun-Ichi Imura

6. Description of your current research

At Georgia Tech, my current research concerns human interactions with teams of robots. In particular, I am working on creating a control system where a robot 'band' can play music along with a human musician by following their speed and patterns, rather than just making noise. I plan to expand this research into more complex situations, such as using other instruments besides drums and even using multiple types of instruments.

In the future I hope to explore how humans can more easily interact with robot swarms in different ways, both controlling them and interacting with them as a team. This could be useful for applications such as search and rescue, or distributed mapping.

7. Research implementation and results under the program

Title of your research plan:

A Novel Control Scheme for Human Operation of Large-Scale Robot Teams

Description of the research activities:

This summer I learned two methods of model reduction. The first, for use on first-order systems, requires positive tridiagonalization of the system. Then, the nodes or agents are clustered following the algorithm developed by Ishizaki et al. I worked briefly with this method, creating examples and simulations in Matlab, before switching to the second-order method.

The second-order model reduction method requires first finding the first-order representation of the original system. Then, the controller-Hessenberg form is used to provide a serially cascaded structure that aids in clustering. The aggregated model is then obtained by characterizing the system in the frequency domain. The strength of clustering depends on a parameter, theta, that can be varied to obtain

different aggregated systems.

Currently, I am attempting to use the second-order reduction method to simulate a large multi-agent robot system. The aim is to determine whether the aggregated model can provide the desired results. For instance, given a certain goal, a control input can be calculated for the aggregated system, saving computation time compared to the original, much larger system. However, if the same input is applied to the original system, does it show the desired results? I am still working on this implementation and hope to have results soon.

Description of the research activities:

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

My experience in Japan was great overall, although the lab I visited was not exactly in my area of knowledge. However, I really enjoyed experiencing the culture and daily life in Tokyo. I would love to come back to Japan again.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Jonathan Elijah Barney
（ID No.: SP14004 ）

2. Current affiliation: Michigan State University

3. Research fields and specialties:

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

4. Host institution: RIKEN, Wakoshi

5. Host researcher: Hiroyoshi Sakurai

6. Description of your current research

My current research is a study of the Nuclear Equation of State Symmetry Energy term at high density. This is an important problem for nuclear physics. A large, international collaboration has constructed a detector, the SpiRIT TPC, for this purpose to use in the SAMURAI dipole magnet at RIKEN Rare-Isotope Beam Facility (RIBF). RIBF has the most intense rare-isotope beams available in the world, which makes it the ideal location to study the symmetry energy at high density. I have held an integral role in the detector development since 2010. We have received approval to run an experimental campaign in Spring 2015, and are finishing the testing of the electronics, as well as calibration of the detector. I will return for the experimental campaign, and it will be my thesis experiment. I have a vested interest to ensure maximum performance of the detector. The goals for this summer included: to test the electronics and data acquisition system, testing and documenting the procedure to insert the detector into the SAMURAI spectrometer, designing a cooling system for electronics, and tracking cosmic rays in a magnetic field.

7. Research implementation and results under the program

Title of your research plan:Testing of the SPiRIT TPC in the SAMURAI Spectrometer

Of the stated goals, all except for tracking cosmic rays in a magnetic field were achieved by 15 August 2014. Tracking cosmic rays has been achieved outside of the magnetic field; however, a non-magnetic power cable had to be specially made to allow testing inside of the magnetic field. Electronics testing went well otherwise: sources of cross talk and signal degradation were discovered in the test setup and solved for the final application. The installation of the TPC into the magnet chamber was completed successfully and documented on the collaboration wiki for all members. Cooling for the electronics was carefully considered. After much deliberation, an air cooling system was decided on, rather than using water, which can easily damage the electronics. An initial design has been produced for the approval of the collaboration.

Description of the research activities:

Electronics were tested for connection and noise issues. Problems in the test setup were diagnosed and removed, vastly improving the signal quality. The TPC moving procedure was tested on a track before the installation. A potential clearance issue was solved by machining screws to a lower profile in the machine shop at RIKEN. The training I received at RIKEN allowed me to use the machine shop there. The cooling system was discussed at length. Water cooling can be very dangerous around electronics, and so a simpler system of air cooling was designed.

The Advances in Rare-Isotope Science conference was held at the university of Tokyo, and so I was able to attend this conference. I also attended and presented at the SPiRIT TPC collaboration meeting.

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

The home-stay program was a truly excellent experience. I do not think that anything could have replaced it, it was one of my favorite parts of the program. Please continue this excellent program for more researchers. I was able to work with many researchers at RIKEN, from many countries. The research environment is very friendly to foreign researchers, and the secretaries made housing arrangements very easy.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Samuel L. Bartlett （ID No.: SP14005 ）

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

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

4. Host institution: RIKEN

5. Host researcher: Dr. Mikiko Sodeoka

6. Description of your current research

This study was aimed at investigating a novel transition metal catalyzed reaction between two classes of organic compounds, namely α-keto esters and nitrile oxides. This reaction allowed the synthesis of a group of chemicals called 2-hydroxyisoxazolines.These products may have useful biological and therapeutic properties.

During the course of this research several important findings were made. First, the experimental conditions, in particular, the order in which reagents and the catalyst are introduced during the reaction, have a dramatic influence on the reaction outcome. If reagents and catalyst are combined prior to addition of the solvent a product other than the desired 2-hydroxyisoxazoline was formed. However, if the nitrile oxide precursor (hydroxamoyl chloride) was allowed to undergo complete transformation prior to addition of the catalyst and α-keto ester substrate the reaction became selective for the desired 2-hydroxyisoxazoline. Moreover, it was found through careful experimentation that the nickel catalyst was not involved in the reaction leading to the unexpected and undesired product. These results showed that the catalyst was destroyed upon reaction with the nitrile oxide precursor, and more importantly when the reaction protocol was changed to prevent catalyst deactivation, the catalyst displayed remarkable activity, allowing the desired 2-hydroxyisoxazoline to be isolated as the major product. The ability to control “chemoselectivity” is an exciting feature of the studied catalysts.

In addition to the finding that the catalyst could control which products were formed, it was discovered that the catalyst also provided high levels of stereoselectivity, an important feature that allows synthesis of the 2-hydroxyisoxazolines in enantioenriched form. This is crucial to studying the medicinal properties of the products of this reaction.

A number of catalyst structures were evaluated in this reaction and it was found that changing the metal in the active catalyst from nickel to copper resulted in formation of opposite product enantiomers. This pattern of reactivity is known as “enantiodivergence” in organic synthesis and the development of new reactions that feature this property is currently one of the most important challenges facing organic chemists. An unreported catalyst structure was also found to provide the highest yield and stereoselectivity for the reaction studied.

In summary, careful tuning of the reaction procedure allowed the product selectivity to be controlled. The observation that the desired catalytic reaction pathway becomes dominant over a very facile uncatalyzed reaction demonstrates the remarkable efficiency of the nickel catalysts investigated. Moreover, both enantiomers of the desired product can be accessed by simply employing a different metal. Finally, it was discovered that a previously undocumented catalyst structure provided the highest yield and levels of selectivity.

Future efforts will focus on further tuning of the reaction conditions, including solvent, concentration, temperature, and additives, to optimize the synthesis of the desired 2-hydroxyisoxazoline products with respect to yield and enantioselectivity. Finally, the mechanistic details of this reaction will be studied experimentally and computationally.

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

Toward the end of my stay in the Sodeoka lab I was asked to return to continue research related to my JSPS Summer Program project. I look forward to coming back to Japan to conduct research for a longer period of time.

9. Advisor’s remarks (if any): N/A

RESEARCH REPORT

1. Name: Howard Brand （ID No.: SP14006 ）

2. Current affiliation: Virginia Polytechnic Institute and State University

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Kumamoto University

5. Host researcher: Makoto Kumon, Ph.D.

6. Description of your current research

Natural disasters often lead to catastrophic conditions making human response efforts risky and potentially hazardous. Consequently, there is an increased need and interest to develop robotic systems capable of collaboratively navigating and collecting information in these environments reducing the risk of human loss during response efforts. These environments are usually dynamic and offer a high degree of complexity for autonomous disaster response efforts. Current robotic systems capable of navigating these environments are limited in their ability to process and combine their data into useful information about the environment. Consequently, post processing at off-site locations is usually necessary and may not be achieved in time enough to initiate a strategic response. This limitation constrains the applicability of robotic response efforts in disaster zones as well as other practical dynamic environments.

The research conducted through the East Asian and Pacific Summer Institute (EAPSI), sponsored by NSF and the JSPS, was aimed toward the development of a compact robotic system that could be utilized to navigate and analyze dynamic environments. This system is designed to process complex information from multiple sensors nodes in the environment. Current research being conducted with this system involves developing an autonomous relay station for acoustic data in which the system will follow a micro aerial vehicle and process its data for acoustic localization. Research is also being conducted to use the system to localize a sound source in a dynamic environment. This research will

be an important advancement towards implementing autonomous robotic systems in practical applications.

7. Research implementation and results under the program

Title of your research plan:

Autonomous Mobile Base Station For Coordinating Drone Data

RESEARCH REPORT

1. Name: **Joseph M. Burling** （ID No.: SP14007 ）

2. Current affiliation: **University of Houston, Houston, TX**

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

4. Host institution: **Kyoto University**

5. Host researcher: **Toyoaki Nishida**

6. Description of your current research

My primary area of research is in child cognition, with a focus on visual perception and attention during the language learning process, and the development of such mechanisms over time. I also have experience with standard eye-tracking hardware, both standalone devices and mobile gaze estimation systems. My main area of research involves implementing these systems in children of various ages in order to understand how children learn information from their visual environment. I have also been working on developmental questions relating to how social experiences can be analyzed using motion analysis (optical flow of first- and third-person-perspectives) using the video sources acquired in our cognitive development lab. These techniques help me to understand the embodied dynamics during parent-child interactions in a word learning setting. In addition to interest in the computational side of developmental cognitive psychology, I'm currently in the process of obtaining a quantitative psychological statistics minor along with my developmental psychology doctorate degree. This area of study has provided me with invaluable knowledge about contemporary statistical models and machine learning techniques to apply to the type of large scale data management systems necessary for frame-by-frame analysis of behavioral video resources.

7. Research implementation and results under the program

Title of your research plan:

Understanding attention during development using a new method for eye gaze tracking

Description of the research activities:

The aim of the research conducted this summer was to test alternative solutions for eye gaze tracking that could be used in studying the eye movements of young children. The studied approach implements a promising new technique for Point of Gaze estimation using images taken directly of the eye. This method analyzes corneal reflections using computer vision algorithms on super resolution eye images to accommodate variable task settings. During my stay, I worked with professors

Nishida, Nakazawa, and Nitschke to help develop a child directed task that would take full advantage of the benefits of the corneal reflection gaze estimation technique. The task that I implemented during my visit measures a child's ability to use spatial information as cues for where to look in a cluttered scene, in particular, how they use information from the periphery to guide attention more efficiently. Standard peripheral eye gaze tracking is prone to noise and errors in most gaze tracking systems used in developmental psychology. Toward the end of my visit and after testing the implementation of our approach, gaze tracking samples using the proposed method were collected, along with eye tracking data from a standalone commercial eyetracking device for comparison purposes. Further analysis and post-processing of the data obtained during my stay would be the next step. We will continue to collaborate remotely by determining the accuracy and precision of the corneal reflection technique for estimating eye gaze in a developmental framework. I will continue communications with the host researchers to propose alternative ways in which we can get the most of the data collected during my stay using both tracking methods, and also plan to pursue joint conferences and/or other publications in the future with the participated host researchers.

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

I am very grateful for having the opportunity to conduct research in a foreign country, especially one that is highly regarded in their contribution and academic achievements in a wide range of research areas. I have had a very pleasant experience thus far, and the culture and local community here have been very welcoming and accommodating during my stay. There are many things I still want to learn about the culture, but one thing I would like to take away from here is the manner in which everyday life has been optimized for maximum efficiency while still having strong mutual respect, professionalism, courtesy, and dedication to their work. I am pleased to have been in the company of many individuals who would go out of their way to accommodate my needs despite already having a very busy schedule.

9. Advisor's remarks (if any):

We spent really productive time with Mr. Joseph Burling who have come over to Kyoto and stayed with us for a while. I am sure that my colleagues and I have learned a lot from you and this great opportunity. The project for the summer project was not an easy one at all. The measurement experiment itself was new to us containing a nontrivial amount of uncertainty and unpredictability. After Joseph's proposal was accepted, we discussed a lot about the details, over skype before he arrived at Kyoto. The joint project was not only successful but also beneficial for us to establish a mutual trust and understand each other, much deeper than ever. We are pretty sure that we continue working with Joseph and his supervisor for further collaborations in research.

RESEARCH REPORT

1. Name: Leah Campbell （ID No.: SP14008 ）

2. Current affiliation:

University of Utah, Salt Lake City, UT, USA

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Hokkaido University, Sapporo, Japan

5. Host researcher: Yasushi Fujiyoshi

6. Description of your current research

My dissertation research focuses on investigating the effects of complex terrain on snowbands generated over bodies of water such as Lake Ontario, New York and the Sea of Japan. Lake-, sea-, and ocean-effect (collectively referred to as lake-effect) snowstorms can inundate affected urban and rural communities with long-duration, intense, and often extremely localized snowfall. This can disrupt local and regional transportation, education, utilities and commerce. Numerical weather prediction models and weather forecasters currently struggle to accurately predict the magnitude, timing, and spatial distribution of this heavy snowfall. My research aims to elucidate the meso-scale mechanisms responsible for the distribution of snowfall in these events, such as the influence of terrain and the patterns of generation, trajectory, and fallout of varied hydrometeors within the storm.

Much of my research includes the close examination of specific lake-effect events. This includes the analysis of observational datasets such as atmospheric soundings, surface-based snowfall measurements and particle type imagery, and radar scans. I also incorporate numerical modeling – once able to successfully model a specific event, certain parameters can be changed (i.e. the removal of terrain) in order to test hypotheses.

7. Research implementation and results under the program

Title of your research plan:

Lake- and Sea-Effect Precipitation Processes

Description of the research activities:

My research project at Hokkaido University involved the analysis of a lake-effect event that affected Sapporo in January 2014. This involved the analysis of radar data not readily available outside of Japan and learning how to conduct a three-dimensional analysis of radar reflectivity and winds as observed by a dual-Doppler radar network. I also used surface-based hydrometeor imagery /fall speed data taken by a 2DVD hydrometeor imager to classify hydrometeor types (graupel vs. aggregate). I applied a hydrometeor identification algorithm to the radar data and compared those results with the hydrometeors observed at the surface.

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: Aida Raquel Colon Berrios （ID No.: SP14009 ）

2. Current affiliation: Columbia University in New York

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: IBM Research Tokyo Shin-Kawasaki

5. Host researcher: Yoichi Taira and Hidetoshi Numata

6. Description of your current research

Congestion of the wireless spectrum requires the development of strict standards in terms of bandwidth utilization and power consumption. There are a lot of empty unused frequencies between bands in the spectrum, making our current usage inefficient. The future of communication systems lies in Software Cognitive Radios, but the current hardware we have cannot keep up with the software in frequency agility. Filters are the foundation of communication systems and their quality (or quality factor(Q)) defines how selective they are, the higher selectivity the better for multiband applications.

At Columbia University I work on the process development, fabrication and circuit design of Micro Electro Mechanical Systems (MEMS) or simply put mechanical filters. Mechanical filters have higher Qs than electrical and are low power. My research focuses on developing the adequate structure for these filters and being able to fabricate multiple samples on-chip for easier integration to a system. The chip will be part of a system design, taking over the complex analog circuitry we have now-a-day for front end antennas and substituting it with an array of filters on a single chip.

7. Research implementation and results under the program

Title of your research plan:

Low Loss Optical Path through a Couple of Micro-lens Arrays for Next Generation Optical Interconnects

Description of the research activities:

During the summer I simulated, fabricated and measured different optical configurations using lenses for the development of high density and low power Optical Interconnects. The experiments focused on the characterization of a pair of Micro-Lens Array (MLA) attached to 1.3um single-mode/ 850nm multi-mode optical glass fibers. The goals were to realize a low loss optical path for the near future high performance computing. For the simulations I learned how to use both Light Tools Simulation Software and Rsoft, used for the simulations of the multi-mode and single-mode, respectively.

Another experiment was meant for the characterization at a 10-25Gbps high speed electrical signal of an special LGA pad between two LGA connectors. The main reason for this experiment is to achieve an electro-optical LGA connector, to connect between the printed circuit board and the optical multi-chip module for a high density and low power chip-to-chip Optical Interconnect.

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

Absolutely loved Japan and am planning on pursuing the post-doc here, with the help of JSPS. Thanks for the opportunity!

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Kevin Arthur Schiff CROKER
（ID No.: SP14010 ）

2. Current affiliation: University of Hawai`i at Manoa

3. Research fields and specialties:
Mathematical and Physical

4. Host institution: Kavli Institute for Physics and Mathematics of the Universe (IPMU)

5. Host researcher: Prof. Naoki YOSHIDA

6. Description of your current research

My present research is in observational signals of novel forms of Dark Matter. One way to probe Dark Matter is to perform massive simulations of the growth of structure within the Universe from very early times to the present day. The results of these simulations can then be compared to observational data. Discrepancies between a model-dependent simulation and observational data can be used to exclude or constrain the particular model under study.

7. Research implementation and results under the program

Title of your research plan:

Extension of GADGET-2 with multiple gravitational interactions

Description of the research activities:

I have spent this summer studying existing massively parallel N-body simulation codes. To gain the required familiarity with such simulation codes, I began by building a toolkit for working with initial conditions for the specific code GADGET-2. This toolkit provides means to combine, alter, and even create initial conditions from plain text. Further, the toolkit permits easy analysis of data generated by GADGET-2 with existing Open Source tools. This toolkit is released to the community under the GNU General Public License v2.

Modern simulation codes like GADGET-2 use many sophisticated methods to compute particle interactions accurately and rapidly. I have completed modification of the GADGET-2 code to support multiple, distinct, gravitational interactions between simulation particles when run in pure tree mode. This is a necessary first step toward extension to all operating modes of the GADGET-2 code and may already be of utility to other researchers in the field.

Using the existing GADGET-2 code, I have entered collaboration with University of Tokyo researchers investigating formation of hypothetical ultra-dense structures within the early universe. The presence or absence of these structures today can possibly place strong constraint on conditions in the very early universe.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I was frequently fed like royalty, thank you! I also had the privilege of being invited to a small conference held in Nagano. Not only were the lecturers interesting, but my hosts through U. Tokyo covered all expenses. This kind of 100% hospitality seems unique to Japan, and I am ever grateful for it. It was my first time at Onsen too and that was very interesting. Nudity in public settings is very rare for Americans. Also, the water is so hot!

Getting familiar with life outside of an academic setting was sometimes challenging. The lack of space (physical), such as many people in a swimming pool lane, taught me patience. Also, I got to know the late-night Family Mart store clerk pretty well.

9. Advisor's remarks (if any):Kevin has been making a remarkable progress in the study of non-Newtonian gravity and its observational signatures. He quickly got himself familiar with the Gadget-2 computer program and started writing a necessary force calculation module for his study. I've been delighted to see his constant progress, achieving finally the primary goal of implementing a variety of interaction potentials. I feel it is worth mentioning that Kevin himself is interactive(!) and so had good scientific discussions with our colleagues at Kavli IPMU and at Department of Physics. Overall I find his stay has been quite fruitful and I hope he feels the same. Perhaps I should mention one thing here, that is that I've been unable to spend much time with him in the past two months. This is because of unexpected duties assigned to me after the decision of NSF fellowship, but I wish I could have more time, possibly discussions on a daily basis, as a host researcher. In this sense the remarkable progress he has made is all attributed to his own effort.

RESEARCH REPORT

1. Name: Renata Cumbee
（ID No.: SP14011 ）

2. Current affiliation: University of Georgia

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution:Tokyo Metropolitan University

5. Host researcher: Prof. Hajime Tanuma

6. Description of your current research

In order to improve our understanding of astrophysical objects in our galaxy, it is important to have models of the various processes that occur. Reliable models of X-ray emission due to a process called charge exchange (CX), a collision between an ion and a neutral atom or molecule, which has been established as a primary source of X-ray emission from comets within our solar system, are currently limited. Detailed knowledge of the emission spectra due to CX between ions and neutral H and He are necessary to predict the resulting X-ray energy dependent spectra which we observe in various astronomical environments. This research project uses explicit CX calculations produced by astrophysically important collision systems to produce a theoretical emission spectra resulting from CX. These calculations will be benchmarked to measurements done by Dr. Tanuma's group at Tokyo Metropolitan University.

These theoretical CX spectra are compared to X-ray observations of the Cygnus Loop, a supernova remnant, from the Japanese telescope *Suzaku*. Recent studies have shown that supernova shock models are unable to satisfactorily explain X-ray emission in some regions in the rim of the Cygnus Loop. In an attempt to account for an "anomalously" enhanced X-ray flux, a CX model of the Cygnus Loop was constructed. Using spectra from *Suzaku*, we fit one region with a model including theoretical charge exchange (CX) data along with shock and background X-ray models. The model includes CX collisions of highly ionized (with 0 and 1 electrons) O, N, and C with H at a collisional energy of ~438 km/s. The observations reveal a strong emission feature near 0.7 keV that can not fully be accounted for by a shock model and current CX data, but the inclusion of CX does provide for a statistically significant improvement over a pure shock model. The inclusion of CX data for other collision systems, specifically Fe may improve the CX model and need to be calculated. This model will give us insight into the processes occurring within the Cygnus Loop and other supernova remnants and will have a direct impact on advancing our understanding of atomic collisions and X-ray emission in various regions of our galaxy.

7. Research implementation and results under the program

Title of your research plan:Ion-Atom Collisions in our Galaxy

Description of the research activities:

I have calculated theoretical charge exchange (CX) cross sections for multiple ionization stages of Fe for high-energy collisions in an attempt to benchmark the resulting emission spectra to experimental results provided by Prof. Tanuma's lab at Tokyo Metropolitan University. I am in the process of calculating more ionization stages so that I can include relevant systems in my CX emission model of the Cygnus Loop supernova remnant.

I have presented my research to atomic physicists and astrophysicists at ISAS/JAXA, Osaka University, and RIKEN and was able to visit many laboratories for atomic collisions at TMU, RIKEN, and ISAS.

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

I learned that culturally, the various Japanese physics labs are very similar to American physics labs, contrary to my expectations, and collaborations are considered a central part of a Japanese physicist's research. In general, the Japanese lifestyle is not so different from the American lifestyle and Japan is a very safe.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Sarah Decato （ID No.: SP14 012 ）

2. Current affiliation: University of Wisconsin - Madison

3. Research fields and specialties:

Humanities Social Sciences Mathematical and Physical Sciences

x **Chemistry** Engineering Sciences Biological Sciences

Agricultural Sciences x **Medical, Dental and Pharmaceutical Sciences**

Interdisciplinary and Frontier Sciences

4. Host institution: University of Tokyo

5. Host researcher: Professor Kazunori Kataoka

6. Description of your current research

Cancer remains a leading cause of death worldwide. Chemotherapy is a potent treatment method yet limitations in the delivery of these drugs remain a major barrier to successful cancer therapy and recovery. One promising approach to enhance delivery is to encapsulate anti-cancer drugs inside a polymer assembly, which can shuttle the drugs safely and preferentially to the cancerous tissue. Unfortunately, many polymer assemblies are prone to dissociation and exhibit short circulation times in the blood, leading to increased toxic side-effects and decreased accumulation of the drug to the target site. A semifluorinated amphiphilic polymer has been synthesized with a versatile design to address these challenges. The semifluorinated tail, installed at the terminus of the polymer, allows for enhanced stability of the polymer assemblies and thus increases bioavailability of the encapsulated drug. An open site on the hydrophilic block can also be used to conjugate antibodies and peptides, to target specific cancer tissue, or imaging contrast agents, to enable tracking of the particles in the body. My host, Dr. Kazunori Kataoka at the University of Tokyo, is a professor in the Materials and Bioengineering Department and in the Graduate School of Medicine. His research also focuses on the development of nanodevices that provide improved diagnosis and treatment of cancer. His expertise has been instrumental in optimizing the polymer design and towards *in vivo* characterization. Through this summer program a long-term collaboration with Dr. Kataoka and his colleagues has been established to continue investigating the advantageous properties of these polymer assemblies. These key experiments will evaluate the behavior of the polymers in order to modulate and further optimize their design for cancer treatment.

7. Research implementation and results under the program

Title of your research plan: **Nanoparticle design for controlled and efficient delivery of anti-cancer therapeutics**

Description of the research activities:

Two of the fundamental goals of this summer program were to expand upon the fundamental polymer design that had been achieved at the University of Wisconsin – Madison and to investigate behavior of the polymer *in vivo*. Efforts toward the latter goal have been very successful. As described above, the polymer was designed to provide enhanced stability of the polymer assemblies *in vivo* in order to allow for increased accumulation of the encapsulated drug

in the tumor tissue. Confocal laser scanning microscopy (CLSM) experiments were performed in an effort to assess this enhanced stability arising from the semifluorinated design by measuring the *in vivo* circulation time of the polymer assemblies. The aqueous polymer micelles were prepared and a fluorescent dye was encapsulated inside, which allowed us to track the particles' movement through the veins and arteries after injection. The expertise of the Kataoka laboratory has been instrumental in quickly preparing, optimizing, and executing the necessary experiments. Through our combined efforts we have data to support that the semifluorinated polymer design indeed significantly prolongs the circulation time of the polymer assemblies *in vivo* and subsequent experiments will be performed to elucidate this effect and its applications.

In the former goal some difficulties in the synthetic route severely hindered our progress, yet provided keen insight into more efficient methods. The original polymer design is to be expanded to incorporate current active-targeting technologies in order to increase accumulation and penetration of the encapsulated drug into the tumor tissue. The Kataoka lab has specific expertise in functionalizing similar polymers with one such technology, a peptide ligand (cRGD). Our original proposed synthetic scheme involved an early-stage incorporation of an azide functionality. Due to the harsh conditions and several purification techniques necessary, it was difficult to maintain the azide group through to the end of the synthesis. Through discussions with both research groups a new scheme that involves a late-stage incorporation of the azide may be achieved.

Mutual interest in these two goals has engendered a long-term collaboration between our two research groups. We look forward to the future of this project and hope to gain insight that can be leveraged to design more efficient and environmentally benign nanoparticles.

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

Engaging in both the social and work culture of Japan was a very rewarding experience. Visiting historic sights and viewing the modern cityscape showed Japan's graceful balance of both the old and the new. It was also a great opportunity to meet several professors from around Japan and hear about the exciting research that they are doing here. Each professor had a unique personality and perspective and gave me a broad introduction to the Japanese scientific community. I am very grateful to the JSPS and NSF organizations, it was definitely a summer I will never forget.

9. N/A

RESEARCH REPORT

1. Name: Candido Diaz （ID No.: SP14013 ）

2. Current affiliation: University of Akron, Akron, OH

3. Research fields and specialties:

Engineering Sciences Biological Sciences

4. Host institution: University of Tokyo, Yayoi Campus

5. Host researcher: Tadashi Miyashita

6. Description of your current research

a) Researching the chemical and mechanical properties of silk and glue produced by the Asian genus of spiders Cyrtarachne.

b) Learning how to raise and convince spiders to produce webs in a laboratory setting.

c) Analysis of silk thread thickness and tensile strength.

d) Attempted analysis of silk glue adhesion strength.

e) Measurement of glue droplet size

f) future identification of spider glue chemical components

7. Research implementation and results under the program

Title of your research plan: **Incites into the the chemical and physical properties of the moth specialized spider family Cyrtarachne**

Description of the research activities:

Gained valuable field experience traveling around Japanese rice fields to find specimens and learn to how make a hospital environment. Spiders can be very difficult to convince to make webs outside of their natural environment. Used a tensile machine at the Tokyo Technical Institution to measure the tensile strength of various species of spider. Compared those values to values of more known and more readily studied spiders. Collected samples of silk to be used in Mass Spec analysis at the University of Akron to identify the proteins and other molecular components of the unique Cyrtarachne Silk.

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

Climbed Mount Fuji

Karaoke

Dinner with host lab

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Brenna DOHENY （ID No.: SP14014 ）

2. Current affiliation:

Medical University of South Carolina, Charleston, SC, USA

3. Research fields and specialties:

Biological Sciences

4. Host institution: National Institutes of Natural Sciences, National Institute for Basic Biology, Okazaki Institute for Integrative Bioscience, Okazaki, Aichi, Japan

5. Host researcher: Taisen IGUCHI

6. Description of your current research

The field of reproductive biology is undergoing a revolution, due to investigations into the role of environmental influences on sex determination and reproductive system development. Evidence is mounting that reveals the widespread and profound effects exogenous agents can elicit on the endocrine system, particularly how early developmental exposure can alter reproductive system development and thus impact adult reproductive success. A well-known example is that exposure to the pesticide DDT severely impacted the reproductive success of many wild birds via eggshell thinning. Laboratory experiments have shown that embryonic DDT exposure directly alters the development of the female reproductive tract of birds, causing structural changes that impair adult reproductive function. This study focuses on the development of the reproductive tract in an important sentinel species, the American alligator, which holds a unique evolutionary position with a reproductive tract that bears similarities to other reptiles as well as to birds. The female alligator reproductive tract develops from a very simple tube, the Müllerian duct, into an oviduct with multiple regions, each serving very specialized functional roles. The signals involved in creating this high degree of regional specificity are not yet known. Studies in mice have shown that exogenous estrogens disrupt the development of the female reproductive tract by altering the expression of genes that set up regional differentiation. The purpose of this study is to investigate whether these pathways also play a role in the development of alligator female reproductive tract, to better understand this process and the potential role of environmental factors such as endocrine disrupting compounds. This research was conducted at the National Institute for Basic Biology in the laboratory of Dr. Taisen Iguchi, a renowned expert on the role of estrogens in female

reproductive system development and endocrine disruption.

7. Research implementation and results under the program

Title of your research plan:

Investigating the regional differentiation of the female reproductive tract of the American alligator (*Alligator mississippiensis)*

Description of the research activities:

Studies in mice have discovered there are a number of genes involved in regionalization of the developing female reproductive tract that can be influenced by estrogen signaling. In mammalian female reproductive tract development, the distal genes of the homeobox A cluster, Hoxa9 – Hoxa13, known to specify axial patterning in many developmental processes, play a major role in regional differentiation of the Müllerian duct into the Fallopian tubes, uterus and upper vagina. We thus identified homologous genes in the alligator genome and amplified, cloned and sequenced unique regions of these genes to make probes for *in situ* hybridization, a technique that allows for the visualization of localized gene expression within a tissue. We also chose a few other candidate genes based on reviewing studies of chicken reproductive tract development, Zeb1 and Tom1l1. With *in situ* hybridization, we can potentially determine if these genes are involved in regional specificity of the developing alligator female reproductive tract. Over the course of the summer, we synthesized the probes and performed *in situ* hybridization in sample alligator tissues to develop and troubleshoot a method for utilizing this technique in this non-model species.

Additionally, we also tested out immunohistochemistry, a method for visualizing protein expression in tissues using antibodies, for proteins of interest in alligator reproductive tract differentiation, the steroid hormone receptors. Because there are no antibodies specific to alligator proteins available, the expertise of Iguchi-sensei and his colleagues was invaluable in finding antibodies to other species that also bind to alligator proteins.

I will utilize the methods we developed over the course of this summer at my home institution to complete the overall research project, using tissues that were not available for export to Japan.

RESEARCH REPORT

1. Name: Levi Henry Dudte (ID No.: SP14015)

2. Current affiliation: Harvard University

3. Research fields and specialties:

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

4. Host institution: University of Tokyo

5. Host researcher: Prof. Yasushi Yamaguchi, Prof. Tomohiro Tachi

6. Description of your current research

My research focuses on a class of surface structures derived from origami tessellations, patterns formed by tiling simple fold designs in two dimensions. These structures exhibit exotic geometric and mechanical properties, which combined with their ease of design and fabrication make them attractive as potential meta-materials. We are interested in the geometric and mechanical features of these surfaces structures, and have been focusing on designing tessellations that form curved surface structures (geometry) and exhibit prescribed mechanical properties.

7. Research implementation and results under the program

Title of your research plan: Geometry and Mechanics of Origami Tessellations

Description of the research activities:

Working primarily with Prof. Tachi, an expert in the field of origami tessellations, I initiated several studies to design curved tessellated structures, in collaboration with my home adviser L. Mahadevan. We will continue our collaboration after the summer.

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

I climbed Mt. Fuji, explored many neighborhoods in Tokyo, traveled to Nagoya, Kyoto, and Kagoshima on the Shinkansen, met countless wonderful Japanese and international friends, learned the Hiragana and Katakana alphabets (along with a bit of Kanji) and developed a great love for the country of Japan. I can’t wait to return!

RESEARCH REPORT

1. Name: Andy Echenique
（ID No.: SP14016）

2. Current affiliation: University of California, Irvine

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: Hideaki Kuzuoka

6. Description of your current research

Computing resources and communication technologies have become the technological backbone promoting innovation in cutting-edge international scientific research. As they evolve, so do the social structures that make collaboration and communication possible. These "socio-technical systems" – or cyberinfrastructure - have enduring effects on the scientific community and provide the framework for advances in a wide array of important areas beneficial for the public good.

Our research investigates the design and use of cyberinfrastructure for international scientific collaboration. This involves investigating how computer systems and communication media, such as e-mail, video conferencing, and data sharing services, support scientific research between distance collaborators. We will also explore how social factors, such as cultural differences, are mitigated by the existing cyberinfrastructure. By investigating both the social and technological aspects of these computer networks, we gain a more holistic understanding of the complex interaction between these systems and their users.

The result from this study will examine how cyberinfrastructure mediates work and knowledge practices between Japanese research laboratories and their international collaborators. This research will provide a foundational understanding of which current technological systems assist international collaboration and researchers' methods of utilizing and integrating shared information. This research will be conducted at the National Institute of Advanced Industrial Science and Technology (AIST) in Tsukuba, providing access to the AIST's Joint Robotics Laboratory (JRL), a cutting-edge robotics laboratory advancing the capabilities of autonomous, humanoid robots and with deep international collaborations. As a joint French and Japanese laboratory, this laboratory provides an ideal location to understand advanced international research and its expanding technological foundation.

7. Research implementation and results under the program

Title of your research plan:

Understanding Cyberinfrastructure in International Scientific Research

Description of the research activities:

My research activities have centered on my ethnographic data gathering within AIST. This includes observing and conducting interviews with laboratory members pertaining their research and their reflections on the computer systems they use. Interviews further investigate the difficulties laboratory members have with their existing computing resources and how it impacts their international collaboration.

I have currently conducted over 200 hours of interviews and observations over the past 8 weeks. From this data, we have created a series of major themes and concepts that characterize participant's interactions with computer systems. An example is the labs continued reliance on mobile computing and cloud storage to support its international activities. The further the distance between collaborators, the more they rely on cloud synchronizing services and mobile communication technologies. Yet, this stands in contrast to the local computer infrastructure, which was designed with desktop computing in mind and has yet to adapt to this evolution in computing.

A critical portion of my research methodology is to co-analyze these results with participants. These concepts are presented to the AIST lab members, and via conversations and interviews, their feedback becomes a powerful tool to further refine our results. Being currently in this phase, we have been gaining the necessary input from participants on our data to better understand the existing phenomena.

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

Summer festivals are my favorite experiences of summer in Japan, and I attended Gion matsuri, Asakusa fireworks, and Tanabata matsuri. I also visited cultural sites, including Todai-ji in Nara and shrines in Kyoto. During my homestay weekend, I visited many historical sites near Zushi and was able to visit an onsen as well. The food in Japan has also been its own cultural experience, with Japanese food and great ramen restaurants within Tsukuba. Finally, an achievement was climbing mount Fuji with other summer fellows, with whom I have had a great time this summer.

9. Advisor's remarks (if any):

I was impressed by thoroughly planned program that includes not only research related programs but also several social programs that help students fit in different culture. Since students may require a week or so to settle down and start there research, it would be great if their stay were several days longer.

RESEARCH REPORT

1. Name: Brian Falcone （ID No.: SP14017 ）

2. Current affiliation: George Mason University

3. Research fields and specialties:

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

4. Host institution: Osaka University - National Institute of Information and Communications Technology (NICT) - The Center for Information and Neural Networks (CiNet)

5. Host researcher: Daniel Callan

6. Description of your current research

The use of unmanned aerial vehicles (UAV) is becoming increasingly common for a variety of different purposes most of which involve visual search of large areas of terrain such as reconnaissance and search and rescue operations. The purpose of this research is to investigate the feasibility and benefits of using non-invasive transcranial direct current stimulation (tDCS) on a real world task. To test this we wanted to see whether tDCS would improve visual search performance on a realistic high fidelity UAV simulation. Functional Magnetic Resonance Imaging (fMRI) was used to determine activated sites during task performance. After this, data was also collected during task performance before and after training with tDCS in order to observe the effects tDCS on hemodynamic responses related to sustained selective attention.

Much of the previous work demonstrating the beneficial effects of tDCS on a variety of basic tasks has not provided much evidence that brain stimulation could be feasible in real world settings. This study hoped to show that tDCS can be a viable training enhancement method by showing perceptual learning improvements on a realistic task. In addition to this, we wanted to show that the beneficial effects of tDCS on spatial perceptual learning can be attributed to improved selective attention.

7. Research implementation and results under the program

Title of your research plan: **EAPSI: Enhancing spatial perceptual sensitivity on a simulated real-world complex visual search task**

Description of the research activities:

A UAV visual search and rescue simulation was programmed using a 3D virtual training software called Virtual Battle Space 2 (VBS2). Once the program was brought to japan the task was modified to work with the MRI machine. After initial pilot testing to ensure the task was working with no errors, we ran a single subject through the task while we collected fMRI data. This subject's data, along with data from prior tDCS publications, was used to determine the stimulation site for the main experiment. The stimulation site that was chosen was the right parietal cortex which was measured for each subject using area P4 according to the International 10-20 EEG system.

A total of 35 subjects participated in the study with 18 being assigned to the stimulation condition and the other 17 being assigned to the sham condition (control). Once they were in the fMRI machine, each participant performed three sessions of the visual search task and each session took from 20-25 minutes to complete. The first session was done without tDCS, nor was any performance feedback given to the participant. This was done in order to determine a baseline level of performance and brain activity for each subject. During session 2, tDCS was administered and feedback was provided to allow for participants to improve their performance. For participants in the experimental group, tDCS was administered at 1mA for 30 minutes. For participants in the sham/control group, tDCS was turned on for 30 seconds and then shut off. For the third and final session, the tDCS was turned off and again no feedback was given just like in the first session.

Preliminary behavioral data analysis so far has not found that tDCS improved performance on the UAV visual search simulation. Further Analyses must be completed to rule out an effect for certain. The neuroimaging data was much more promising. Analysis of the fMRI data has shown that several areas of the brain appear to become more activated when tDCS has been applied to the scalp. These areas include occipital, right frontal, and right parietal cortices.

RESEARCH REPORT

1. Name: David Favero （ID No.: SP14018 ）

2. Current affiliation: Washington State University

3. Research fields and specialties: Biological Sciences

4. Host institution: RIKEN Yokohama, Center for Sustainable Resource Science

5. Host researcher: Dr. Keiko Sugimoto

6. Description of your current research

My research focuses on how an external signal, light, affects seedling development in the model plant *Arabidopsis thaliana*. Specifically, I study a family of DNA-binding proteins which play roles in modulating hypocotyl elongation in light-grown seedlings. Previous work revealed that members of the *AT-HOOK-MOTIF NUCLEAR LOCALIZED* (*AHL*) gene family, particularly *SUPRESSOR OF PHYTOCHROME B-4 #3* (*SOB3*)/*AHL29*, function to repress seedling elongation specifically in light-grown seedlings. Further research has revealed that AHL proteins have the ability to interact among themselves and with other DNA binding proteins, and that these protein-protein interactions are important biologically for the modulation of seedling growth by AHLs. This suggests a model whereby AHLs contribute to the formation of large protein-DNA complexes, which in turn influence the expression of nearby genes.

A major remaining question at this point is what downstream targets SOB3 and other AHLs act on in order to influence seedling growth. Since internal signals, including phytohormone signaling pathways, also have a strong influence on seedling elongation, I hypothesized that SOB3 and other AHLs affect seedling growth by acting on one or more of these hormone signaling pathways. AHLs could influence hormone signaling pathways in either of two different ways, either by directly affecting the biosynthesis of phytohormones, or by acting on downstream components of the hormone signaling pathways. During my time at RIKEN Yokohama, my goal was to begin to test the hypothesis that SOB3 and other AHLs exert their effect on seedling development by influencing phytohormone signaling pathways, using two different approaches: direct measurement of hormone levels in seedlings bearing AHL mutations and chromatin immunoprecipitation followed by PCR (ChIP-PCR), the latter which enabled identification of genes directly bound by SOB3.

7. Research implementation and results under the program

Title of your research plan:

Investigating molecular connections between internal and external cues which affect seedling development

Description of the research activities:

In order to investigate if SOB3 and other AHLs have a direct effect on the levels of various phytohormones, solid-phase extraction, liquid chromatography, and tandem quadrupole mass spectrometry were used in sequence to generate hormone profiles from seedlings. Seedlings of eight different genotypes were used in this experiment, one being the normal, wild-type genotype, and the remaining seven genotypes bearing various mutations for *SOB3* and other *AHL* family members, which together represent a wide range of seedling elongation phenotypes. Using both seedling elongation phenotype data (hypocotyl length) and biochemical data (normalized hormone quantity) for each genotype, correlation coefficients were calculated for all hormone species measured, which includes six different classes of phytohormones: auxins, cytokinins, gibberellic acid (GA) , abscisic acid(ABA), jasmonic acid (JA), and salicylic acid (SA). However, no strong correlation was found between the seedling elongation phenotypes and the levels of any hormone species. This suggests that the *SOB3* and other *AHL*s do not influence any of these six signaling pathways by directly affecting metabolism of the six associated hormones, at least in regards to the control of seedling elongation.

Secondly, to identify candidates that may be under direct transcriptional regulation by SOB3, ChIP followed by PCR was used to identify targets directly bound by the SOB3 protein. The ChIP procedure allows for the isolation of DNA bound to a particular protein of interest, in this case SOB3. Results from two independent ChIP-PCR experiments revealed that SOB3 binds to DNA associated with three different genes relevant to phytohormone signaling: BAS1, GATA2, and LOX2. BAS1 and GATA2 are both known to play roles in both BR signaling and hypocotyl growth response to light, so they are both of high interest for further analysis. The LOX2 gene plays a role in the biosynthesis of JA. However, since there was not a good correlation between JA levels and hypocotyl phenotypes in the hormone profiling experiment, it is not a good candidate for being a downstream target of SOB3 that affects hypocotyl growth. LOX2 may be a downstream target of SOB3 that is biologically relevant in other contexts, such as during flowering. SOB3 mutants display flowering time phenotypes, a process which is heavily influenced by JA.

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

Dr. Sugimoto and her lab members were fantastic to work with and made this a very positive experience for me! I am very grateful for the funding provided by JSPS.

9. Advisor's remarks (if any):

It was a fun and rewarding experience hosting Mr David Favero in my lab. Mr Favero was a very smart and highly motivated PhD student, and although his project was challenging, he made impressive progress in this very short period of time. Having him in the lab also had many positive impacts to my lab both professionally and personally – he even helped revising manuscripts we were completing! Many thanks for the generous support from JSPS!

RESEARCH REPORT

1. Name: Eli Fox-Epstein (ID No.: SP14020)

2. Current affiliation:

Brown University

3. Research fields and specialties:

Humanities Social Sciences Mathematical and Physical Sciences

Chemistry Engineering Sciences Biological Sciences

Agricultural Sciences Medical, Dental and Pharmaceutical Sciences

Interdisciplinary and Frontier Sciences

4. Host institution: JAIST

5. Host researcher: Ryuhei Uehara

6. Description of your current research

Problems as diverse as jaguar conservation, power grid management, Internet's backbone routing, and pen-and-paper puzzles can be abstracted and mathematically formulated as computational 'reconfiguration problems'. Reconfiguration problems are a class of computational problem in which one must interpolate between two states of a system while maintaining some properties. Theoretical computer science offers efficient ways to solve broad classes of these types of problems and provides tools to demonstrate that, in many instances, they cannot be solved efficiently. This project develops algorithms for constrained cases still applicable to the real world.

Perhaps the most studied reconfiguration problem is 'Sliding Token'. A simplified formulation is a puzzle involving moving tokens one at a time between intersections of a road map, ensuring that two tokens are never at adjacent intersections, with the goal of transforming an initial token configuration into some target configuration.

We explore instances on which Sliding Token can be efficiently solved, such as bipartite permutation graphs.

7. Research implementation and results under the program

Title of your research plan:

Reconfiguration Problems on Graphs with Structure

Description of the research activities:

See above for a general description. We found an asymptotically optimal algorithm for the Sliding Token problem on forests, chain graphs, and distance-hereditary graphs. We are currently wrapping up an asymptotically optimal algorithm for Sliding Token on bipartite permutation graphs.

Additionally, we have found a number of graph classes on which Sliding Token is computationally intractable.

As an unrelated and unexpected collaboration, we settled an open problem posed during a conference presentation.

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

Attended 3 conferences.

Climbed Fuji.

Cycled Shimanami Kaido.

Stayed in ryokan.

Soaked in onsen.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Andrew Giguere （ID No.: SP14021）

2. Current affiliation: Oregon State University

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

4. Host institution: Chuo University

5. Host researcher: Dr. Yuichi Suwa

6. **Description of your current research:**

Soils derived from materials of volcanic origin (e.g. Andisols) play an important role in Japan, the United States and other countries around the Pacific Rim with volcanic activity. In Japan, Andisols comprise a large fraction of the agricultural soil resource and have a considerable influence on human activities on the Pacific Rim. They are often located in regions with high population density, and have high agricultural productivity. Andisols also have unique physical and chemical properties not found in other soil types. This research project examined how the properties of fertilized and non-fertilized Andisols influence the nitrogen (N) cycle and greenhouse gas emissions.

Nitrification is an important part of the global N cycle, in which ammonium (NH_4^+) is oxidized to nitrate (NO_3^-). The oxidation of NH_4^+ is the rate-controlling step of nitrification and is carried out by ammonia-oxidizing bacteria (AOB) and archaea (AOA). Nitrification may promote N loss from terrestrial environments that otherwise would be available to plants. The process of nitrification can lead to loss of N as nitrous oxide (N_2O) which is a potent greenhouse gas with 350 times the warming potential of carbon dioxide (CO_2). The process of nitrification is especially important in soils that are heavily impacted by human activities. This study examined the factors that influence nitrification activity and N_2O emissions from AOA and AOB in fertilized non-fertilized Andisols.

Understanding the factors that control N cycling in soil systems is critical for prevention of N loss. The loss of N from agricultural soils not only represents a financial loss, but also pollutes water sources and the atmosphere. This project evaluated the factors that control N cycling, with the long term aim of preventing N loss. Obtaining a better understanding of the factors that influence N cycling could allow for management practices to be altered to best conserve N fertilizer, prevent pollution, and minimize financial losses.

7. Research implementation and results under the program

Title of your research plan:

Contributions of microorganisms to greenhouse gas emissions from volcanic soils prevalent in the Pacific Rim Region

Description of the research activities:

This project examined the factors that influence nitrogen cycling in agricultural volcanic soils (Andisols). The aim of this project was to determine the contributions of ammonia-oxidizing bacteria (AOB) and archaea (AOA) to nitrification and nitrous oxide (N_2O) production.

Soils were sampled from the Niigata Prefectural Agricultural Research Institute, Research Center Crop Cultivation Department. Soil samples were collected from fertilized and non-fertilized Andisols planted with corn. Samples were transported to Chuo University where experiments were conducted.

Initial experiments were designed to determine the impact of fertilization on the nitrification responses of ammonia-oxidizing bacteria (AOB) and archaea (AOA) to ammonia (NH_3). Whole soil (~30% soil water content) incubations were performed with a range of anhydrous NH_3 additions, in the presence and absence of the AOB nitrification inhibitor 1-octyne. Initial results indicate that AOA and AOB from fertilized and non-fertilized soils have may different nitrification responses to NH_3.

A series of soil incubations were performed to determine if N_2O production from AOA and AOB was detectable. In four soil slurry experiments N_2O production was measured in the presence of 1mM $^{15}N\text{-}NH_4^+$, $^{15}N\text{-}NO_3^-$ + $^{14}N\text{-}NH_4^+$, and $^{15}N\text{-}NO_2^-$. Use of ^{15}N allowed for the determination of the sources of N_2O from soil organisms. Using this method, the source of N_2O produced from the soil could be determined. Preliminary results indicate that the majority of N_2O produced was attributable to NH_4^+, indicating that AOA and AOB may potentially be involved in N_2O emissions.

The final series of experiments were conducted to determine the influence of low oxygen on N_2O production from AOA and AOB. A series of whole soil incubations were performed at 21% and 5% O_2. For these experiments, $^{15}N\text{-}NH_3$ was synthesized and added to the soil in a gaseous form, with the gaseous AOB nitrification inhibitor 1-octyne to determine contributions from AOA and AOB to N_2O production. Preliminary results indicate that decreasing O_2 levels may increases N_2O production.

Soil samples from whole soil incubations were collected and frozen at -80ºC, for transport to Oregon State University. Where DNA and RNA will be analyzed to determine if different groups of AOA and AOB were actively growing under the tested conditions. This analysis will provide insights into the phylogenetic diversity actively growing AOA and AOB, and may allow for insights into phylogenetic groups responsible for nitrification and N_2O emissions. Soil samples will also be shipped to Oregon State University for further analysis.

RESEARCH REPORT

1. Name: Steven Gilhool （ID No.: SP14022 ）

2. Current affiliation: University of Pennsylvania

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: National Astronomical Observatory of Japan

5. Host researcher: Dr. Motohide Tamura

6. Description of your current research

My current research deals primarily with Doppler radial velocity studies of low-mass stars. Low-mass stars are both abundant, and small enough that we can, in principle, measure their reflex motion due to the orbit of planets that are roughly Earth-sized. The measurement of the star's reflex motion is performed by taking multiple spectra of the target star over a sufficient time period, and measuring the Doppler shift of stellar absorption lines between those spectra. The observed change in wavelength of the lines corresponds to the velocity change of the star along our line of sight. To reliably infer the presence of a planet, its period and its minimum mass, the Doppler shifts must be very precisely measured.

The most critical step in the radial velocity measurement is wavelength calibration. Wavelength calibration is the process of determining the wavelength corresponding to each pixel on the detector. The function that relates pixel position to wavelength is called the wavelength solution. The wavelength solution is determined by identifying the positions of spectral features (emission lines or absorption lines) with known wavelengths.

For example, high-precision measurements are now routinely obtained at optical wavelengths by observing stars through a cell of iodine gas. The observed spectrum then is the product of the stationary iodine spectrum and the Doppler shifted stellar spectrum. By measuring where the known iodine spectral features fall on the detector, it is possible to determine the wavelength solution. In a sense, the iodine cell (or some other reference spectrum) is used as a wavelength 'ruler.'

Low-mass stars, however, are not bright at optical wavelengths. We observe such stars at infrared wavelengths, where they are brightest. Currently, there is no ideal wavelength reference for infrared observations. At my home institution, I am investigating the use of absorption lines from the Earth's atmosphere as a potential wavelength reference for infrared radial velocity studies.

7. Research implementation and results under the program

Title of your research plan:

Detecting Earth-like planets using a cutting-edge instrument on the Subaru Telescope

Description of the research activities:

This summer I worked on data reduction and wavelength calibration of images taken with the Subaru Telescopes's Infrared Camera and Spectrograph (IRCS). In contrast to my research using the atmospheric spectrum as a wavelength reference, the IRCS uses an ammonia (NH_3) cell as a wavelength reference. I spent the summer processing raw IRCS observations in order to produce wavelength-calibrated one-dimensional spectra (a graph of relative intensity vs. wavelength).

In performing the wavelength calibration, I have identified important features in the NH_3 spectrum which will be used for the wavelength calibration and radial velocity measurements of future observations.

My work this summer will also help to inform the method of data processing used for the Infrared Doppler Instrument (IRD), the next-generation infrared spectrograph for the Subaru Telescope which is expected to see first light in 2015. The IRD, uses a highly sophisticated laser frequency comb for wavelength calibration, and will be able to measure much smaller shifts in wavelength/velocity. Due to the design of the IRD, however, it is unclear whether or not the sky background will hinder the wavelength calibration process. Since the sky can be easily subtracted from IRCS images, I am working to determine its effect on the wavelength calibration process by calibrating images with and without the sky background subtracted.

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

This program has been an incredible learning experience for me. Not only did I learn much from my research, but being open to a different culture and way of life has allowed me to develop as a human being, as well. Finally, my experience in this program has reminded me of our global interconnectedness, and reaffirmed my belief in the importance of international cooperation, both scientific and otherwise.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Kevin T. Gray （ID No.: SP14023 ）

2. Current affiliation: Washington State University

The Voiland School of Chemical Engineering and Bioengineering

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: Okinawa Institute of Science and Technology

5. Host researcher: Fadel Samatey

6. Description of your current research

The brain communicates and forms memories through a specialized group of cells called neurons. These cells form connections through extensions called neurites. Neurites are formed when neurons alter their protein skeleton to reach for other cells. Disruptions to the cellular skeleton can harm memory formation and motor skills. Tropomodulins (Tmods) are a family of proteins that contribute to the formation of the cellular skeleton. During seizures, strokes, and methamphetamine exposure and also in Down syndrome and epilepsy, the amounts of Tmods in the brain have been shown to be vastly altered. Understanding the role of Tmods in brain development will elucidate these conditions and may lead to treatments. Previously, the Kostyukova Research Group at Washington State University has shown that variation in Tmods' roles in neurite formation correlates with structural differences. The goal of this project is to determine the atomic structure of Tmod2 for comparison with the known structure of Tmod1. A protein's function is decided by its atomic structure. This project was conducted in collaboration with Dr. Fadel Samatey, an expert in protein structure at the Okinawa Institute of Science and Technology in Japan. A solved structure for Tmod2 will uncover details about Tmods' finely tuned role in brain development and disruption in disease states.

7. Research implementation and results under the program

Title of your research plan: From Tropomodulin Protein Structure to Brain Connections

Description of the research activities:

Crystallization and X-ray Diffraction are techniques used to determine protein structure. This project aimed to screen for and optimize crystallization conditions for the leucine rich repeat (LRR) domain of Tmod2 and then determine its structure by X-ray Diffraction. This domain is important for localization of Tmods in muscle cells, thymosin binding and Tmod's actin nucleation ability. In the course of the fellowship, the protocol for purification and refolding of the fragment was optimized, initial crystallization conditions were found and several rounds of refinement were completed. Although additional round of refinement are still necessary, considerable progress was made on the project. A second project was pursued to receive training in in the culture of PC12 cells, a model system to study neurite extension, and several constructs were tested for expression in this system.

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

Okinawa is a wonderful place to visit and OIST has an incredible work environment. I thoroughly enjoyed my opportunity to explore the island. While I was here I got to see the Okinawa Prefecture Museum, Shurijo Castle, and Churaumi Aquarium among other sites on the island.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Danielle Grogan (ID No.: SP14024)

2. Current affiliation: University of New Hampshire

3. Research fields and specialties:
Geosciences, Environmental Sciences

4. Host institution: University of Tokyo

5. Host researcher: Taikan Oki and Hyungjun Kim

6. Description of your current research

Flood prediction and mitigation are important aspects of watershed management, especially in New England where a 30-year upward trend in floods has been attributed to a combination of urbanization and climate change. In addition to urban development, New England is currently experiencing an increase in agricultural land development. While flood risk increases from conversion of forests to urban land has been well studied, conversion from forest to agriculture requires further research. In order to study how the conversion from forest to agriculture in the context of a changing climate impacts flood risks in New England, I have combined two existing hydrology models. The first is a water balance model that represents the land surface and water management through dams, irrigation, and inter-basin water transfers. The second is a flood model that predicts flood events, flood water volume, and inundation levels. The land surface model can represent different forested, agricultural, and urban environments. These environments alter how much rainfall runs off into rivers during and after rainfall events. Runoff amounts are then passed on to the flood model, which simulates how this runoff accumulates in river channels, moves downstream, and overflows the river banks.

The flood model used in this study was chosen because it is designed to be coupled with other hydrology models, such as the water balance model. However, this flood model has never been used to study small river basins such as those in New England; all past research using this flood model has focused on large, continental- to global-scale simulations. One of the key factors in modeling flood occurrences, flood depth, and flood extent is the accuracy of the representation of river channels. River channel width and depth effectively determine the volume of water the channel can hold before flooding. Previous studies using this flood model showed that it accurately estimated river width and depth for large (>30 meter wide) river channels. Therefore, in order to study flooding of small (<30 meter wide) rivers, it is important to test and appropriately modify the representation of stream channels in the flood model. In my research, I am working on testing two different methods of river channel representation for small rivers.

7. Research implementation and results under the program

Title of your research plan:

Understanding the impacts of agricultural and urban land use on flood prediction and mitigation

Description of the research activities:

During my stay at the University of Tokyo, I engaged in three main research activities. The first was to gather and preprocess the input data necessary for running the CaMa-Flood model at high spatial resolution. Dai Yamazaki, a researcher at Jamstec, visited the lab and taught me how to use the Flexible Location Of Waterways (FLOW) method for CaMa-Flood data preprocessing. The second research activity was to test a new version of the CaMa-Flood model. One aspect of these test is to compare the model-simulated river discharge and flooded area when using river networks of different spatial resolutions. I found that at coarse spatial resolutions the modeled river discharge increases. One potential way to reduce this difference is to calibrate the river channel width and depth parameters, or even to input field-survey based data on river width and depth. The last research activity I undertook was testing different calibrations and methods for estimating river channel width and depth. To summarize, I was able to set up the model for simulating the region and time scales I am interested in, but have not yet determined the best calibration method to use. I will continue working on this research project with Dr. Oki and Dr. Kim.

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

Researching in Japan has been a wonderful experience. While I did not complete all the research I proposed, I have taken significant steps towards completing it that I could not have accomplished without the personal interactions I had in the Oki Lab. In addition to research, I had the opportunity to experience life in Japan. I particularly enjoyed climbing Mt. Fuji, eating at an okonomiyaki restaurant, and visiting the Cat Café in Shibuya, Tokyo.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Michelle E. Guitard ID No.: SP14025

2. Current affiliation: University of South Florida, College of Marine Science

3. Research fields and specialties:

Humanities Social Sciences Mathematical and Physical Sciences

X Chemistry Engineering Sciences Biological Sciences

Agricultural Sciences Medical, Dental and Pharmaceutical Sciences

Interdisciplinary and Frontier Sciences

4. Host institution: University of Tokyo, Atmosphere and Ocean Research Institute (AORI)

5. Host researcher: Dr. Yusuke Yokoyama

6. Description of your current research:

Antarctica and the Southern Ocean are key components of Earth's climate system. We must understand Antarctic ice shelf dynamics and their response to oceanic and atmospheric stressors to estimate future ice sheet volume and sea level with continued climate change[10]. Thinning of ice shelves along the Antarctic margin suggest marine-based glaciers are sensitive to ocean temperatures. Ice-proximal margin sediments can be used to investigate past glacial advance and retreat, and ultimately understand past ocean-cryosphere interactions.

I am investigating late Quaternary (125-0 ka) variations in the Amery Ice Shelf system, East Antarctic Ice Sheet in Prydz Bay, East Antarctica. I am measuring the relative abundance of beryllium (^{10}Be) isotopes in Prydz Bay cores (NBP01-01 JPC 34, 35, 36) to determine calving history of the AIS and understand the style of ice shelf retreat. Meteoric ^{10}Be precipitates from the atmosphere into the ocean, eventually depositing on the sediment. Permanent ice cover affects delivery of ^{10}Be to the sediment; we assume low ^{10}Be abundance indicates glacial advance. Previous studies from the Ross Sea indicate significant differences in ^{10}Be concentration in open marine (1.5×10^{9} and 7×10^{7} atoms g^{-1}), sub-ice shelf, and sub-glacial (e.g. ice stream; 1.4×10^{7} - 2.0×10^{6}) sediments. Thus, ^{10}Be may be useful in resolving the late Quaternary depositional environment of Prydz Channel open-marine and glacial units.

7. Research implementation and results under the program

Title of your research plan:

Late Quaternary advance and retreat of an East Antarctic ice shelf system: Insights from sedimentary ^{10}Be concentrations

Description of the research activities:

Sediment preparation for 10Be analyses included acid digestion, cation exchange chromatography, and 10Be fuming. Laboratory procedure involved weighing aliquots of sample, working with strong acids (e.g. hydrochloric and hydrofluoric acid), acid evaporation using a hotplate, a series of ion exchange steps involving resin, fuming beryllium precipitate at ~850 C, pressing samples into copper cathodes and 10Be analysis using the Accelerator Mass Spectrometer at the University of Tokyo. Other research activities included meetings with my host advisor and students involved in similar research. During these meetings, we discussed use of facilities, instruments, and chemicals. We also reviewed laboratory procedure and core sampling strategies. I was also able to participate in departmental seminars and discussions at AORI concerning geochemical dating of sediments and current work being done in Antarctica

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

My host lab was perfectly set up to do my experiment. I was also impressed with the professionalism of the students in Yokoyama-sensei's lab. His students are doing a variety of paleontological projects and I was able to learn a lot about my own project and gain a breadth of knowledge about paleo investigations. Dr. Yokoyama has done a really good job setting up a lab that effectively runs itself. Culturally, I learned a lot. I appreciate the respect and presence that family/ancestors have in Japan. It was also interesting to note there is a distinct difference between home life and work life. I thought this was an interesting cultural difference between Japan and the United States

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: John Hellerstedt
（ID No.: SP14 026 ）

2. Current affiliation: University of Maryland

3. Research fields and specialties:
Mathematical and Physical Sciences

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

5. Host researcher: Prof. Yukio Hasegawa

6. Description of your current research

The goal of this project was to apply the technique of spin-polarized scanning tunneling microscopy (SP-STM) to the topological insulator bismuth selenide. A topological insulator is a material that can be thought of as an empty metal box: the bulk of the material does not conduct, electrons instead can only move at the surfaces and edges. There is a further “topological” aspect to this idea, that the direction of movement is correlated with the spin state of the electron. This unique property is realized in crystals of bismuth selenide (Bi_2Se_3), presently one of the most extensively studied topological insulators.

Scanning tunneling microscopy (STM) is an experimental technique that allows for the imaging of surfaces at atomic resolutions by measuring the quantum tunneling of electrons between the probing tip and the sample. Spin-polarized STM further refines this technique by introducing a magnetic probing tip: a magnetic moment allows for the discernment of different spin states of electrons.

Application of this technique to a topological insulator would provide further insight into how defects affect their conduction, as well as a microscopic view of the out-of-plane spin polarization, an open area of investigation whose understanding is crucial to being able to utilize these properties in electronic devices.

7. Research implementation and results under the program

Title of your research plan:

Next generation electronics materials- seeing the spin current at the surface of topological insulator bismuth selenide

Description of the research activities:

In the course of this summer we were able to prepare reasonable samples by cleaving crystals *in situ,* and with significant effort find sufficiently flat areas for atomic resolution as well as limited spectroscopy mapping while using a Pt-Ir tip. Our preliminary results were unusual in that the measured spectra do not match existing literature on the subject, suggesting a tip-sample effect not fully understood at the time of this writing. A crucial component failed within the host researchers instrument during the process of changing to a different imaging tip, prompting a repair process that prevented the collection of more data before the conclusion of the program. Despite this setback, these preliminary findings have provided excellent insight into the challenges of using this technique with this material system, and are promising enough that we believe this project to be worth further pursuit as opportunity arises.

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

This program has been a deluxe introduction to living and conducting research in Japan. The Hasegawa lab has been exceptionally generous with their time and support in pursuing this project over the past couple of months, and excellent conversation about the differences and similarities of research cultures on all sides of the Pacific. Tokyo has been an overwhelming fractal of cultural experiences, a direct physical expression of the fleeting smallness of an individual.

9. Advisor's remarks (if any):

Jack has been working so hard trying to obtain unique results of Bi_2Se_3 using our facility. After tough nerve-racking sample searching processes, Jack finally obtained atomically resolved surface images and spectroscopic mappings showing peculiar nanometer-scale spatial distribution of local density of states. As these results has neither been observed before nor simply explained by existing theories, we are working on their interpretation.

We really enjoyed having Jack in our group. Doing research and communicating with him were always stimulating to us including students and young staff members in my lab.

RESEARCH REPORT

1. Name: Brandi M. HUDSON （ID No.: SP14028）

2. Current affiliation: University of California, Davis

3. Research fields and specialties:
Chemistry

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

5. Host researcher: Professor Keiji MOROKUMA

6. Description of your current research

Terpenes are complex natural products produced by plants, which are composed of isoprene units (Figure 1). Terpenes have applications in perfumery, medicine, food and wine flavoring, and pesticides, among others. To understand the chemical mechanisms by which terpenes are formed will be beneficial for laboratory production. It can also provide the insight needed to predict for and design terpenes that have not yet been isolated. Specifically, we are interested in those terpenes deriving from geranyl pyrophosphate (GPP), which are made up of two isoprene units and is known as a monoterpene (Figure 2).

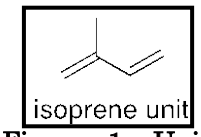

Figure 1. Unit that makes up a terpene.

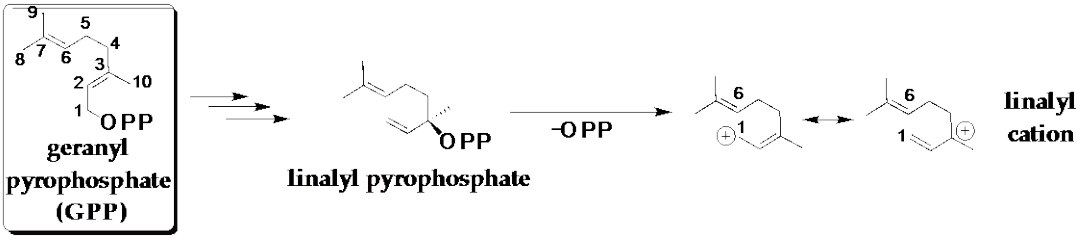

Figure 2. Monoterpene of interest.

Although this pathway has been extensively studied, we wanted to investigate this pathway using a new computational tool developed by Prof. Morokuma (available in his group at Kyoto University) – the global reaction route mapping (GRRM) strategy using the artificial force induced reaction (AFIR) method. Previous collaboration of the Tantillo and Morokuma groups showed promising results for this method, as this new tool found pathways not found by current, commonly used methods: manual transition state searching, intrinsic reaction coordinate (IRC) calculations, and dynamics calculations. This project investigated the GPP pathway using the GRRM/AFIR method, as well as the effect of altering the GPP backbone on pathways and potential products.

7. Research implementation and results under the program

Title of your research plan:

Predicting Methylation Effects on Terpene-forming Pathways – Natural Products from Plants

Description of the research activities:

Upon my arrival, I was granted access to Kyoto University and Fukui Institute computer clusters, which were used to run all of my calculations. These clusters also had the GRRM/AFIR program that I used for this project. Once I ran through a tutorial, I quickly began investigating the GPP pathway. This involved taking optimized structures and specifying on which atoms (two or more) I wanted to apply a positive or negative force on. Doing this leads to bond forming or breaking and shows viable pathways that one may not think if relying solely on chemical intution. From this information, I used common methods I typically apply in a mechanistic investigation to further probe the energetics of the pathway. Since I am a computational chemist, I worked on a computer all day, submitting jobs and analyzing their outputs. Gratefully, during my time in the Morokuma Group, I also had the opportunity to learn more about scripting from a JSPS post-doctoral fellow from France and wrote several new scripts, which increased the efficiency of my work. Once I had enough of the GPP pathway mapped out and some stable intermediates isolated, I began experimenting with the second half of this project: methylation effects on terpene-forming pathways. Thus far, I have found two new terpenes from the GPP pathway using the GRRM/AFIR method. Concurrently, I studied the result of removing two methyl groups off of stable intermediates found in the GPP pathway to see if the removal of these groups will cause the structure to no longer be stable. I found that these structures can be either stabilized by cation-pi interactions or they can form stable, 6- and 7-membered ring intermediates (Figure 3). The preliminary results are promising and with the new knowledge and access to the computational method, I will continue my collaboration once I return to the U.S.

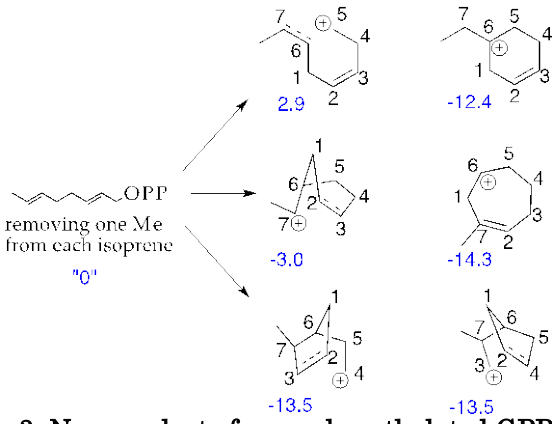

Figure 3. New products from a demethylated GPP backbone. Energies shown in kcal/mol.

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

I am grateful for the opportunity to conduct research and experience life in Japan this summer. I found everyone, from my host researcher and lab mates to strangers, welcoming and helpful. I love that although Japan is a modern society, they are still true to their culture and traditions. I enjoyed visiting temples in Kyoto, attending all of the summer festivals and watching amazing firework shows, and getting to visit World Cultural Heritage sites. I hope to be back soon!

RESEARCH REPORT

1. Name: James Iocozzia （ID No.: SP14029 ）

2. Current affiliation: Georgia Institute of Technology (USA)

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 University, Uji Campus

5. Host researcher: Professor Kohji Ohno

6. Description of your current research

This research will employ a developed nano-template technology and a new method of polymer-mediated nanoparticle synthesis to create chains of nanoparticles of specific width and length. It will also make use of existing particle systems developed in my host group to achieve similar results.

This work aims to produce long chains of linked iron oxide (Fe_3O_4) nanoparticles via magnetic alignment in nano-channels. Surface-functionalized nanoparticles are primarily synthesized via controlled polymerization from several multi-functional initiators.

Alignment is achieved by magnetically-directing the particles into aluminum oxide channels where they are photo-crosslinked and removed. Drawing from polymer, chemical and materials science disciplines; this work will be characterized by several techniques including gel permeation chromatography, scanning electron microscopy (SEM), and transmission electron microscopy (TEM). Though this project is limited to iron oxide nanoparticle chains, it is generalizable to more complex systems of nanoparticles with an iron oxide core covered in a shell material (metal, semiconductor, inorganic etc.) to afford additional functionality.

The majority of efforts will be focused on proper synthesis and characterization of the polymer template as well as any resulting chain structures.

7. Research implementation and results under the program

Title of your research plan: Template strategies for the alignment of nanoparticle chains

Description of the research activities:

The work performed during the project falls into the areas of chemistry and materials science and engineering. Part I of the project entailed polymer template and particle synthesis. During this part, sequential polymerizations were performed to produce a star-like copolymer system. This system was characterized by gel permeation chromatography (GPC) and proton nuclear magnetic resonance spectroscopy (HNMR) to fully elucidate its structure. Attempts to synthesize particles are currently ongoing.

In addition, several attempts to polymerize off of particle systems developed in the group have been performed. Efforts in this area were faced with the challenge of preparing pure monomers as well as improving the yield of the reaction which is currently ongoing.

Chain alignment was, unfortunately, unable to be performed as the nanoporous templates arrived to my host institute severely delayed. However characterization of them has been performed by scanning electron microscopy and transmission electron microscopy.

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

The only way the program could be improved is to make it longer as two months was not long enough to complete all objectives of the proposed project.

- Went to Gion Matsuri Festival
- Went to the Gozan no Okuribi Festival
- Participated in a takoyaki cooking party
- Participated in a sushi rolling party

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Kaitlin Kelly-Reif （ID No.: SP14030 ）

2. Current affiliation: University of North Carolina Chapel Hill

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: Radiation Effects Research Foundation

5. Host researcher: Dr Harry Cullings

6. Description of your current research

Main research question: What is the extent and amount of residual radiation (fallout) in distal areas following the Hiroshima atomic bomb?

Residual radiation doses to survivors are likely negligible compared to direct doses. However, there remain many questions and concerns from both scientists and the public about the role of residual radiation. Many people are concerned about the effects of black rain, which is dark colored rain which occurred hours after the bombing. Black rain may have contained fallout, or it may not have. Also, clear rain may or may not have contained fallout, so black rain is not a reliable indicator of residual radiation exposure.

To assess the levels and distribution of fallout, we utilized early surveys of gamma radiation and beta emissions. 6 Japanese teams and 2 US teams conducted surveys between August 9th 1945 and March 31st 1948 using a variety of instruments including Lauritzen electroscopes, Neher-type cosmic-ray meters, and Geiger-Müller counters.

Before a valid geostatistical analysis of fallout from these surveys can be conducted, the studies must be aligned to the same geography through the use of Geospatial Information Technology. Terrestrial and cosmic background radiation, as well as neutron-induced soil activation must also be estimated and subtracted from survey measurements to understand what radiation can be attributed to fallout. Geospatial Bayesian models for each survey's measured radiation and the estimated soil activation based on prior dosimetry studies can provide insight into correctly calibrated soil activation and background for each survey.

Once the surveys are properly aligned and calibrated using the approach described above, a hierarchical model can be used to estimate the true extent of fallout, accounting for space-time variation, using the different known time dependencies associated with background, soil activation, and fallout. The hierarchical model will utilize Bayesian priors and Markov-Chain Monte-Carlo sampling methods.

7. Research implementation and results under the program

Title of your research plan:

Geostatistical analysis of early fallout from the Hiroshima atomic bomb

Description of the research activities:

The research activities I conducted are those which are listed above in the description of my current work. Additionally, I performed a detailed search on all information regarding early survey results, digitized and georeferenced maps, and preformed exploratory data analysis through the use of variograms and kriging interpolation.

Before a final map of fallout is completed, a more complete model of the calibrated soil activation must be estimated before a final spatial-temporal hierarchical model can be fit. The prior estimate of soil activation appears to be too high, resulting in negative calibrated measurements at the hypocenter. To elucidate the question of true soil activation levels, iron and scandium soil composition within 2 kilometers of the hypocenter will be analyzed geospatially and through lognormal models. This is the current focus of the project.

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

My experience in Japan was excellent, both in terms of research and cultural experiences. Through this fellowship I was given the opportunity to network with Japanese researchers and community members who share my interests in radiation research and radiation protection. A highlight of my experience was travelling from my host institution (RERF) to the Kyoto University Research Reactor Institute to meet Dr Tetsuji Imanaka. I plan to continue networking with scientists and citizens in Japan as I continue my work.

9. Advisor’s remarks (if any):

This program worked very well. A lot of that was due to the diligence of the fellow and other personal factors. The time allotted was rather short for a research project, but I think it needs to be understood that some prior coordination and preparation is essential before the fellow comes to Japan, and that completing enough work to do something like getting a paper into the peer-reviewed literature will typically require continued collaboration between the fellow and host researcher, well after the end of the time spent in residence at the host institution.

RESEARCH REPORT

1. Name: Jamie Kennedy （ID No.: SP14031 ）

2. Current affiliation: Drexel University

3. Research fields and specialties:

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

4. Host institution: Tsukuba University

5. Host researcher: Shuichi Miyazaki, Material Science Department

6. Description of your current research

The research completed at Tsukuba University with Dr. Miyazaki was based on Ni-Ti shape memory alloys (SMA). The project characterized Ni-Ti based alloys through the following properties: shape, size, element compound, heat treatment, which provided results of comparable data in frequency, stress loads, and transition temperatures. By understanding the different effects each material property has on the alloy's output functions it is capable to know how to precisely use the SMA as efficiently as possible in actuation. By pairing these results with mathematical modeling from my home research at Drexel University a full character mapping of Ni-Ti based alloys can be made for actuation purposes.

7. Research implementation and results under the program

Title of your research plan: Actuation based character mapping of Ni-Ti based alloy material properties

Description of the research activities:

During my stay, I was trained on a lot of equipment including a vacuum and micro server. I performed chemical prep work on the samples, blew glass around the samples to vacuum and heat-treated them through an electrical furnace. I conducted experiments on the transition times, stress constants and frequency change. The frequency experiments were conducted at Nagoya University of the course of a two day trip with my advisor, Dr. Miyazaki.

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

I accomplished a good amount of travel while in Japan (Tokyo, Kyoto, Nara, Kobe, Osaka, Fuji-san, Naygoa) but the largest cultural experience was seeing how different the work environment and culture in Japan is. It is a beautiful country both visually and in personality.

RESEARCH REPORT

1. Name: Emily Kleber （ID No.: SP14032 ）

2. Current affiliation: Arizona State University

3. Research fields and specialties:

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

4. Host institution: Hiroshima University

5. Host researcher: Dr. Koji Okumura

6. Description of your current research

Earthquakes are worldwide phenomena that cross cultural, social and historical boundaries. Recent large scale and highly publicized earthquakes in Japan make it critical for researchers of different cultures affected by earthquakes to combine efforts in order to advance the deeper understanding of Japanese seismicity. Within the last decade, tectonic geomorphology has been invigorated with the addition of light detection and ranging (lidar) topographic data with increasing resolution and coverage. High-resolution topographic data (<1 m per pixel) for a tectonically active area presents a new opportunity to assess prior investigations and test the value of lidar data in defining geomorphic metrics to understand the response of surface processes to variable rock deformation.

My current research focuses on examining tectonic geomorphic features using this high resolution topographic data. Japan has the highest frequency of pre-earthquake and post-earthquake lidar data in the world. The marvelously accurate data surrounding each isolated event sheds light on new ways to understand active faulting and increase the depth of knowledge about earthquakes in Japan and around the world. A major limitation to lidar data is the cost to collect it, making the need to collaborate when using lidar data essential. I am part of a project that combines computer scientists and earth scientists to deliver lidar data in an effective easy way for researchers as well as conduct trainings.

7. Research implementation and results under the program

Title of your research plan:

Analyzing recent earthquakes in Japan using high resolution topographic data

Description of the research activities:

The goal of my research of the tectonic geomorphology of active on land fault zones in Japan focusing on the Itoigawana Shizuoka Tectonic Line (ISTL) and learn about the application of earthquake science to policy and public safety in Japan. Both of these goals required extensive travel, meeting with researchers from many institutions, and field investigations. During my time in Japan, I traveled to the national institute of Advanced Industrial Science and Technology (AIST) to visit researchers and conduct field investigations with the Geological Survey of Japan (GSJ). This trip was very fruitful because I had a chance to share my knowledge regarding my research on earthquake producing faults in California and a successful National Science Foundation (NSF) project I am part of that distributes high resolution topographic data. In this visit, we went to the ISTL and the Iwazaki fault rupture from 2011 as examples of quaternary land based faulting in Japan. I had a chance to discuss with the JGS researchers their previous and current research on these landforms and discuss their origin. Additionally, I had valuable scientific discussions at the Asia Oceania Geophysical Society (AOGS) meeting in Sapporo, at a high resolution topographic data course at the University of Tokyo in Kashiwa, and conducted fieldwork in the Nara basin with undergraduate students.

Traveling to Japan as a JSPS fellow was a valuable addition to the efforts by myself and my advisor, with Dr. J Ramón Arrowsmith, with the Southern California Earthquake Center (SCEC) Virtual Institute for the Study of Earthquake Systems (VISES) program and the National Science Foundation (NSF). VISES aims to establish connections and working relationships between early career scientists in different countries. The recognized partnership between Arizona State University, Hiroshima University and Geological Survey of Japan has been strengthen and diversified during my stay.

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

The JSPS Summer Program was an incredible experience and I am very thankful to have participated. The research funds were sufficient but took some time from my adviser to organize the funds. Since we fellows are new researchers, it would be a nice experience to manage the funds ourselves and report the costs to JSPS instead of our institutions. I think the orientation at the beginning of the program was longer than it needed to be by two days. Focusing on presenting the research and Japanese language classes and the home stay (still two nights) would be sufficient.

9. Advisor’s remarks (if any):

The research money was very nice and adequate. However, due to the short staff at Hiroshima University, the logistics for completing the payments were very cumbersome and took a lot of time. Perhaps in the future, the JSPS fellows could complete their reimbursements for the research funds.

RESEARCH REPORT

1. Name: Christopher Kovalik
（ID No.: SP14033 ）

2. Current affiliation: Florida Institute of Technology

3. Research fields and specialties:
Biological Sciences

4. Host institution: Kyushu University

5. Host researcher: Dr. Hironobu Kan

6. Description of your current research

My current research is on changes in coral growth during the Holocene across the Pacific. Using push-cores of uncemented coral reefs from Pacific Panamá; Kiritimati Island, Line Islands and Kumjima, Japan Holocene changes from the western, central and eastern Pacific can be compared. Previous hiatuses in coral growth have been observed throughout the Pacific, my research will investigate if this hiatus was transpacific or was restricted locally.

7. Research implementation and results under the program

Title of your research plan:

Understanding how coral reefs in the Ryukyu Islands, Western Pacific adapted to changes in the past using paleoecological analysis

Description of the research activities:

Hand-operated open-barrel coring was done on coral reefs in Kumejima, Ryukyu Islands, Japan. Using this coring method, fifteen cores were collected (between 66 and 325 cm). These cores were then cut in half (lengthwise), with one half remaining frozen and the second half further separated into 5cm sections to be analyzed. Due to the short time period of this fellowship and the schedule of the field work required, the analysis of the cores will be conducted at the Florida Institute of Technology in the United States. This was a very successful coring trip, obtaining 6 more cores than expected.
Besides the field work, Dr. Kan also introduced me to his Scanning Electron Microscopy (SEM), having his own SEM in his lab was a great learning experience. This experience showed me how useful and valuable such a tool is, and I now hope to learn the procedures and become certified to use the SEM at my home institution.

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

This entire experience was amazing. I was introduced to a culture I knew very little about. From the scenery to the history and the people it was an eye-opening experience.

9. Advisor's remarks (if any):

Did an excellent job, especially in the small amount of time for the project.

RESEARCH REPORT

1. Name: Mark Oscar Larson （ID No.: SP14 034 ）

2. Current affiliation:

University of Maryland

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: University of Tokyo (Todai)

5. Host researcher: Dr. Kyoko Okino

6. Description of your current research

My research in Japan was to develop code for a new approach to numerical modeling of mid-ocean ridge processes, by introducing a whole rock chemistry into the forward modeling process. The first step is to construct a 3D box of the ridge. Using COMSOL Multiphysics software, the ridge is modeled to steady state conditions, and the solver grants physical fields (e.g. temperature, velocity, pressure). In post-processing a 'permeability barrier' [Montesi & Behn, 2007] is identified, and crustal accretion is solved for. This is compared with observations and has proven a viable method for explaining how melt gets from within the Earth to the surface.

I modify the method for a specific ridge (Southwest Indian 35-40 degrees latitude), and introduce a hotspot (Marion) into the modeling. I also model the magma and rock chemistry in order to further test, and evaluate the modeling process. This will grant insight into the interior of the Earth, and the pathways by which magma ascends to the surface.

7. Research implementation and results under the program

Title of your research plan:

Geochemical, and Geodynamic modeling of a hotspot-mid-ocean ridge interaction zone: Southwest Indian Ridge 35-40 degrees latitude

Description of the research activities:

The main objective was to write matlab scripts to develop forward modeling of whole rock geochemistry for this specific ridge. The scripts would be robust enough to model for many magma chambers, beyond the mid-ocean ridge applications.

I also ran multiphysics models to test a hypothesis on how the crust at this ridge segment evolved over time. Running >10 models, and comparing them against each other, I identified possible patterns of magma ascent and forces which cause melt to be focused to different areas of the ridge.

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

My stay in Japan was remarkable. My research was aided by collaboration with Kyoko Okino (my host researcher), Dr Seama (Kobe University), Masakazu Fujii (PhD candidate Todai), and many other students and professors from Todai and Kobedai. Throughout my stay I experienced as much as I could of Japanese culture (staying at a Buddhist temple, going to onsens, visiting popular historical sights, trying all manner of food, etc). This program is of the utmost importance for maintaining strong research ties across national boundaries, and is a fantastic way to keep Japanese culture strong.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Joseph Lemanski
（ID No.: SP14035）

2. Current affiliation: Oregon State University

3. Research fields and specialties:

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

4. Host institution: Hokkaido University

5. Host researcher: Dr. Hiroshi Ueda

6. Description of your current research

Many salmon hatcheries in Oregon utilize and rely on fishways to gather salmon that return annually to continue hatchery production. Unfortunately, this process is not perfect and many hatcheries observe variable return rates of hatchery-reared salmon to specific fishways, and this may cause varying ecological and genetic effects on wild and native populations. Within the last decade, considerable attention has been directed towards dissolved free amino acid's (DFAA) as a set of molecules salmon use to navigate and identify their natal rivers. Research has shown that salmonids possess the ability to distinguish between certain water sources based on their DFAA compositions, correctly identify artificial natal river water based on DFAA composition, and that DFAA compositions often differ significantly between watersheds. If salmon do indeed utilize DFAA for homing to natal spawning sites, alteration of DFAA composition in hatchery system water during key imprinting and homing periods may be a possible technique implemented to improve return rates of hatchery-reared salmon to their respective hatcheries by creating a more distinguishable chemical signal for hatchery-reared salmon to identify. The objective of this study was to identify whether the DFAA composition (types and percent composition) differed significantly between river water and water from the same river that has passed through a hatchery. By using ultra high performance liquid chromatography we analyzed DFAA compositions in 6 locations; 3 locations within a hatchery and 3 locations along the river running adjacent to the hatchery. Our results conclude that the composition of DFAA within this hatchery system do not differ significantly from the composition of DFAA in river water. These results might suggest that some of the variability observed in the returns of hatchery-reared salmon to hatchery fishways might be due to their inability to distinguish between hatchery water and river water based on its chemical components.

7. Research implementation and results under the program

Title of your research plan:

Characterization of Dissolved Free Amino Acids in Salmon Hatchery Water

Description of the research activities:

This research utilized ultra-high performance liquid chromatography (UHPLC) to analyze water samples for dissolved free amino acids (DFAA). This included the collection and shipment of samples from Oregon to Hokkaido University as well as the derivatization of all samples, proper UHPLC machine care and maintenance, and reading output from UHPLC to determine molar concentrations of DFAA within samples.

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

This was an absolutely fantastic program! It not only allows students who lack international experience a chance to learn a new culture and way of life, but it also truly does bolster international research collaborations and relationships. I hope to return to Japan again very soon to continue this collaboration!

9. Advisor's remarks (if any):

I am very pleased to become the host researcher of Joseph Lemanski who has high ambition to research "Characterization of Dissolved Free Amino Acids in Salmon Hatchery Water" that had been carried out successfully. He also presented his research plan for two times. To the best of my knowledge, he has a very bright future as an academic and successful scientist, and his experience spending as a JSPS-NSF summer program fellow will not only broaden his training, but also provide future possibilities of international collaboration that will continue throughout his scientific career.

RESEARCH REPORT

1. Name: Alex Craig Levine
（ID No.: SP14036）

2. Current affiliation: State University of New York: College of Environmental Sciences and Forestry, Syracuse, NY, USA

3. Research fields and specialties:

Chemistry Biological Sciences

4. Host institution: Rikagaku Kenkyūsho (RIKEN), Wako, Saitama

5. Host researcher: Keiji Numata

6. Description of your current research

My work involves the use of biodegradable plastics and their applications. Polyhydroxyalkanoates (PHAs) are biodegradable and biocompatible plastics with physical properties similar to petroleum based plastics. They are important as both potential replacements for commodity plastics, and materials for medical devices. To increase the number of available applications for PHAs, I have utilized a chemical method to improve the strength of these plastics, so that plastics with defined properties can be synthesized and tailored as needed for the chosen application.

7. Research implementation and results under the program

Title of your research plan:

Cross-linked polyhydroxyalkanoates in tissue-engineering scaffolds

Description of the research activities:

The results of this summer's research are the fabrication of enhanced scaffolds for biomedical uses with improved physical strength. Scaffolds were made from a unique PHA plastic, resulting in a highly porous mesh for use in medical implants. The physical properties of the scaffolds were significantly improved using a chemical method, and these new, stronger scaffolds were tested for compatibility with human cells. Results showed that the chemical method did not alter cell viability. Therefore, a new type of plastic material for biomedical uses was successfully produced, with potential application for vascular grafts, skin patches, heart valves, and other medical implants.

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

Both the research and cultural experiences were phenomenal. The facilities at RIKEN are first-class, and allowed for substantial amounts of work to be accomplished in a short period of time. Culturally, Japan was both exciting and welcoming, especially to foreigners who speak very little Japanese.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Amanda C. Martin （**ID No.:**SP14037）

2. Current affiliation:

The Department of Horticultural Science & Plant Biology, Microbial & Genomics Institute, University of Minnesota-Twin Cities, USA

3. Research fields and specialties:

Chemistry, **Biological Sciences, Agricultural Sciences**

4. Host institution: Laboratory for Single Cell Mass Spectrometry, Quantitative Biology Center RIKEN, Osaka, Japan

5. Host researcher: Dr. Tsutomu Masujima

6. Description of your current research:

Individual cells in biological systems contain a diverse array of chemicals, respond differently to stimuli, and exist at various developmental stages. Single cell analysis of biological systems is essential to understand basic biochemical processes. Medicinal plants provide us with chemicals that are used as pharmaceuticals, in cosmetics, and as botanical supplements. Studying single cells from medicinal plants may help reveal biochemical processes or novel chemicals that could be useful to humans. In this project, stereomicrocopy was paired with nanospray mass spectrometry to facilitate the detection of chemicals from single plant cells. This technique named live single cell mass spectrometry (LiveSC/MS) was used on cells from stem tissue of the medicinal plant *Glycyrrhiza uralensis* Fisch. (Chinese licorice). The chemical profiles of intact live cells were compared those of a bulk extracts prepared from homogenized licorice material. From these measurements it will be possible to measure the degree of cell heterogeneity and the distribution of specific chemicals among plant cells. Using LiveSC/MS to evaluate intact plant material may facilitate the discovery of novel compounds present at high levels in individual cells that are not detectable in homogenized bulk extractions. Development of LiveSC/MS using highly tractable plant cells will be applicable to other biological systems to better understand molecular biology on a cell specific level.

7. Research implementation and results under the program:

Title of your research plan:

Real-time chemical profiling and direct localization of living plant cell chemical contents by live single-cell mass spectrometry

Description of the research activities:

Training in the technique of live single-cell mass spectrometry was conducted by one of my lab

colleagues. Leaves and stems from plants collected outside the lab were used to practice the technique, especially stereomicroscopy and micromanipulation.

In early July, I traveled to Takeda Medicinal Plant Garden in Kyoto with my host supervisor Dr. Masujima, where we met with Dr. Kodaira. At the garden I gave a presentation about my project proposal and then completed an educational garden tour learning about medicinal plants used in Traditional Chinese Medicine, Japanese Kampō medicine, and other botanical medicine traditions. A live *Glycyrrhiza uralensis* plant was transported to the RIKEN QBiC in Suita, Osaka. The plant suffered superficial death of its aerial tissue due to being transplanted. After acclimation in 100% shade, the plant was moved to partial sun where, with daily watering of 2000 mL of tap water, the rhizomes eventually sprouted new growth and full leaves and stems.

A bulk extract was prepared from a full stem with leaves (2.98g fresh weight) after being dried at 30°C for 72 hours (0.58 g dry weight). The dry material was ground and homogenized with a mortar and pestle and solvent extracted in 80% methanol for 4 hours with 20 minutes of sonication at the beginning and the end. 1 mg/mL extract samples were analyzed by liquid chromatography-mass spectrometry (LC-MS) analysis using an LC gradient developed the week before.

The chemical contents of *G. uralensis* single cells were analyzed using live single cell mass spectrometry (liveSC-MS). A full stem with leaves was collected and stem tissue sections were taken using a razor. These were placed on the stage of a M205C stereomicroscope (Leica, Germany) where single cells could be visualized at 16x to 156x magnification. The cellular contents were sampled into 1 µm cellomics tips (Humanix, Japan), specialized platinum coated glass nanospray tips, and introduced into a hybrid linear iontrap-orbitrap mass spectrometer (Thermo Scientific).1µL of methanol with 0.1% formic acid was added to aid with ionization. A spray voltage of 1.6 kV was required to maintain suitable ion intensity (~1E6). Cells from the licorice stem pith, which are soft spongy parenchyma cells, were readily sampled. In all, three useable replicates of licorice single cell chemical contents were acquired via LiveSC/MS. These replicates along with those acquired from the bulk extract were processed using Xcaliber™ software (Thermo Scientific).

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

It was stimulating to work in the very well-equipped QBiC lab with such knowledgeable and kind lab mates. They arranged social events including meals at typical Japanese restaurants and even a Nagashi sōmen celebration. In addition the lab assistant, Keiko Ito, was extremely helpful and supportive during my stay helping me with the needs of everyday life. My host, Dr. Masujima, made time to meet with me to discuss my project and even to go on a trip to Hiroshima for the Peace day festival and to tour his *alma mater* Hiroshima University.

RESEARCH REPORT

1. Name: Emily Meissen （ID No.: SP14038 ）

2. Current affiliation: University of Arizona

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 Miyazaki

5. Host researcher: Professor Ryusuke Kon

6. Description of your current research

Population cycles occur in many plants and animals, though the causes of these cycles is usually unknown. For example, although there are 13- and 17-year cicadas in the United States which exhibit periodic outbreaks in their populations every 13 or 17 years, cicadas in Japan are prevalent every summer and lack such periodicity. The understanding of population cycles is important to managing fisheries and crops, protecting endangered species, and dealing with species invasions and the spread of epidemics. We research the causes of periodic life cycles through a model of two competing populations. When isolated, the populations do not exhibit periodic outbreaks; however, when together, the interactions between them cause both to develop periodic outbreaks similar to those of the famous 13- and 17-year cicadas found in the eastern United States.

7. Research implementation and results under the program

Title of your research plan:Developing Periodic Life Cycles through Competition
Developing Periodic Life Cycles through Competition

Description of the research activities:

We located the possible fixed points of the discrete-time matrix model and analyzed their existence and their stabilities, first through numerical exploration in Mathematica and then analytically. We have proved many of the existence and stability criteria of the fixed points of the system, and have hypotheses supported by numerical simulations for the behavior of the remaining fixed points.

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

Attended 2 conferences (WAAC and JSMB/SMB)

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Lily MOMPER （ID No.: SP14 039 ）

2. Current affiliation: University of Southern California

3. Research fields and specialties:
Biological Sciences

4. Host institution: JAMTEC, Yokosuka

5. Host researcher: Dr. Hiroyuki IMACHI

6. Description of your current research

My current laboratory at USC does research in the deep continental subsurface. This vast biosphere represents the largest microbial habitat on Earth. The deep subsurface biosphere (DSB), in particular the continental subsurface, has only recently been appreciated as a dynamic, populated, metabolically active ecosystem, actively interacting with, perhaps controlling, global elemental cycles. We aim to understand how microorganisms are making a metabolic living in the DSB. Our primary study location at this time is an abandoned gold mine in Lead, South Dakota, USA. The mine reaches 8500 feet below surface within an iron rich Precambrian sedimentary sequence. Our team has sampled levels 300-4850 feet below surface. Geochemical measurements, bulk water for microbial cultivation, and DNA samples for molecular characterization were collected between September, 2013 and March, 2014. My research specialty within our group is microbiology: trying to grow novel organisms endemic to the deep subsurface. Only a few deep subsurface microorganisms have been grown in the laboratory hence how they survive remains unclear. Biological samples from the deep subsurface will not grow using traditional microbiological cultivation techniques. Therefore, successfully cultivating its residents requires innovative technology. Dr. Hiroyuki Imachi at JAMSTEC-Yokosuka, Japan, has designed continuous-flow bioreactors to cultivate fastidious, low energy-adapted anaerobes (organisms that use a terminal electron acceptor other than O2) from the subsurface. In 2012-2013 Dr. Imachi taught me how to maintain and sample these bioreactors, and I have two in operation at my home institution. The bioreactors contain mineral substrates and media designed to mimic the deep subsurface environment from which samples were collected. Subsequent collection of effluent from the reactors have yielded enrichments of subsurface anaerobes, excellent for isolation and metabolic characterization of typically low-density, slow-growing microorganisms. Samples were removed from the reactors and sent to JAMSTEC for research during the EAPSI 2014 fellowship.

7. Research implementation and results under the program

Title of your research plan:

PHYSIOLOGICAL CHARACTERIZATION OF LOW-ENERGY ADAPTED, DEEP-SUBSURFACE BACTERIA FROM HOMESTAKE GOLD MINE, USA

Description of the research activities:

Under the mentorship of Dr. Imachi I was able to isolate an anaerobic, deep subsurface bacterium which represents a new family within the phylum Spirochaeates. I was also able to enrich an Archaeon belonging to a phylum (Thaumarchaeota) that has only three individuals currently in isolation. During this study, anaerobic culturing techniques were employed. I learned DNA extraction/cloning/DNA sequencing methods. This is a series of molecular methods that allows me to sequence the DNA of the organisms growing in my enrichment cultures. I can then compare the DNA sequences to a global database to determine if I have novel organisms growing in culture. I determined two priority targets using this technique: one archaean and one bacterium, named above. I learned how to design FISH (fluorescence in situ hybridization) probes that are specific to my target organisms. I also learned how to perform FISH and optimize the assay for the newly designed probes. The last technique I learned was qPCR (quantitative PCR). This was used to track growth rates of the Thaumarchaeote because its growth rate and yield are too low to track with traditional optical measurements. Further physiological characterization of the two targets will be conducted at my home institution

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

While I was in Japan I was able to travel to Kyoto and Nagaoka. Both times I traveled with people from the JAMSTEC laboratory, so it was very nice that they took the time to show me other parts of Japan. My favorite place in Kyoto was a water shrine built in the mountains north of Kyoto, called Kibune; it was incredibly beautiful.

I also keep in touch with my host family and have been to their house two times since orientation week. We usually just have lunch together and make origami and practice language. They are so nice.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Sampson Moore
（ID No.: SP14040）

2. Current affiliation: University of Minnesota, Department of Mechanical Engineering

3. Research fields and specialties:
Chemistry Engineering Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Professor Tomohiro Nozaki

6. Description of your current research

The current research investigates the efficient production of hydrogen. The uses of hydrogen are vast, including powering fuel cell vehicles, and internal combustion engines.

Hydrogen is produced in a chemical reaction from methane, carbon dioxide, and nickel. The energy source to drive the chemical reaction is a plasma. A lot of research has been performed to study hydrogen production using a plasma, but many of the details of the reaction in a chamber with solid form Nickel are unknown.

The chamber where the hydrogen is produced is a continuous-flow reactor, packed with nickel-coated pellets. The nickel enhances the reaction, acting as a catalyst. Carbon dioxide is the other reactant, which may be recycled from combustion at another industrial facility, leading to sustainable hydrogen production. The reaction occurs at high temperatures (600C), and one of the goals of the research is to further understand the chemistry in order to produce the hydrogen at low temperatures. Evidence has been found that this is possible by pressure variation, the use of the nickel catalyst, and plasma power variation.

The primary tool that was used to study the chemistry was spectroscopy. During the reaction, the light that was emitted was collected and studied. Multiple situations were studied including observing the role of the nickel catalyst, the role of the temperature, the role of the chamber pressure, and the role of the plasma power. Each of these variables and their combination lead to a different final output of hydrogen, which was observed in the light spectra and by a mass spectrometer.

7. Research implementation and results under the program

Title of your research plan:

Spectroscopic Analysis in Methane Reforming: The Production of Hydrogen

Description of the research activities:

During hydrogen production, the light spectrum was collected and analyzed under many situations to investigate the key reactions. The role of the nickel catalyst was studied by observing the light spectrum with and without the nickel in the chamber. The gas temperatures in the reactor were also determined using a comparison to theoretical information. With the gas temperature, we observed correlations between the reactor temperature, and the temperature of the nickel catalyst. A spatial variation of the temperature in the reactor was also studied, leading to information about the extent of hydrogen production, and the rates at which it is occurring in the continuous flow system.

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

This JSPS and NSF program has been invaluable to me. Not only did I complete valuable research with Professor Nozaki and his team, I made friends with them, and believe the relationship to be long-lasting. The culture of Japan is different than any I have seen before, including the cultural customs, the hospitality of the people, the manners of the people, and their uniqueness. Overall, I am honored to have spent this summer in Japan.

9. Advisor's remarks (if any):

I am amazed by his outstanding achievements and fine personality. We conducted our research as we planned and results will be submitted a journal paper by the end of September. Moreover, he enjoyed Japanese culture every weekend and maximized his stay in Japan as JSPS planned. He is one of the most original and excellent PhD students I have ever had.

Tomohiro Nozaki, Tokyo Tech

RESEARCH REPORT

1. Name: **Kenneth Moser**
（ID No.: **SP14041**）

2. Current affiliation: **Mississippi State University**

3. Research fields and specialties:

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

4. Host institution: **Nara Institute of Science and Technology (NAIST)**

5. Host researcher: **Dr. Christian Sandor**

6. Description of your current research

The area of interest for my doctoral work is Augmented Reality (AR) and the role human factors play in the perception and effectiveness of AR systems. I am primarily concerned with AR systems utilizing computer graphics to overlay "virtual" data onto the real world through an optical see-through (OST) head mounted display (HMD), such as the recently developed *Google GLASS*. Such systems are of great benefit to persons requiring hands-free access to schematics or component information as well as locations and identities of otherwise invisible points of interest in the immediate field of view, such as a meeting point occluded by a large building on a city street. My research directly deals with a very crucial facet of AR systems; registration errors in the computer generated overlay. Registration refers to the mechanism of displaying a virtual item such that it appears to the user to be at a certain location within the world. This location may be at a three dimensional position in a room, or simply within two dimensional screen space. Essentially, registration error is the result of misalignment between the user's eyes and graphics on the display. Thus, an error in registration will cause the augmenting information to appear at an improper location. The underlying causes of misalignment can be attributed to disparity between the center of the eye and the center of the display and discrepancy between the actual point of view of the observer and that of the virtual "pin-hole camera" used by the graphics application to render the virtual geometry. My research aims to investigate contributing sources of registration error due to: calibration procedures, systemic inaccuracies, and user error. Current studies are investigating the utility of incorporating eye tracking technology into calibration procedures in order to generate more robust estimations for the eye position relative to the display screen. The current research performed under the JSPS summer program directly addresses this issue, and a user study experiment was designed and implemented during the 2014 summer program to examine the utility of eye tracking methods for HMD calibration. Planned studies for the upcoming year will utilize a 3D virtual environment to simulate an AR display. The simulation will allow for rapid testing and examination of HMD specific features and their impact on registration error. These features include optical distortion, image plane distance, and movement of the HMD on the user's head during use. The results of this research will be of direct benefit to designers and developers of the emerging see-through display technologies.

7. Research implementation and results under the program

Title of your research plan:

Quantifying Error Sources in Optical See-Through Display Calibration

Description of the research activities:

During the 2014 JSPS summer program, I worked with Dr. Christian Sandor and Professor Hirokazu Kato, leading researchers in the field of Augmented Reality (AR) development. The goal of the project was to investigate the utility of using eye tracking technologies to increase the robustness of calibration procedures for head mounted displays. Using a head mounted display shipped from my home university in the USA, I mounted a small webcam below the left eye piece to record eye images of the wearer. In collaborative talks with Dr. Sandor, my major professor in Mississippi Dr. Ed Swan, and another graduate student at the Technical University of Munich in Germany, we designed a user study to record subjective measures in order to gauge how well the eye tracking enhanced calibration performed over the general procedure. During the last week at the host institution, I have been able to run 13 subjects, students in other departments at the university, through the experiment. The preliminary results look promising, and we are working towards a publication of the findings in the upcoming months.

Along with the afore mentioned project, I was also able to collaborate with a post-doctoral student at the host institution, Dr. Igor Almeida, on a new AR related project. This project also focuses on calibration procedures, but for haptic devices. During the JSPS fellowship I assisted Dr. Almeida in developing a hardware and software framework to perform the calibration procedure. The next steps in the project will be designing a user study to examine the robustness of the calibration techniques. I have plans to continue collaboration on this project after returning to my home institution as well.

In addition to project related activities, I was afforded the opportunity to visit several labs at my host institution as well as labs at Osaka University. There was also a symposium on Augmented Reality development held at my host institution during the summer as well, and I was able to meet with and discuss various AR topics with several leading researchers in AR from both academia and industry.

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

I have greatly enjoyed the JSPS summer fellowship program. The connections and collaborations I have formed during this period will be invaluable during the remainder of my doctoral studies and throughout my career in academia. Contact with the Japanese native students at the university has broadened my viewpoint about researching abroad. Also, many of the students in the lab at my host institution were non-Japanese natives from around the world and it was quite enlightening to be able to learn about their perspectives on Japanese culture.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Kevin Moses （ID No.: SP14 042 ）

2. Current affiliation:

Utah State University

3. Research fields and specialties:

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

4. Host institution: Kyoto University

5. Host researcher: Akira Mori

6. Description of your current research

I research animal behavior with regards to defensive behaviors of reptiles. The lab I work in at Utah State University is primarily concerned with chemical defenses of reptiles. My dissertation work is concerned with the native Japanese snake yamakagshi, scientific name *Rhabdophis tigrinus*. These snakes are interesting for their ability to consume toxic toads (genus *Bufo*). They are resistant to the bufotoxins these toads create and are able to store bufotoxins in specialized skin glands just behind the snake's head called nuchal glands. This gives the snake a chemical defense against its predators. I am interested in exploring how being poisonous effects anti-predator behaviors in this species.

7. Research implementation and results under the program

Title of your research plan: Physiological costs of ingestion of toad toxins in the snake *Rhabdophis tigrinus*.

Description of the research activities: I attempted two main studies this summer. The first was designed to measure the metabolic costs these snakes incur from ingesting toad toxins. Using a FoxBox field gas analyzer, I measured the snake's carbon dioxide production and oxygen depletion from the ambient air. My first experiment looked to establish a baseline metabolic rate and found metabolic rates for the snake in response to digestion. I intended to inject the snakes with a bufotoxin (gamabufatalin) but organization and timing issues made me run out of time to conduct those experiments.

My second test was to build a three meter long racetrack and measure the snake's locomotor speed before and after injection. Unfortunately the snakes all had different responses to being placed on the racetrack. Some ran, others slithered away slowly, showing little response to me, and others simply coiled up and refused to move. I had no consistent data that could be compared between individuals.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I went on two field excursions with my lab, both two day, one night, trips. The first was to Gifu prefecture to look for snakes around rice paddies, and we spent the night in at an onsen. The second was to a biological field station in Ashiu. I arrived in Japan 10 days before orientation started and I traveled with 4 other fellows. We visited Kyoto, Hiroshima, Osaka, Koya-San, Kanazawa, and Tokyo during that time. I got to experience matsuri in Kyoto and Kanazawa during my stay, and while living in Kyoto have visited numerous cultural sites and temples.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: David Newman （ID No.: SP14 043 ）

2. Current affiliation: University of Southern California

3. Research fields and specialties:
Social Sciences

4. Host institution: Hokkaido University

5. Host researcher: Prof. Masaki YUKI

6. Description of your current research

Maximizing describes a decision making strategy in which one attempts to find the absolute best option in a given set of choices. In contrast, satisficing refers to the tendency to select the option that is good enough. In many studies, the tendency to maximize has related negatively to well-being. In my research, I aimed to investigate the tendency to maximize in the specific domain of friendship selections and to explore the moderating effect of the number of choices. Research has shown that an increase in the number of options is particularly detrimental to the well-being of maximizers because they are more likely to regret their decision and continue to think about options that could have been. In the context of friendship selections, relational mobility acts as this moderator because relational mobility can be defined as the extent to which one can move in and out of social relationships. I hypothesized that the tendency to maximize would relate more strongly and negatively to well-being in a society high in relational mobility, such as the US, than it would in a society low in relational mobility, such as Japan.

My host advisor and one of his graduate students translated our questionnaire into Japanese and we distributed it online and then compared our results with the questionnaire that we had previously collected in the US. Our hypotheses were generally confirmed. In high relational mobility societies, the relationship between maximizing and well-being was strong and negative, whereas in low relational mobility societies, the relationship was weak and negative or sometimes even positive.

7. Research implementation and results under the program

Title of your research plan: Cross-cultural differences in maximizing tendencies and well-being

Description of the research activities:

Most of my work at the beginning of the summer involved the translation of the questionnaire into Japanese. Although I do not know Japanese, I met regularly with my host advisor and one of his graduate students to clarify the meaning of the items of the questionnaire. After several weeks of working on the translation, we posted the questionnaire online, and I then spent the next few weeks analyzing the data and writing the first draft of the manuscript

8. Please add your comments, including any cultural experience during your stay in Japan (if any): Through this research experience, I learned much about conducting a cross-cultural research project and I have a greater appreciation for the complexity of such studies. I had read a considerable amount of research describing differences between Japan and the US, but I have never really experienced Japanese culture. Through conversations with lab mates and interactions with Japanese people, I was able to learn much more about cross-cultural differences in relational mobility as well as mental states such as collectivism. In addition to conducting this research project in Sapporo, I met with some professors and graduate students in Tokyo and Kyoto and learned more about different perspectives on cross-cultural research, and that was quite informative and beneficial as well.

9. Advisor’s remarks (if any)

RESEARCH REPORT

1. Name: Hoang Yen Nhi Ngo （ID No.: SP1444 ）

2. Current affiliation: Northeastern University

3. Research fields and specialties:

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

4. Host institution: Kyoto University

5. Host researcher: Sakiko Yoshikawa

6. Description of your current research

Understanding how individuals perceive emotions through facial expressions can provide insight into how humans interact socially and form relationships. Successful emotion perception requires attention to both the emotion expressed on the face, and the context in which that emotion occurs. In daily life, people have access to multiple sources of contextual information. However, these various sources of contextual information may diverge. How the perceiver resolves these disagreements between context sources may be shaped by their life experiences, cognitive abilities, and culturally-specific way of thinking. The current research thus investigates how individuals in different age groups from various cultures use conflicting contextual information to interpret emotional expressions in others.

7. Research implementation and results under the program

Title of your research plan:

Cultural and Age Differences in the Utilization of Conflicting Contextual Cues in Emotion Perception

Description of the research activities:

From mid-June to the beginning of July, we conducted several norming experiments on lancers, a Japanese online platform for data collection. The norming experiments were to rate our morphed facial expressions and our selected context scenes to ensure they convey the intended emotional information. At the same time, my labmates and I translated (and back-translated) our survey materials and study instructions to be used in the main experiment. We also contacted an employment center for older adults to recruit participants. In July and the beginning of August with the help of two research assistants, I ran the hour-long experiment with 43 younger adults from Kyoto University and 30 older adults from the Kyoto area (the older adults took more than an hour). It was challenging running the experiment in Japanese but I learned a lot about how participants in Japan differ from those in the US (they take longer to complete the task, ask more questions, but are more conscientious). I was also able to present and discuss my research with two labs at Nagoya University, and was able to establish a connection there and learn more about psychology research in Japan. Data collection was finished after the first week of August. I have processed the data, and am now currently learning the statistical techniques necessary to analyze the data.

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

It has been a great experience! I was in Kyoto during the festival season, so it has been very nice to be able to participate in such activities after work. I was also able to visit professors and labs in Japan that do similar research and discuss possible post-doc opportunities. It was really challenging because I had to finish my project within the short 2 months that we have, but along the way I have learned a lot about the academic environment in Japan, and about conducting cross-cultural research. All in all, it was a very rewarding experience.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Erin Partlan （ID No.: SP14045）

2. Current affiliation: Clemson University

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Hokkaido University

5. Host researcher: Dr. MATSUI Yoshihiko

6. Description of your current research

I have been focusing on the filtration performance aspects of introducing a superfine carbonaceous material to water treatment systems for the removal of trace contaminants. I used membranes with a nominal pore size of 0.1 microns to remove carbon particles with an average diameter of 0.2 microns. Without coagulants, the carbon particles block the membrane pores more fully and decrease the rate of water passage. I explored the use of two common chemical coagulants, ferric chloride and polyaluminum chloride (PACl). The membranes I used were a ceramic monolith membrane with an inside out filter channel configuration and an organic polyvinylidene fluoride (PVDF) in a flat sheet configuration. The PVDF membrane had the option of agitated filtration with the inclusion of a floating stir bar. I explored various water qualities, including alkalinity and pH. For the ceramic membrane, both ferric chloride and PACl improved flux to the same degree. For the PVDF membrane, PACl with stirring produced the best results, followed by ferric chloride with or without stirring, followed by PACl without stirring. However, ferric chloride was highly influenced by pH – whereas previous trials were performed at pH 7, when the filtration was performed at pH 6, the flux decline was worse than the carbon particles alone without a coagulant. When natural organic matter (NOM) was introduced, the recipes for coagulation needed to be adjusted, thus direct comparison was not possible. Use of coagulant resulted in less NOM passage through the membrane, but did not particularly reduce flux decline.

I also measured the attachment efficiency of the particles using time resolved dynamic light scattering (TR-DLS) on the Malvern Zetasizer Nano ZS. I explored a range of salt concentrations of NaCl, KCl, and $CaCl_2$. NaCl and KCl produced maximum attachment rates at a concentration of 10 mM; KCl resulted in slightly faster particle aggregation than NaCl. $CaCl_2$ produced the highest rates of particle aggregation and reached a maximum around 1 mM. Modeling with DLVO theory resulted in a slight match to experimental results, but did not explain behavior at lower concentrations.

7. Research implementation and results under the program

Title of your research plan:

Comparison of ceramic and PVDF microfiltration membranes for the application of induced particle aggregation to improve performance of superfine powdered activated carbon (S-PAC) filtration

Description of the research activities:

- Performed parallel filtration experiments to compare the performance of inorganic and organic membranes under identical conditions. Recorded permeate flux over time to measure the degree of flux decline.
- Conducted TR-DLS measurements for a determination of particle attachment efficiency under various ionic strength conditions. Also measured zeta potential to find the isoelectric point of the carbon particles.
- Modeled particle attachment efficiency using DLVO theory.
- Measured DOC in permeate from filtration experiments with NOM to examine both the effect of coagulant for the prevention of DOC passage and the effect of DOC on baseline filtration performance.

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

I enjoyed being a part of Japanese culture for this summer, including daily greetings (ohaiogozaimasu, otsukarasamadeshita), living styles (shoes off, room slippers), eating styles (itadakimasu, gochisousamadeshita), and many other details, all of which I have grown quite fond of. In retrospect, I only wish I had more time to learn Japanese before coming here so that I could have interacted more with my wonderful labmates.

9. Advisor’s remarks (if any):

I very much enjoyed having an exchange student and I think the program is fine. I think this type of interaction is very beneficial for exchange of experimental ideas and building a connection between Clemson University and Hokkaido University. I look forward to hosting another student next year.

RESEARCH REPORT

1. Name: Anna Penner
(ID No.: SP14046)

2. Current affiliation: University of California, Irvine

3. Research fields and specialties: Social Sciences

4. Host institution: Nihon University

5. Host researcher: Yasuhiko Saito

6. Description of your current research

Using the Nihon University Japanese Longitudinal Study of Aging (NUJLSOA), I consider the functioning changes that occur among Japanese elderly over a ten year period. I examine the change over the ten year period in the ability for these elderly (65+) to perform 23 functions on three difference scales. These scales are: activities of daily living (ADL), instrumental activities of daily living (IADL), and activities that are necessary to operate in the wider world outside of the home (AWW). Most elderly see both improvement and deterioration in their ability to perform these functions and few respondents only improve or only deteriorate. I investigate various covariates that might explain the return to functioning or the loss of functioning. These covariates include age, gender, various chronic illnesses or ailments, as well as co-residence with adult children.

7. Research implementation and results under the program

Title of your research plan:

The Role of Health and Relationships on Gaining or Losing Functioning among Older Japanese

Description of the research activities:

Over the course of this summer I utilized the NUJLSOA to investigate changes in functioning among Japanese elderly. As this is a longitudinal survey, it allows me to investigate changes within individuals over time. I began by cleaning the dataset and recoding key interesting variables. After further researching the intersecting fields of gerontology and health, and running preliminary analyses, I honed in on the sequence of losing or gaining functioning in three scales: activities of daily living (ADL), instrumental activities of daily living (IADL), and activities that are necessary to operate in the wider world outside of the home (AWW). I spent time at the International Sociological Association World Congress of Sociology that was held in Yokohama where I attended sessions on gerontology and health as well as Japanese gerontology specifically. I also made time to meet with gerontologists and sociologists who are interested in Japanese gerontology specifically.

My findings thus far show that on average losing one function between the 1999 and 2001 surveys results in losing 7.19 other functions on a 23 point scale. However, between 2006 and 2009 (among respondents who are now older) losing one function on average results in losing 6.66 other functions. On average gaining a function between 1999 and 2001 results in gaining 4.72 other functions, while gaining a function between 2006 and 2009 yields an average of 3.83 other functions gained. Thus we see less change in the total gain and loss in the older sample (2006 to 2009) than we do when they were younger (1999 to 2001).

Analyses also suggest that deterioration in the ADL and IADL functioning are listed by respondents to be caused by the onset of stroke and dementia (though dementia would require a proxy answering survey questions, so there are some reliability concerns on that account). While it is more difficult to ascertain the cause of deterioration of the AWW functions due to different questions being asked than with the ADL and IADL scales, there is a large proportion of respondents (over 20%) with stroke, high blood pressure, arthritis and chronic back pain who have lost AWW functioning.

With the increase of other functioning difficulties the odds of regaining a previously lost function are consistently low among most AWW functions (for eight of the nine AWW functions in the 1999 to 2001 surveys, and six of nine in the 2006 to 2009 surveys). Aging consistently increases the odds of losing an AWW function, though this is much stronger in the 1999 to 2001 surveys than in the 2006 to 2009 surveys. Further the presence of arthritis decreases the odds of regaining an AWW function for the earlier surveys but is not significant in the later surveys.

Age and an increase in the number of other functioning difficulties yield higher odds of losing almost all of the ADL and IADL functions and there is little difference between the surveys.

Over all three scales there is no pattern of chronic ailments or illnesses that affect the odds of gaining or losing functioning with the exception of arthritis as mentioned above. There is also no consistent pattern associated with living with an adult child, but I suggest further analyses that investigate reasons for living with children, proximity to children are not co-residing with the respondent, as well as marital status.

RESEARCH REPORT

1. Name: Lumarie PEREZ-GUZMAN （ID No.: SP14 047）

2. Current affiliation: The Ohio State University

3. Research fields and specialties:

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

4. Host institution: Kanazawa University

5. Host researcher: Yoshihiro FUKUMORI

6. Description of your current research

Atomic force microscopy (AFM) has provided new opportunities in microbiology for studying single cells and molecules in a near-native state. In AFM, a sharp tip is scanned over the surface of a sample; the interaction force between the tip and the sample is measured, and recorded as three-dimensional images (Dufrêne, 2008). This technique has been widely used to image biomolecules including antibodies, cells, membranes, proteins and nucleic acids (Henderson, 1994; Oestreicher, et al., 2012; Prozorov et al., 2007; San Paulo, et al., 2000; Yamamoto et al., 2010) because of its ability to visualize biological specimens without the need for a vacuum and freezing. Furthermore, it can provide information about cell-wall elasticity, and measure cellular interactions such as adhesion and biofilm formation (Lower et al., 2005; Lower et al., 2001).

The objective of this study was to visualize and analyze cell membrane structural dynamics of Gram positive bacteria. This was achieved by isolating *Bacillus subtilis* from natto, and visualizing it using high-speed AFM (HS-AFM). Briefly, bacterial cells were grown in LB medium, collected during exponential growth phase, and treated following the method by Yamashita et al., (2012). Subsequently, cells were analyzed using the HS-AFM. This instrument has an improved performance (i.e., higher imaging rate). This allows visualizing the structure dynamics, and processes of biological molecules directly in physiological solutions at sub-second resolution without affecting the molecule's function (Ando et al., 2013; Ushihashi, and Ando, 2012). To our knowledge, this is the first time that a Gram positive bacterium has been analyzed using HS-AFM.

References:

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7. Research implementation and results under the program

Title of your research plan: **Structural analysis of bacteria cell membrane using high-speed atomic force microscopy**

Description of the research activities

Training: I was trained to use the high-speed atomic force microscope (HS-AFM). The first part of training consisted of getting familiar with the instrument, and its components. During this period, I learned about the different parts, cleaning procedures and assembly. The second part consisted of imaging proteins (e.g. Actin). This allowed me to learn how to adjust tip speed and other parameters to avoid damaging the sample.

Project: I isolated *Bacillus subtilis* from natto and grew the cells on LB media at 37 ºC. Then, cells were checked for their viability using the BacLight LIVE/DEAD kit (Molecular Probes, Carlsbad, CA), and analyzed using fluorescence microscopy (Eclipse E600; Nikon, Tokyo, Japan). Subsequently, cells were deposited on chemically treated mica and observed with a laboratory-built HS-AFM.

The images were analyzed with the AFM software, and stored in the lab server. The cells had a rod shape which is characteristic of the genus *Bacillus*. The height and width were measured vertically along the axis to estimate cell diameter. The images revealed small particles in the surface of the cell. These particles will be further examined by both molecular techniques and additional microscopy analysis. The results from this project have provided valuable information about Gram positive cells. To our knowledge, this is the first time that *B.* subtilis has been imaged and analyzed using HS-AFM.

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

I really enjoyed the Japanese hospitality, culture and the food. I felt welcomed at every place I visited. Working with Fukumori-sensei and his team was an amazing experience. The students treated me as a member of the lab.

9. Advisor's remarks (if any):

Although two months is not enough time for conducting research, we obtained first images that provide insight about the surface of Gram positive cells and valuable information using the high-speed AFM. These preliminary results have potential to lead new research field. We would like to collaborate with Lumarie in the near future.

RESEARCH REPORT

1. Name: J. Edmon Lee Perkins （ID No.: SP14048）

2. Current affiliation: University of Maryland

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 University

5. Host researcher: Dr. Takashi Hikihara

6. Description of your current research:

Noise (random mechanical vibrations) can have adverse effects on mechanical systems. Control schemes have been developed to minimize the effects of noise. However, with the discovery of stochastic resonance by Benzi, *et al.*, in the 1980s, noise is known to produce beneficial phenomena as well. Whereas stochastic resonance happens with static equilibrium points, my current research studies the effects of noise for dynamic phenomena. For instance, noise can change the stability of an equilibrium point, push a system into quasi-periodic or chaotic motions, or even attenuate energy from certain frequencies. The effects of noise on nonlinear systems are necessary to understand the dynamics of these systems in the presence of noise.

7. Research implementation and results under the program

Title of your research plan:

Noise-influenced Dynamics of Oscillator Array

Description of the research activities:

During this EAPSI, research has been conducted with Dr. Takashi Hikihara, Dr. Masayuki Kimura, and Dr. Shinji Doi of Kyoto University. By observing the dynamics of the coupled oscillator experiment at Kyoto University, additional insight has been gained into the coupled oscillator experiment designed at the University of Maryland. Dr. Kimura modified his experiment to allow a controlled amount of stochastic vibrations into the forcing of the array, along with the deterministic sinusoidal forcing. Two interesting noise-induced phenomena were observed, which could be utilized in further studies of intrinsic localized modes (energy localizations) in coupled oscillator arrays.

By having technical discussions with the host colleagues, a fuller understanding of the key parameter ranges and analytical tools for which to study intrinsic localized modes was acquired. From these conversations, codes written in MATLAB were constructed, which combine nonlinear dynamical analysis and stochastic analysis.

These findings will be summarized in a paper, with the intention of submission to a research journal.

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

The assistance of the JSPS and NSF in sponsoring this EAPSI program is gratefully acknowledged. This collaboration has been fruitful, both professionally and personally. Inclusion in the lab members' discussion and lunches was gratifying. Also, the hospitality of the host family is very much appreciated. The host family's choice of activities, which included a formal tea ceremony, homemade sushi, a tour of Tokyo, and a dinner in Kyoto, were culturally enlightening and enjoyable.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Tyler Perlenfein （ID No.: SP14049 ）

2. Current affiliation: University of Wisconsin – Madison

Department of Chemical and Biological Engineering

3. Research fields and specialties:

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

4. Host institution: RIKEN Research Institute, Wako campus

5. Host researcher: Dr. Mizuo MAEDA and Dr. Tamotsu ZAKO

6. Description of your current research

My current work is concerned with the effect of human cystatin c, a protein in the cerebrospinal fluid, on the aggregation and toxic properties of amyloid-beta, the protein implicated in Alzheimer's disease pathology. This is important because the self-assembly and aggregation properties of amyloid-beta are intimately connected with symptoms of Alzheimer's disease, including neuron cell death and loss of synapse plasticity. Cystatin c has been shown in previous work to inhibit the aggregation of amyloid-beta. Additionally, cystatin c was shown to protect neuronal cells against amyloid-beta related toxicity. At present, very little is known of the mechanism of interaction between these two proteins. It is not clear whether inhibition of amyloid-beta aggregation alone can explain the protection conferred by cystatin c, or if the structure of the protein-protein complex is fundamentally less toxic to neurons.

The goal of this study is to demonstrate the connection between the structural changes that occur as cystatin c binds to amyloid-beta and the reduction in cellular toxicity. At the RIKEN, we employ a variety of biophysical characterization tools in order to explore these effects. We monitor protein structural changes by gel electrophoresis and fluorescence studies using a novel oligothiophene-based amyloid stain. We then relate those structural features to changes in amyloid beta toxicity by cellular survival assays.

7. Research implementation and results under the program

Title of your research plan:

Understanding the Neuroprotective Role of Cystatin C in Alzheimer's Disease

Description of the research activities:

In order to investigate the effect of cystatin c binding on the aggregation properties of amyloid-beta, I employ two different techniques. Gel electrophoresis/western blotting is used to examine the size distribution of specific proteins in the system. This information is important in determining the effect of heterogeneous protein interaction on aggregation kinetics. The second technique I use is a dye binding/fluorescence assay to examine the structure of the protein aggregates. In this study, I am using a novel oligothiophene-based dye that was developed by our collaborators, the Peter Nilsson group of Sweden's Linköping University. This type of dye is much more sensitive to early protein aggregates, and offers more structural information than traditional thioflavin dyes.

To correlate the aggregation/structural changes of the interacting protein system to differences in amyloid-beta toxicity, I perform cell survival assays in the presence of these protein mixtures. This assay quantifies the survival rate of neuronal cells by taking advantage of the live cell's ability to catalyze the reduction of a colorful tetrazolium substrate (MTT).

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

This was the experience of a lifetime! This was my first time in Japan and I found the country to be very beautiful, and the people friendly. I was able to travel to many places during my stay here and experience much of the Japanese culture. My host institution and advisors made the project very enjoyable and successful! I hope to return to Japan after I graduate, either for an extended vacation or as a post-doctoral researcher.

9. Advisor's remarks (if any):

We appreciate this opportunity to accept Mr. Perlenfein in our group as a JSPS student. We could obtain good results after his hard working. Importantly, we enjoyed working with him. This JSPS program is a good chance to start collaboration between Japan and USA, and we wish to continue it in the future.

RESEARCH REPORT

1. Name: Brandon Price （ID No.: SP14050）

2. Current affiliation: University of Texas at Arlington

3. Research fields and specialties: Engineering Sciences

4. Host institution: Hokkaido University

5. Host researcher: Dr. Taichiro Okazaki

6. Description of your current research

Despite the advantages of adhesive connections; efficient load transfer, connections without bolts or welds, and ease of construction, to name a few; they have not been incorporated in structural applications due to a lack of knowledge on the behavior, construction, and quality control metrics of these connections. This project will investigate the elimination of expensive on-site welding or bolting techniques in beam-splice connections by utilization of an adhesive. First, five beam-splice connections utilizing adhesives will be tested under three and four point bending to determine the effect of shear-moment interaction on the connection. Second, modeling of the beam-splice connections using a finite element software, ADINA, and calibration using experimental data will be carried out. An analytical study on the properties of the adhesive, the thickness of the adhesive layer, and any assumptions that can be made regarding material properties will be performed. This project will be a collaborative effort with Dr. Taichiro Okazaki, a renowned expert in the area of steel structure beam-to-column connections, structural mechanics, and earthquake engineering at Hokkaido University in Japan.

7. Research implementation and results under the program

Title of your research plan:

Investigation on Steel-to-Steel Adhesive Beam-Splice Connections

Description of the research activities:

First, five beam-splice connections utilizing adhesives were tested under three and four point bending to determine the performance of the specimens under loading. Second, modeling of the beam-splice connection and double-lap shear tests using a finite element software, ADINA, and calibration using experimental data was carried out. An analytical study on the properties of the adhesive, the thickness of the adhesive layer, and any assumptions that can be made regarding material properties was performed. A test was designed and fabricated to determine the tensile properties of the adhesive was designed, fabricated, and will be tested at a later date. This project was a collaborative effort with Dr. Taichiro Okazaki, a renowned expert in the area of steel structure beam-to-column connections, structural mechanics, and earthquake engineering at Hokkaido University in 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: Kathryn E. Ringland
（ID No.: SP14051）

2. Current affiliation: University of California, Irvine

3. Research fields and specialties:
Social Sciences, Engineering Sciences, Interdisciplinary and Frontier Sciences

4. Host institution: Hiroshima University

5. Host researcher: Dr. Norimune Kawai

6. Description of your current research

Children with autism (Autism Spectrum Disorder) often have difficulty communicating. Children with autism vary dramatically in their range and severity of symptoms. Some children with autism are nonverbal, but are able to communicate in other ways such as gesture, sign language, or through pictures. Often nonverbal children use Augmentative and Alternative Communication (AAC) devices to communicate. While there are a great number of AAC devices to choose from in the United States, there is a dearth of options for families in Japan.

While autism is a global phenomenon, it is framed in a cultural context. Treatment of autism varies from culture to culture, with each culture expecting different outcomes for the patient. For instance, some cultures, such as the United States, may expect individuals with autism to live as independently as possible, while others assume the extended family will care for these individuals indefinitely. This is an important consideration when attempting to develop assistive technologies on a global scale. There will be a need for the AAC to be adaptable to the needs of the local users.

Over the course of the summer, I designed and developed a prototype of an AAC device in the form of an iPad application. This prototype will be used in interviews with Japanese families of children with autism to inform future iterations of the application until it is ready to be tested with children with autism in a pilot study and eventually released for use in Japan.

7. Research implementation and results under the program

Title of your research plan:

Design of Augmentative and Alternative Communication Devices for Japanese Children with Autism Spectrum Disorder

Description of the research activities:

Research activities included: weekly meetings with advisor, Dr. Kawai, to discuss the design of the communication application, investigating current communication methods for children with autism in Japan, prototyping a communication tool, developing a high fidelity prototype that runs on an iPad, and interviewing a parent about the prototype for feedback (to help with future iterations of the communication tool). I also traveled to Tokyo University to meet with Drs. Kondo and Iwabuchi. I met with them and students in their lab and learned about their research in assistive technology. The trip was most informative for my design of the application.

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

While staying in Japan, I had many different cultural experiences from eating a variety of cuisine to visiting temples and shrines. I also experienced much of day-to-day life, meeting professors and students on campus and enjoying many experiences such as shopping on the weekends. I also participated in the events in Hiroshima for the Peace Day on August 6th, including watching the lantern ceremony. Without all of these experiences, I would have found designing and developing the iPad application much more difficult.

RESEARCH REPORT

1. Name: Chad Martin RUPRECHT
（ID No.: SP14 052）

2. Current affiliation: Texas Christian University

3. Research fields and specialties:
Social Sciences

4. Host institution: Kanazawa University

5. Host researcher: Prof. Tohru TANIUCHI

6. Description of your current research

Mammals are united in our ability to think, reason, and navigate through space. This research focuses on spatial cognition procedures in two mammal species (rats and humans) to explore similarities and differences in learning and memory. This research was conducted in collaboration with Dr. Tohru Taniuchi, a noted expert in Comparative Psychology at Kanazawa University in Kanazawa, Japan. Some preliminary results gathered were jointly presented at the Society for Animal Psychology in Inuyama-city, Nagoya Prefecture on July 19th through the 21st. I was able to make many potential collaborators here in Japan. A major aim of my summer project was to explore conditional relations by setting up experiments on a two-dimensional video game (humans), a three-dimensional video game (humans), or a three dimensional open-field search task in real space (rats). We believe that by exploring conditional relations during search tasks across species will further elucidate the true psychological mechanism backing our own species extraordinary ability to navigate through space.

This project trained rats and humans that the spatial location of a hidden goal, in relation to the landmark, is entirely conditional on the conditional cue paired with it. Transfer tests, given after substantial training pitted pre-trained conditional cues with landmarks differing from training, to assess the general excitatory, and spatial properties of the conditional cue. One advantage of such an approach is that given there are precisely 8 response locations to choose from, whether it was a human participant or rat subject, the magnitude and spatial accuracy of responses could be analyzed in precisely the same fashion allowing for easy comparison of the types of strategies either species used. The results are discussed within the backdrop of current configural and hierarchical accounts of conditional relations. Our data will be made available via publication in journals targeting memory and spatial cognition. The project intends the help inform findings that can be incorporated into educational research examining why children have particular problems solving problems in geometry and trigonometry: two subfields of mathematics that require both conditional *and* spatial reasoning

7. Research implementation and results under the program:

Title of your research plan:
What Role do Conditional Discriminations Play in Spatial Cognition?

Description of the research activities:

Landmarks can provide the organism two central pieces of information: 1) the *direction* of a desired location (i.e., goal), and 2) the *distance* of a desired location. This summer, we ran all 3 experiments by splitting the participants or subjects into two groups. In Group 1, the conditional cue (a background wall) signaled the *distance* of the goal (1 vs 2 locations away from the landmark), whereas the landmark indicated the *direction* (left vs. right of the landmark). For Group 2, the opposite was true, the conditional cue indicated *direction,* whereas the landmark indicated *distance.* Rats and humans then received trials starting with the presentation of the conditional cue (a colored background, or patterned background; rats are color-blind), followed by the presentation of a landmark in one of eight response locations. Participants and subjects were allowed time to find the hidden goal, either a computer generated treasure chest for humans, or a piece of chocolate cereal for the rats.

The results are still being analyzed. We had two original predictions. Given current theories of landmark utility, we predicted that the members of Group 1 would be able to solve the conditional discriminations 1) faster (measured by the latency or time it takes them to locate the hidden goal on a trial), and 2) more accurately (measured by the number of errors they made prior to selecting the goal location). Every trial, therefore, we tracked the latency and errors of each subject or participant. While there is no statistical confirmation yet, it appears upon empirical observation of the data, that early in training (the first 10 trials or so), our prediction was confirmed, animals and humans hone in on the goal faster if the conditional cue provides *distance* information rather than *direction.* These findings will require more analysis in the coming weeks; however, we were able to successfully collect all the data during my time in Japan. We will continue to communicate further analyze the data.

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

Dr. Taniuchi was an incredible host. Not only was he helpful within the laboratory, he personally tended to my needs in settling into my residence hall, obtaining necessary cooking tools, and answering any and all questions I had. He was kind enough to take me on numerous outings to discover and learn more about Japanese culture, particularly in the Ishikawa prefecture. Just a small portion of these outings included: a) hiking in the nearby mountainsides to locate fireflies, b) visiting a traditional Onsen spa far in a remote village, c) travelling to a traditional festival far up in the Noto peninsula of Japan, and d) exploring the world heritage sire in nearby rural Gifu.

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

RESEARCH REPORT

1. Name: Lindsay Rutter
（ID No.: SP14 053）

2. Current affiliation: Iowa State University

3. Research fields and specialties:
Biological Sciences

4. Host institution: Okinawa Institute of Science and Technology

5. Host researcher: Dr. Nori Satoh

6. Description of your current research

My current research is in the area of statistical graphics and software development. I am developing a package for R, a statistical computing and graphics environment, that will be submitted to the Comprehensive R Archive Network (CRAN). The package allows biologists and bioinformatics to examine and analyze phylogenetic relationships with new visual tools.

7. Research implementation and results under the program:

Title of your research plan:
RNA-Sequencing Analysis of *Acropora digitifera* across six life cycle stages

Description of the research activities:

For the first half of the summer, I contributed to the development and expansion of the MarinegenomicsDB[1,] an integrated genome browser for the Marine Genomics Unit at the Okinawa Institute of Science and Technology (OIST). The browser will be used to promote open-access to data, and a user-friendly environment for community-based manual genome annotation of marine species, all of which could potentially assist the lab in annotating the massive genomic data that it obtains through sequencing projects, as well as the field of marine genomics in general.

In 2011, the Marine Genomics Unit at OIST successfully decoded the 420-megabase genome of this coral, one of the most sensitive of corals to environmental changes[2]. Their success in deciphering the *A. digitifera* genome has already led to innovative findings with implications about how the coral symbiosis with algae responds to environmental threats[2].

For the second half of the summer, I performed RNA-sequencing analysis across six life cycle stages (egg, prawnchip, donut, planula, polyp, and adult) of the lab's *A. digitifera* genome. Count data was estimated from the high-throughput data, and differential expression was calculated based on a model using the negative binomial

distribution with the R Bioconductor package DESeq[3].

Broadly, the adult stage showed drastically larger gene expression than any other life cycle stage. This pattern of gene expression across developmental stages appears to potentially be consistent with the "maternal to zygotic transition" phenomenon observed in other metazoans, with higher gene expression occurring once zygotic genes are activated when maternal transcripts are removed[4,5,6,7.]

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2. Shinzato C., Shoguchi E., Kawashima T., Hamada,M., Hisata K., Tanaka M., Fujie M., Fujiwara M., Koyanagi R., Ikuta T., Fujiyama A., Miller D.J., Satoh N. (2011). Using the Acropora digitifera genome to understand coral responses to environmental change. *Nature*, 476(7360), 320-323.

3. Anders S. and Huber W (2010). Differential expression analysis for sequence count data. *Genome Biol*, 11(10), R106.

4. Ferg M., Sanges R., Gehrig J., Kiss J., Bauer M., Lovas A., Szabo M., Yang L., Straehle U., Pankratz M.J., et al. (2007). The TATA-binding protein regulates maternal mRNA degradation and differential zygotic transcription in zebrafish. *bo J*, 26(17), 3945–56.

5. Mathavan S., Lee S.G., Mak A., Miller L.D., Murthy K.R., Govindarajan K.R., Tong Y., Wu,Y.L., Lam S.H., Yang H., et al. (2005). Transcriptome analysis of zebrafish embryogenesis using microarrays. 1(2), 260–76.

6. Alizadeh Z., Kageyama S., and Aoki F. (2005). Degradation of maternal mRNA in mouse embryos: selective degradation of specific mRNAs after fertilization. *Mol Reprod Dev,* 2(3) 281–90.

7. Schier A.F. The maternal-zygotic transition: death and birth of RNAs (2007) *Science*, 316(5823):406-7.

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

It was a very unique experience to study in such a special place as Okinawa. I had lived in Tokyo as a child and teenager, and had studied/ interned in other parts of Japan as an adult, but the cultural, historical, and lingual differences in Okinawa were all very new to me. I was able to see much of Okinawa with language partners and excursions through the Okinawa Institute of Science and Technology (OIST). I was also able to use my Japanese in day-to-day life, and participated in a science fiction writing class in Japanese at OIST. The campus was very international, which was also very rare, and I was able to better learn about how some foreigners navigate a career in science in Japan.

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

RESEARCH REPORT

1. Name: Joel Matthew Sarapas （ID No.: SP14 054 ）

2. Current affiliation: University of Massachusetts Amherst

3. Research fields and specialties:

Chemistry

4. Host institution: Kyoto University

5. Host researcher: Mikihito Takenaka

6. Description of your current research

Commodity plastics, from grocery bags to touch screens, are ubiquitous in modern lifestyle and critical to the global economy. Among these, materials made from block copolymers have become increasingly widespread, including extensive use in 3D printing and shock resistant applications. Current commercial block copolymers are typically molecular chains with two or three chemically distinct segments, or “blocks.” Expanding the number of blocks past three can often enhance their already interesting properties, making even more valuable materials known as multiblock copolymers (MBCs). Understanding the properties and phase behavior of MBCs is currently limited by their difficult synthesis. A series of MBCs containing polystyrene (PS) and polyethylene oxide (PEO) using thiol-ene radical coupling was recently synthesized in the Tew labs at the University of Massachusetts. In Massachusetts, the length, thermal properties, and crude domain sizes were analyzed. The nine MBCs were brought to Kyoto University, where, under the direction of Mikihito Takenaka, they were analyzed by more powerful small and wide angle x-ray scattering techniques (SAXS and WAXS), as well as sectioned and imaged by transmission electron microscopy (TEM). The PS-PEO system has been examined numerous times in the past for potential applications in lithium ion conduction, wherein the PS component provides mechanical stability and the PEO component provides ion conductivity. Such systems can be limited by the continuity of the two phases. If the PS phase is not continuous throughout the membrane, the mechanical integrity will suffer. Similarly, if the PEO phase has inhomogeneity, ion conduction will drop significantly. MBCs provide a possible solution to the problem of challenging bicontinuous domain formation, as the composition window for bicontinuous morphologies seems to be larger for these materials.

7. Research implementation and results under the program

Title of your research plan:

Understanding Phase Separation in Multiblock Copolymers

Description of the research activities:

The MBC samples were received in Kyoto. The samples were all thermally annealed, and cooled to allow for an equilibrium morphology to form. From there, all nine samples were analyzed by SAXS and WAXS. Samples containing higher molecular weight PEO, or simply more PEO than PS, were found not only to be crystalline by WAXS but also phase separated by SAXS. Some samples even displayed higher order scattering peaks. The samples that demonstrated phase separation by SAXS were then analyzed by TEM. The samples, due to the low glass transition temperature of PEG, were sectioned into 70 nm films at -70 ºC by a Leica Ultramicrotome. The samples were stained with RuO_4 in order to enhance contrast between PEO and PS domains, and then imaged by TEM. Samples that displayed phase separation by SAXS also displayed interesting morphologies by TEM, that looked somewhat lamellar, but in some look more bicontinuous. Samples with very low molecular weight components were double stained with both RuO_4 and OsO_4 to obtain appropriate images. The data from this program is promising, and demonstrates that interesting, potentially useful morphologies can be obtained by tailoring MBC components.

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

I learned a great deal during my time in Japan, both about the project I set out today and about culture in and out of the lab. I am very impressed by how this country is able to weave extremely old culture seamlessly with modern technology, and even exist at the forefront of many scientific pursuits.

9. Advisor's remarks (if any): Although two months is very short, Mr. Sarapas mastered various kinds of experimental techniques including transmission electron microscopy, small-angle X-ray scattering, and wide-angle X-ray scattering completely and obtained good results with the techniques. His stay in our laboratory is also very fruitful for our laboratory members. Our students learned much from him. I would like to express my thanks to JSPS and NSF for joining the summer program.

RESEARCH REPORT

1. Name: Alexander SCHLEGEL （ID No.: SP14055 ）

2. Current affiliation: Dartmouth College

3. Research fields and specialties:
Biological Sciences

4. Host institution: Kyoto University, Primate Research Institute

5. Host researcher: Prof. Tetsuro MATSUZAWA

6. Description of your current research

Please note that my host researcher and I changed my original project to address a related question, as follows:

Humans have the ability to flexibly manipulate mental representations such as images, symbols, and concepts. This ability may have allowed our early ancestors to construct new and complex social groups and tools, and today it remains vital to a range of human endeavors including science, art, and mathematics. Is this ability unique to humans? If so, evolutionary changes to the human brain that enabled the mental manipulation of visual imagery may underlie many of the abilities that define our species. In collaboration with Drs. Tetsuro Matsuzawa and Ikuma Adachi at the Kyoto University Primate Research Institute (KUPRI) in Inuyama, Japan, the current project tests whether chimpanzees can mentally manipulate visual imagery.

A classic method to study mental manipulation in humans is the mental rotation paradigm developed by Shepard and Metzler (1971). In this paradigm, two similar visual stimuli at different angles of rotation are presented to a participant. The participant must then decide whether the two stimuli are images of the same object or one stimulus is a mirror image of the other. Shepard and Metzler found that participants' reaction times scaled with the angle of rotation needed to bring the two stimuli into alignment. This finding provided evidence that participants had mentally rotated an internal model in much the same way as one would rotate a physical object.

The current experiment will use a variation of the Shepard and Metzler task to study mental rotation in seven chimpanzees housed at KUPRI. In each trial of this experiment, the subject will view on a computer monitor an abstract visual stimulus surrounded by a frame. The subject will rotate the frame 90° clockwise or counterclockwise via a button press and will then have to match the rotated stimulus to one of two test stimuli. One test stimulus is the correct stimulus after undergoing the rotation, and the other test stimulus is the mirror image of the correct stimulus after undergoing the rotation. In control trials, the subject will be able to see the stimulus as it undergoes the rotation. In test trials, the stimulus will disappear as soon as the rotation begins. We will test whether subjects can choose the correct test stimulus above chance levels on test trials.

7. Research implementation and results under the program

Title of your research plan:

Original: Investigating inferential use of metaphors in chimpanzees
New: Investigating mental rotation in chimpanzees

Description of the research activities:

We are currently training seven chimpanzees (6 female, ages 14-37). In the first training stage, subjects perform a match-to-sample task as follows: First, a self-start button appears on the screen. Once the subject touches this button, it disappears and the target stimulus appears. Once the subject touches the target stimulus, two test stimuli appear. One is identical to the target stimulus, and the other is a different stimulus. If the subject touches the matching target, a chirping sound plays and the subject receives a piece of fruit from an automatic feeder as a reward. If the subject touches the non-matching target, a buzzer sounds and the subject receives no reward.

Once subjects reach a criterion of 80% of trials correct on the first training stage, the second stage begins in which the test stimuli are the correct stimulus and its mirror image. This task is difficult for the subjects, and none have yet reached criterion. Once a subject reaches criterion in the second stage, testing will begin.

Each chimpanzee completes a half-hour training block each weekday. During each block subjects complete between 150 and 200 trials, depending on their speed and motivation. The chimpanzees are voluntary participants at KUPRI, and on some days choose not to participate in the experiment.

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

I am grateful to the JSPS and my host researchers for this incredible opportunity. I have learned a great deal about research with non-human primates and Japanese language and culture. The summer program has also helped me establish research connections that I would not have been able to otherwise.

Cultural highlights of my stay were watching a day-long sumo tournament in Nagoya, exploring Himeji Castle's gardens, and hiking among forests and temples in Kyoto.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Leona R. Sirkisoon

（ID No.: SP14056）

2. Current affiliation: Wake Forest University

3. Research fields and specialties:

Chemistry

4. Host institution: Saitama University

5. Host researcher: Dr. Shingo Saito

6. Description of your current research

The goal of my research at Wake Forest University is to show that new nanomaterials known as graphene quantum dots (GQDs), like their inorganic quantum dot counterparts, are applicable as molecular sensors and separation mediators for biological materials without high cost and toxicity like other organic functionalized molecules. In previous studies, the high resolution charge-based separation technique known as capillary electrophoresis (CE) was employed to characterize the GQDs. GQDs prepared in-house, obtained by different synthetic approaches using various organic precursors were subjected to CE, to determine uniformity in size and charge. Differences in size and charge of the GQDs usually limit their utility as sensing agents due to their non-uniform interaction with analytes. Preliminary CE experiments with the GQDs from citric acid, indicated that these new nanomaterials were uniform in size and charge, and can be manipulated in electrophoresis-based methods.

Selective and sensitive detection of proteins involved in a variety of human health issues is of importance. Still, it is very difficult to separate holo (metal-bound) from apo (metal-nonbound) forms of metalloproteins, while it is well known that they play important roles in biological systems. The usefulness of the in-house GQDs as biosensing probes for metalloproteins would be evaluated at Saitama University, under Dr. Saito's supervision. The fluorescent and electromigration properties of the GQDs would be compared to those of other nanomaterials such as gold nanoparticles (Au-NPs), plasmonic gold GQDs (Au-GQDs), and commercially available GQDs. Spectrofluorometry and CE techniques will be used for two types of model metalloproteins, apo and holo transferrin (Tf) and calmodulin (CaM) for Fe^{3+}- and Ca^{2+}-bound proteins, respectively. The goals of this research are to obtain deeper insight for the interaction between GQDs and metalloproteins, and to open doors for nanomaterials as biosensing and separation probes.

7. Research implementation and results under the program

Title of your research plan:

Evaluation of New Nanomaterials as Sensing Agents Using a Charge-Based Separation Technique

Description of the research activities:

Research activities involved spectrofluorometry to investigate emission enhancement of various nanomaterials in the presence of proteins through interaction of each nanomaterial with both apo/holo Tf and CaM. In addition, CE-UV/Vis studies were conducted using the nanomaterials as auxiliary agents in the running buffer (50 mM–222 mM Tris–Tricine buffer pH 7.4) to enhance the resolution of the apo and holo proteins. Electropherograms for apo and holo Tf in the absence of nanomaterials is shown in Figure 1a and 1b, respectively. Figure 1c is a typical electropherogram of a mixture of apo and holo Tf with the addition of 1% in-house GQDs to the running buffer, resulting in three distinct peaks. The first peak corresponds to holo Tf, the middle is likely to be a mixture of the two different isoforms of Tf with one iron ion bound (with C-lobe and N-lobe), and the last one is apo Tf. This high resolution among the slightly different conformations of Tf was probably based on different degrees of complexation with the GQDs. No separation was observed when Au-NPs were added to the mixture of apo and holo proteins and the running buffer (Figure 1d). Separation enhancement was not observed for apo and holo CaM with GQDs nor with Au-NPs. Subsequent studies will involve the evaluation of the sensing capabilities of commercial GQDs and Au-GQDs for apo/holo Tf and CaM using CE to investigate holistic understanding of interaction between nanomaterials and proteins conformers.

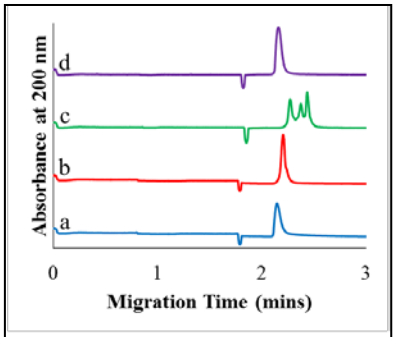


Figure 1. Electropherograms of apo (**a**) and holo (**b**) Tf in run buffer alone. A mixture of apo and holo Tf with 1% GQDs (**c**) and with 1% Au-NPs (**d**).

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

I enjoyed my stay and had a rich learning experience in Japan. My host family told me about their religion and took me to the shrines and temples. I felt privileged to wear a kimono and learn about the koto. At Saitama University, it was a pleasure to work with my lab mates. I learned about Japanese culture and participated in many group activities. I toured several cities and visited places of interest with other JSPS fellows. Dr. Saito and his family treated me to traditional Japanese food. I enjoyed Japanese cuisine and great hospitality everywhere. Overall, it was an exciting summer filled with new experiences, friendships and possible future collaborations, as well as a phenomenal research experience abroad, which increased my ability to work in culturally diverse environments.

9. Advisor's remarks (if any):

Ms. Leona Sirkisoon has successfully found a new separation mode of metalloproteins induced by graphene quantum dots during her short stay in Japan. In addition, she succeeded to build a good relationship with laboratory members with her good cooperativeness. She hopes to keep contact with me and laboratory members in terms of research collaboration as well as friendship. I believe this program is useful for Japan-U.S. cooperation.

RESEARCH REPORT

1. Name: **Sean-Ryan Smith**
（ID No.: **SP14057**）

2. Current affiliation: **University of California Santa Cruz**

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: **IBM Research – Tokyo**

5. Host researcher: **Dr. Chieko Asakawa**

6. Description of your current research

Navigating indoor spaces poses a significant challenge for visually impaired individuals. Indistinguishable landmarks, in tandem with limited external sensory information further add to the navigational complexity of indoor locations. Strategic placement of lightweight, inexpensive Bluetooth Low Energy (LE) beacons (iBeacons) offers a feasible solution to indoor localization and navigation. My research aims to propose a novel implementation of an iBeacon based navigations system for indoor spaces.

7. Research implementation and results under the program

Title of your research plan:

iBeacon based Indoor Navigation for People with Visual Impairments

Description of the research activities:

Participated in weekly meetings with managers to discuss project progress and brainstorm development and testing plans. Met with advisors every day to discuss research progress and receive guidance in execution. Conducted literary review of relevant research papers. Coded application for blind user indoor navigation.

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: Liam Solus

（ID No.: SP14058 ）

2. Current affiliation:

University of Kentucky, Department of Mathematics

3. Research fields and specialties:

Humanities Social Sciences X 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 Pure and Applied Mathematics, Graduate School of Information Science and Technology, Osaka University.

5. Host researcher: Dr. Takayuki HIBI

6. Description of your current research:

High dimensional polygons, commonly called polytopes, are geometric objects arising from finite sets. For certain types of polytopes we can produce a polynomial, called the h*-polynomial, that encodes interesting information about the polytope, such as its volume. One interesting property of the h*-polynomial, called unimodality, is when its coefficients rise and then fall when read from left-to-right. The hypersimplices are a collection of polytopes that are important in algebra, integer programming, and other areas of mathematics. The goal of the PI's current research is to show that the h*-polynomials of the hyperpsimplices are unimodal.

While at Osaka University, the PI and Host Researcher have investigated a new geometric approach to showing the h*-polynomials of the hypersimplices are unimodal. Recently, the PI has identified a collection of subpolytopes, one nested inside the next, that live within each hypersimplex. These subpolytopes share a nice geometric connection with the hypersimplex. In particular, there exists a regular unimodular triangulation of the hypersimplex that restricts to a regular unimodular triangulation of each of these nested subpolytopes. Such a triangulation of a polytope can be used to compute the h*-polynomial. Hence, the PI's current research goal is to study the unimodality property for the h*-polynomials of these nested subpolytopes, and in doing so, extract a result on unimodality of the h*-polynomials of the hypersimplices.

In particular, we would like to identify at least one of these subpolytopes in each hypersimplex that has a unimodal h*-polynomial, and then using the geometric connection between these polytopes show that the next largest subpolytope also has a unimodal h*-polynomial. In this way, we work up to showing that the h*-polynomial of the hypersimplex is unimodal. A nontrivial key-step in this process is to identify at least one subpolytope within each hypersimplex that has a unimodal h*-polynomial.

7. Research implementation and results under the program

Title of your research plan:

Unimodality of the h*-polynomial of the r-stable n,k-hypersimplex.

Description of the research activities: We call these subpolytopes nested within the hypersimplex the r-stable hypersimplices. The hypersimplex is the special case when r=1. A polynomial of degree d in the variable x is called symmetric whenever the coefficients of x_i and x_{d-i} are equal for every i=0,1,...,d. If an r-stable hypersimplex has a symmetric h*-polynomial then, since it has a regular unimodular triangulation, it is also unimodal. Hence, this Summer we identified the collection of r-stable hypersimplices with symmetric h*-polynomials. These polytopes are called the Gorenstein r-stable hypersimplices. To do this, we computed the equations of the "facets" (the highest dimensional (nontrivial) faces) of the r-stable hypersimplices. Using these equations and a well-known technique developed by the Host Researcher we determined the Gorenstein r-stable hypersimplices. The Gorenstein property is quite rare amongst the r-stable hypersimplices. In particular, not every hypersimplex contains a Gorenstein r-stable hypersimplex. Hence, ongoing work includes identifying r-stable hypersimplices with unimodal h*-polynomials within hypersimplices not containing a Gorenstein r-stable hypersimplex. As well, we would like to show that the h*-polynomials of the r-stable hypersimplices containing the Gorenstein r-stable hypersimplices also have unimodal h*-polynomials.

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

While in Japan, my host researcher provided many excellent opportunities for me to gives talks on my research. This was very helpful for me as a young graduate student. I also enjoyed experiencing Japanese culture first hand. I have made many new friends here, and I hope to come back to Japan very soon!

9. Advisor's remarks (if any):

This program is very useful for foreign graduate students. Apart from the effectivity of scientific discussions with their host researchers, their talking with graduate students in Japan encourages the international exchange of young researchers in the near future.

RESEARCH REPORT

1. Name: Kimberly A. STEVENS
（ID No.: SP14059）

2. Current affiliation: Brigham Young University

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Ritsumeikan University

5. Host researcher: Prof. Isao TOKUDA

6. Description of your current research

Many people in the world are affected by voice disorders. Effective clinical treatment of voice disorders is limited by knowledge of the physics that affect voice production, as well as the ability to properly diagnose some voice disorders. Laryngoscopy, the use of a specially designed endoscope to examine the vocal folds, is an important technique for vocal fold visualization in both clinical and research settings. One limitation is that the technique is limited to providing information regarding movement in two dimensions. However, the motion of the vocal folds has been shown to be three-dimensional, and diagnosis of certain voice disorders are difficult without information regarding the third dimension. The host researcher, Dr. Isao Tokuda, and his associates, have developed a method for reconstructing three-dimensional vocal fold motion using a laryngoscope with two cameras. However, the technique has not yet been extensively validated. This project will use synthetic vocal fold models, recently used in voice biomechanics research, to validate the stereo-endoscopy system using multiple cameras and computer vision techniques. The validation of the stereo-endoscopy system will allow its use in clinical settings as well as for quantitative analysis of vocal fold motion, leading to improved understanding of the dynamics involved in phonation.

7. Research implementation and results under the program

Title of your research plan: Validation of three-dimensional endoscopy system with synthetic vocal fold models

Description of the research activities:

A setup was created and procedure adapted to the materials available in Japan for making synthetic vocal fold models. An experimental setup to record the motion of the models in three dimensions was created. The models were vibrated, and the motion was recorded with a variety of settings with both the high-speed stereo-endoscopy system and two methods of validation: two SLR cameras positioned in stereo and a laser measurement system. The surface of the vocal fold model was reconstructed in three-dimensions using both the stereo-endoscopy system and the SLR cameras, and the results were compared. The laser measurement system served to validate the results obtained. The systems compared favorably, validating the use of the stereo-endoscopy system, which was a necessary step in its development for widespread clinical use. Preliminary results indicate that the accuracy of measurements in the plane of the camera was very good, while accuracy in the direction orthogonal to the imaging plane was less accurate.

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

During the duration of the JSPS Summer Program, the fellow had the opportunity to explore some of the rich cultural heritage of Japan. This included visiting several temples and shrines, climbing Fujisan, visiting historical and cultural sites in Hiroshima, exploring Shiga and the area around Lake Biwa, and experiencing many types of delicious Japanese cuisine. The fellow also highly valued the opportunity to interact with and form relationships with many researchers in Japan, from faculty members and graduate students to undergraduates. The opportunity to explore Japan and build relationships with Japanese researchers was extremely valuable personally and professionally will motivate the creation of future opportunities to collaborate with researchers from Japan.

9. Advisor’s remarks (if any):

Collaboration with the fellow, Ms. Kimberly Stevens, has been extremely fruitful to me. Her model of the synthetic vocal folds was not only useful for validating our stereo-endoscopic measurement technique but it also led us to further common projects on evaluating the synthetic models from the view point of the inferior-superior dynamics. She has been quite generous and open for discussions and exchanging ideas. Her existence has been a strong stimulus for many students at my lab. I wish we continue our collaboration on a long-term basis.

RESEARCH REPORT

1. Name: Melissa Stiksma
（ID No.: SP14060）

2. Current affiliation: Florida Atlantic University

3. Research fields and specialties:
Social Sciences

4. Host institution: University of Tsukuba

5. Host researcher: Prof. Shintaro YUKAWA

6. Description of your current research

My current research investigates the relationships between mindfulness, personality traits, and levels of depression and anxiety in Japanese and American college students. Subsidiary variables also included religiosity, natural disaster experience, and affect. Mindfulness can be described as having a focused awareness and acceptance of the present moment. This recent buzzword in psychological research originates from Buddhist philosophies but is gaining notoriety in Western clinical interventions, such as mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapy (MBCT), for treating anxiety and depression in clinical populations. Interestingly, levels of mindfulness significantly correlate with different personality profiles based on the Big Five traits, which have well-established relationships with levels of anxiety and depression, particularly neuroticism, conscientiousness and extraversion. One goal of the current research was to combine previously found associations between mindfulness, personality, and clinical symptoms in one study in order to compare correlations and mediations between all three variables. A second goal, and the reason for studying in Japan, was to compare the results from American college students to those of Japanese college students. Data was collected from approximately 200 undergraduate students at Florida Atlantic University from February to April 2014. I oversaw data collection in Japan at the University of Tsukuba from July to August 2014. Approximately 70 students' data has been collected thus far and is enough to generate preliminary analyses, however, my collaborators will continue the data collection process until a more comparative number has been reached. American results analyzed confirm initial hypotheses that levels of mindfulness mediate the relationship between certain personality traits and levels of anxiety. This supports the notion that mindfulness should be included in treatment or at least considered a valuable part of assessment. Statistical analyses are far from complete but preliminary analyses are promising for differing levels between American and Japanese samples.

7. Research implementation and results under the program

Title of your research plan:

"An examination of relationships between mindfulness, personality, anxiety, and depression in American and Japanese populations"

Description of the research activities:

Initially, my research activities included working closely with my primary collaborator, graduate student Masato Kanai, to perfect the Japanese versions and translations of the measures of the proposed variables. While many of the measures were already well-validated, other measures required ensuring proper item content, meaning, and order utilizing translation and back-translation. Once the online questionnaire (utilizing Qualtrics software) was piloted successfully on Japanese graduate students we began advertising our study to several Japanese undergraduate classes. I oversaw the daily recruitment and data collection process; Japanese research assistants informed participants of all necessary information, risks, benefits (¥500 book coupon) and I ensured proper data collection online and answered any questions. If some participants showed interest in the study I would engage a brief discussion about what mindfulness meant to them and how they saw it fit with Buddhism in Japan. I also used this time for statistical analyses and conducting further literature searches for drafts of my master's thesis that will ultimately be incorporated in publications.

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

If there's anything I have learned about the Japanese it's that they work hard but they play harder. I have had an absolutely indescribable and enriching experience with exploring the Japanese culture. From starting with the amazing homestay experience to traveling to temples and shrines throughout Nara and Kyoto, experiencing the modern marvels in Shibuya and Akihabara of Tokyo; it's been a surreal experience. Climbing both Tsukubasan with my Japanese lab mates and Fujisan with my American ones, every conversation has left me a more educated and cultured individual.

9. Advisor's remarks (if any):

Ms. Melissa Stiksma has been conducting her research project, collaborating with the graduates of my lab in a thorough and enthusiastic manner, even though the period of this program is short. Also, because of her active and positive personality, she has had a lot of experiences besides research activities, which absolutely have significant influences on her career as a psychologist, for example, experiences of various things in Japanese culture and communicating with Japanese psychology graduates and researchers.

RESEARCH REPORT

1. Name: Sean D. TALLMAN
（ID No.: SP14061）

2. Current affiliation: University of Tennessee, Knoxville, TN, USA

3. Research fields and specialties: Biological Sciences

4. Host institution: Chiba University, Department of Bioenvironmental Medicine

5. Host researcher: Dr. Yoshiharu MATSUNO

6. Description of your current research

The efficacy of the biological profile (sex, age, ancestry, and stature of skeletonized remains) depends on the development, validation, and refinement of population-specific methods. However, most biological profile methods were developed in North America on individuals of African and European descent, and it is unclear whether such methods can generate accurate biological profiles for Asian individuals. Moreover, Native Americans historically served as biological proxies for Asians due to their shared genetic history, resulting in the assumption that Native Americans and Asians share nonmetric skeletal features (traits), including a less sexually dimorphic skeleton compared to non-Asian groups and a unique suite of cranial traits. As such, Native American and Asian populations have been viewed as skeletally homogeneous, despite significant differences in population histories. The continued reliance on methods developed from non-Asian populations is especially problematic in forensic contexts where Asian remains are likely to be recovered (i.e., large U.S. cities and international humanitarian settings). The current study will statistically test and refine methods used to visually assess nonmetric sex from cranial and postcranial remains, and establish nonmetric cranial trait frequencies that can be used for ancestry estimation for modern adults from documented anatomical collections in Japan. The proposed research will contribute to bioarchaeological studies and forensic anthropology through the development of more quantifiable and replicable methods necessary to increase the accuracy of biological profiles for an understudied population representing East Asia.

The first objective of this study is to determine how the cranial and postcranial nonmetric sex assessment methods developed on individuals of African and European descent perform when applied to Japanese individuals. As such, a total of 15 sexually dimorphic traits will be ordinally scored on the cranium, mandible, clavicles, humeri, and the pelvis following Buikstra and Ubelaker (1994), Rogers *et al.* (2000), and Vance *et al.* (2011).

The second objective of this study is to establish cranial trait frequencies for Japanese individuals so that they can be compared to published data on Native Americans, and Thai individuals in an expanded study. As such, thirty-three cranial and mandibular traits will be ordinally scored following Hefner (2009), Rhine (1990), Berg (2008), and Parr (2006).

7. Research implementation and results under the program

Title of your research plan: Improving the Identification of Japanese Individuals in Forensic Contexts

Description of the research activities: In order to test and refine the cranial and postcranial sex assessment methods and establish cranial trait frequencies for Japanese individuals, nonmetric data collection occurred at Chiba University, the primary host institution, and Jikei University's School of Medicine. In total, the skeletal remains of 446 individuals who lived during the late 19th to early 20th century were analyzed (n=210, Chiba University; n=236, Jikei University). Twenty individuals from the Chiba University skeletal collection were re-analyzed in order to explore the effect of intraobserver error in the scoring of nonmetric traits. Additionally, the intact skulls in the Chiba University skeletal collection were digitally photographed in eight views in order to document the diagnostic cranial trait expressions. Subsequent to data collection, univariate and multivariate statistical analyses will determine which sexually dimorphic traits best predict sex, and which cranial traits represent Japanese individuals. The results will be compared to other Asian and non-Asian populations for a dissertation in the Department of Anthropology at the University of Tennessee, Knoxville.

Additionally, the PI measured the anterior-posterior and medial-lateral subtrochanteric dimensions of 327 left femora (n=208, Chiba University; n=119, Jikei University) in order to determine if proximal femur shape and size can be useful in distinguishing Japanese individuals from other populations. Forty femora were re-measured by the PI and a colleague to determine the effects of intra-and inter-observer error.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): My research experience was greatly enhanced by my colleagues at Chiba University who exposed me to numerous cultural experiences, including summer festivals, Japanese food and music, museums, and the sights of Tokyo. In particular, Dr. Matsuno introduced me to prominent anthropologists at St. Marianna University, who curate and conduct research on an impressive archaeological skeletal collection with individuals from the Kamakura era. This productive meeting will likely facilitate future collaborations and research into the skeletal biology of past Japanese populations.

9. Advisor's remarks (if any): Mr. Sean has studied in a positive attitude from the morning to late in the evening every day. In addition, he presented on his research to Chiba University staff, and explained the importance of anthropological research. I hope that his work here will lead to the doctoral degree.

RESEARCH REPORT

1. Name: Steven Tompson （ID No.: SP14062 ）

2. Current affiliation: University of Michigan, Department of Psychology

3. Research fields and specialties:
Social Sciences

4. Host institution: Kyoto University—Kokoro Research Center

5. Host researcher: Dr. Yukiko Uchida

6. Description of your current research

People are constantly bombarded with choices in their everyday lives. Often these choices are made, not in a vacuum, but rather in a complex social environment. In this project am examining how people make effective choices and how they incorporate others' thoughts and feelings into their decision-making process. This project directly compares choice strategies of people from the United States (an individualistic culture that values expressing one's personal preferences) and people from Japan (a collectivistic cultures that values being sensitive to others' thoughts and opinions), and is being conducted in collaboration with Dr. Yukiko Uchida at Kyoto University, a noted expert in the field of Cultural Psychology. Both psychological and economic theories of choice have focused on the role of personal preferences in choice, and therefore this research expands upon this literature by investigating the role of others' preferences in the choice process. By understanding the dynamic interplay between personal information (e.g., personal preferences), objective information (e.g., product specifications), and social information (e.g., others' preferences), this research can help people make better choices which lead to better long-term physical health, mental health, and life satisfaction. These goals are being tested in two studies using both self-report questionnaires as well as behavioral measures.

7. Research implementation and results under the program

Title of your research plan: Understanding how people incorporate others' preferences into personal choices

Description of the research activities:

I conducted two studies as part of the JSPS Summer Program. The first study consisted of an open-ended survey that was administered to 98 undergraduates at Kyoto University, and in the second study, 33 Kyoto University students participated in a behavioral experiment. For both studies I collaborated with Dr. Uchida and another student to develop new surveys and experimental procedures for studying choice in a cross-cultural context. Across the two studies we found that Japanese college students were more likely to rely on others' preferences when making a choice if they lacked confidence in their ability to make the correct choice or if they considered others to be knowledgeable about the choice. Additionally, in Study 2 Japanese students were more likely to consider others' preferences important factors in making a consumer choice and spent more time evaluating information about others' opinions if they viewed the self as being interconnected with others (versus independent and distinct from others).

Following the conclusion of the JSPS program, I will continue to analyze the data collected at Kyoto University using both qualitative as well as quantitative methods. This Fall I will also collect data from University of Michigan students to enable a direct cross-cultural comparison with the data collected at Kyoto University. I hope to continue working with Dr. Uchida on future studies expanding upon the current project to examine different types of choices as well as look at the implications for social choices on happiness and subjective wellbeing.

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

During my stay in Japan I learned a great deal about Japanese cultural traditions, which has expanded my insight into how people from collectivistic cultures think and behave, and perhaps most importantly, how these psychological tendencies are developed and maintained over time. I enjoyed experiencing the Japanese tea ceremony, multiple Japanese summer festivals, visiting temples and shrines, and experiencing Japanese daily life.

9. Advisor's remarks (if any):

Mr.Tompson achieved great progress in collaboration research. He learned a great deal about the critical components of cross-cultural studies (i.e., translation, setting up experiments in Japan) and completed data collection for two studies, even within his short stay. He interacted with other members of the lab and learned a lot about Japanese culture. The Japanese graduate students also learned a lot from him (He helped them both in English and academic discussion).

RESEARCH REPORT

1. Name: Anderson Daniel Trimm
（ID No.: SP14063 ）

2. Current affiliation: The University of Texas at Austin

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Prof. Yuji Tachikawa

6. Description of your current research

I study a class of four-dimensional gauge theories with N=2 supersymmetry, which arise as compactifications of string/M-theory. These theories enjoy various dualities, which allows one to solve their strongly-coupled dynamics.

7. Research implementation and results under the program: Papers to be submitted for

publication.

Title of your research plan:

On the Superconformal Index of Class S Theories

Description of the research activities:

1. Characterized the TQFT which computes the superconformal index of class S theories in the presence of outer-automorphism twists. Performed many tests confirming this result. Using this result, have checked many aspects about the construction of these theories.
2. Continued classification program of these theories.

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: Daniel Winkler （ID No.: SP14064 ）

2. Current affiliation: University of California, Irvine

3. Research fields and specialties:

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

4. Host institution: Hokkaido University

5. Host researcher: Dr. Gaku Kudo

6. Description of your current research

Understanding what allows for invasive species success is a current challenge in ecology. This is especially true in alpine regions, where ecosystems may be highly vulnerable to the effects of climate change and moisture largely determines species distributions. Similar ecological drivers function in deserts of the American Southwest which are predicted to experience decreases in overall precipitation. Plant communities in these areas are already changing as a result of non-native species invasions. My research examines how future precipitation regimes may enhance changes in community structure. However, this project will shift focus from desert systems to an alpine system in Daisetsuzan National Park, Hokkaido, Japan. This research will be fostered in collaboration with Dr. Gaku Kudo, a noted alpine ecologist at Hokkaido University, and will elucidate resource allocation strategies of the invasive bamboo Sasa kurilensis. Results from this research will provide an empirical understanding of species invasions in alpine ecosystems and connect this understanding to how environmental changes may facilitate or prevent future invasions. Understanding changes these regions will undergo is vital to helping government agencies protect lands. Furthermore, linking resource allocation strategies and their responses to environmental variation can assist in producing a mechanistically-based predictive framework for scientists.

7. Research implementation and results under the program

Title of your research plan:

Responses to climate change: Resource allocation trade-offs of *Sasa kurilensis*, an alpine invasive in Daisetsuzan National Park, Japan

Description of the research activities:

The proposed research aims to understand how future climate change will promote or deter the expansion of an invasive species. I will employ a comparative approach of resource allocation patterns in historical and recently expanded ranges. Elevation and moisture gradients within ranges will allow me to understand how morphological and physiological plasticity will affect the species' distribution. The result is an integrative model of species invasion in a changing climate.

Sixty 0.25 × 0.25 m experimental plots were be established along an elevation and moisture gradient on the southeast-facing slopes of Mount Goshiki in DNP. The elevation gradient will extend from approximately 1200 m to 1900 m. Plot locations were randomly selected and stratified by slope, aspect, and plant density. Measurements of near-surface temperature and humidity were be recorded at one location in the subalpine forest, treeline, and alpine using iButton dataloggers (Maxim Integrated Products, San Jose, CA). Soil moisture data was collected once per week at all plot locations using a HydroSense II probe (Campbell Scientific, Logan, UT, USA).

Aboveground biomass was measured by clipping all *S. kurilensis* aboveground biomass in each plot. Tissues were separated into live and dead fractions of culms and leaves. Belowground biomass was estimated by sieving plant tissue from three soil cores per plot. Collected belowground tissues was separated into live and dead fractions of spreading (leptomorphic) rhizomes, fine root matter, and basal (pachymorphic) rhizomes (McClure 1966). All samples were dried at 60 °C to obtain dry weight measurements. Ratios of biomass components were correlated with environmental and topographic variables in order to understand the relationship between resource allocation strategies and environmental variability.

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

N/A

9. Advisor's remarks (if any):

N/A

RESEARCH REPORT

1. Name: Jessie Wishart
（ID No.: SP14065）

2. Current affiliation: Oregon State University

3. Research fields and specialties:

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

4. Host institution: Japan Agency for Marine Earth Science and Technology

5. Host researcher: Drs. Fumio Inagaki & Yuki Morono

6. Description of your current research

Hydraulic fracturing (HF), a method of natural gas production, uses millions of gallons of water which is injected into subsurface gas-bearing formations and subsequently returned to the surface where it must be recycled or disposed of. Production fluid can contain high concentrations of chloride, heavy metals and radionuclides. Research has revealed the presence of a microbial community consisting of bacteria and archaea in Marcellus shale HF production fluids. Some of these microbes are extremophiles which can withstand the harsh conditions of HF fluid and subsurface environments. Many of these microorganisms are known to influence the geochemistry of their environments through metabolic activities that transform both organic and inorganic compounds. However, the activity level of microorganisms in HF wells is not well understood and carbon and nitrogen requirements are unknown. The goal of this research was to investigate the availability of different carbon sources and ammonium nitrogen in flowback fluids and determine the rate of nutrient acquisition. The enrichment of heterotrophs, autotrophs, methanogens, methanotrophs and, microorganisms that can utilize HF fluid components will provide insight into the microbial metabolisms that occur in HF fluids. This research will provide a better understanding of the importance of biogeochemistry in HF wells.

7. Research implementation and results under the program

Title of your research plan: Assessing Microbial Activity in the Marcellus Shale

Description of the research activities:

Stable isotope tracing was used to track carbon and nitrogen assimilation, respiration and, methane production in flowback fluids incubated for 0, 19, 32 and, 60 days under aerobic and anaerobic conditions. HF production fluids were supplemented with ^{13}C-labeled glucose, acetate, bicarbonate, methanol or methane and, ^{15}N-labeled ammonium. Samples were analyzed at sub-micrometer scale by ion imaging with the JAMSTEC NanoSIMS. Headspace CO_2 and CH_4 were analyzed for ^{13}C enrichment using irm-GC/MS. At 32 days incubation carbon assimilation was observed in samples containing 1 mM ^{13}C-labeled glucose under aerobic and anaerobic conditions with a maximum of 10.4 and 6.5% of total carbon, respectively. Nitrogen assimilation of ^{15}N ammonium observed in these samples were 0.3 and 0.8% of total nitrogen, respectively. Head space gas analysis showed ^{13}C enrichment in CH_4 in anaerobic samples incubated with 1mM ^{13}C-labeled bicarbonate (2227 ‰) or methanol (98943 ‰). Lesser ^{13}C enrichment of CO_2 was observed in anaerobic samples containing 1 mM ^{13}C-labeled acetate (13.7 ‰), methanol (29.9 ‰) or glucose (85.4 ‰). These results indicate metabolic activity and diversity in microbial communities present in HF flowback fluids. The assimilation of ^{13}C-labeled glucose demonstrates the production of biomass, a critical part of cell replication. The production of $^{13}CO_2$ and $^{13}CH_4$ demonstrate microbial respiration and methanogenesis, respectively. Methanogenesis additionally indicates the presence of an active archaeal community. This research shows that HF production fluid chemistry does not entirely inhibit microbial activity or growth and encourages further research regarding biogeochemical processes occurring in Marcellus shale HF wells. Biogeochemical activity may impact the efficacy of HF and natural gas production as well as the chemistry of produced fluids which have become an environmental and public health concern.

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

There were many cultural experiences in Japan including the Yosakoi festival held yearly in Kochi City, trying numerous Japanese foods, a tea ceremony, visiting temples and, being able to go to a beer garden on top of an airport. Although I was in a more rural part of Japan I enjoyed the setting and the additional uniqueness of the opportunity.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Benjamin WU （ID No.: SP14066 ）

2. Current affiliation: University of Florida

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: National Astronomical Observatory of Japan

5. Host researcher: Prof. Fumitaka NAKAMURA

6. Description of your current research

The problem of how stars form is one of the key questions in modern astrophysics, with the evolution of the universe, structure of galaxies, and creation of planetary systems all inextricably tied to star formation. All current star formation exists within giant molecular clouds (GMCs)—the coldest, densest regions of the interstellar medium—but the initial conditions and specific process through which this occurs are still uncertain. One theory posits that the dominant mechanism for star formation is through triggering via collisions between GMCs.

This current research project explores the cloud-collision theory by creating detailed numerical simulations to investigate GMC interactions. The gas is modeled using the method of magnetohydrodynamics such that regions of interstellar gas, hundreds of light-years across, can be evolved over millions of years using supercomputers. Different initial conditions and physical properties are implemented and the resulting structures are analyzed to determine the detailed process and likely precursors to forming stars.

Specifically, supersonic turbulence and magnetic fields have been confirmed observationally and shown to be potentially important dynamical processes, but the detailed effects of each are unknown. Further, large-scale GMC collisions are suspected to occur, but are difficult to observe. This project attempts to shed light on all of these processes by including the effects of turbulence, magnetic fields, and collisions. Each of these parameters is tested via numerical simulation and analysis of simulation data can provide unique detection signatures.

7. Research implementation and results under the program

Title of your research plan:

Testing Mechanisms for Star Formation via Supercomputer Simulations

Description of the research activities:

Interstellar gas clouds were initialized and simulated using 3D magnetohydrodynamics. This involved careful thought and mathematical calculation coupled with substantial coding in C and Python. Each additional physical process required testing against analytic models.

The project implemented supersonic turbulence and magnetic fields, and is in the process of including additional thermal and chemical effects to provide the most physically realistic models of molecular gas clouds thus far. Many parameters have been explored, including magnetic field strength and orientation, turbulent power spectrum, and the effect of large-scale gas collisions.

Preliminary analysis of density and velocity structures has been performed, leading to interesting new insights on the formation and characterization of filamentary structures. These types of structures are a fairly recent discovery in this field, and least two scientific papers are planned as a result of this work—one of which is currently being drafted.

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

Every single day was a cultural experience! From historical sights (shrines, temples, museums, Asakusa) and traditional festivals (Tanabata, hanabi matsuri) to natural beauty (Mt. Fuji, Enoshima Island), popular culture (manga, fashion, music), and even everyday life (interacting with coworkers, eating delicious food, riding the subway), Japanese culture was a large and essential part of this summer.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Naomi Yoder （ID No.: SP14 067 ）

2. Current affiliation: University of Southern Mississippi

3. Research fields and specialties:

Mathematical and Physical Sciences

Biological Sciences

4. Host institution: Hiroshima University

5. Host researcher: Shin-Ichi Uye

6. Description of your current research – Identifying habitat conditions for jellyfish and environmental change in East Asian Marginal Seas

My research encompasses gathering information on environmental change in the East Asian Marginal Seas, especially information in Chinese seas. The "East Asian Marginal Seas" are the Bohai Sea, East China Sea, Yellow Sea, Seto Inland Sea and the Sea of Japan. The first three contain coastlines in China, thus constituting the Chinese portion of the East Asian Marginal Seas. Chinese East Asian Marginal Seas are of particular interest to marine biologists interested in jellyfish, because they are thought to be the "seeding" grounds or benthic habitat areas for the endemic giant jellyfish, *Nemopilema nomurai* (Kishinouye 1922). The giant jellyfish has bloomed in more years in the past two decades than in all other years over the last century combined. The blooms of *N. nomurai* have drawn Japanese governmental and scientific attention in large part because the blooms have intensely and adversely affected the local fishing industry. While much has been discovered about the life history, physiology and reproductive behavior of *N. nomurai*, several questions remain, including: where are the polyps? This jellyfish has a complex life cycle, and understanding the large medusae that foul nets are only one component of understanding the population dynamics of the species. The medusae reproduce sexually, and form small zygote planulae that "settle" by attaching to a hard substrate (often on the sea floor). This settling begins the asexual part of the *N. nomurai* life cycle, and the benthic part. Planulae settle and grow into polyps. At a certain trigger point, polyps begin to transform into strobila, which then asexually reproduce several larval medusae ephyrae. Ephyrae float off into the water, beginning the planktonic life stages (characterized also by sexual reproduction). The benthic life stages are thought to be especially important in determining "bloom or not-bloom" for the year, as there can't be medusae in large numbers without large numbers of ephyrae having been released, and sexual reproduction produces fewer offspring than does asexual reproduction. The entire life cycle generally takes one year to occur, although polyps (and their associated structures, podocysts) can remain dormant for more than 6 years. Thus a large occurrence of medusae in one year had to have come from either a large standing stock of polyps and successful ephyrae, or from a successful recruitment the previous year of medusae that spawned planulae. No polyps or podocysts have ever been found in the wild for *N. nomurai*. However, their ephyrae have been found in the East China Sea, and the location of those findings suggests a seeding area of polyps near the Changjiang River mouth, and possibly one more coastal location

along China. Thus there is a desire to document the water conditions in these regions, and how those water conditions vary from year to year, to understand how *N. nomurai* might be able to produce such large quantities of medusae. My work is focused on summarizing the environmental change in the East China Sea, Yellow Sea and Bohai Sea in hopes of addressing this issue.

7. Research implementation and results under the program

Title of your research plan:

Are jellyfish indicators of degraded marine ecosystems? A case study in Japan.

Description of the research activities:

Cataloguing the environmental change in East Asian Marginal Seas helps us figure out whether there might be a correlation between jellyfish blooms and changing ocean conditions. Data has been acquired for jellyfish blooms in the Sea of Japan for *N. nomurai*, and a literature review completed of changing ocean conditions over time for Chinese seas. We also collected data at sea in the Sea of Japan and the Ariake Sea, for related studies. The results show that there has been significant environmental change in Chinese coastal waters over the past two decades, and, at least to some extent, since the 1960s. The Changjiang River output has dramatically since the 1960s, and again now since construction of the Three Gorges Dam (complete in 2006). The Changjiang River flows into the East China Sea, and in the plume region, nitrate levels have soared, multiplying much faster than background rates since the 1960s. Phosphate is the limiting nutrient in this region. Silica loads have steadily decreased, especially after the filling of the Three Gorges Dam (which has resulted in less sediment delivery to the East China Sea). Hypoxia and large hypoxic zones have developed more frequently in the summer in the East China Sea near the plume. Phytoplankton communities shifted from diatoms (large bodied, mineral-rich, best at carbon sequestration) to dinoflagellates (smaller size, also some species of which become Harmful Algal Blooms). These results suggest that the Changjiang River outflow has a significant impact on the oceanography of the region. There have also been water temperature increases in the East China Sea in the summer, especially as measured in surface waters. Another place that seems to have seen significant environmental degradation is the Bohai Sea, where nitrogen loads have multiplied and heavy metals pollution is comparatively high. The next step remains to discover why *N. nomurai* blooms in certain years and not others, and if the blooms are correlated with individual environmental changes, or with a combination of these factors.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I was really touched by the kindness and generosity of the people in my lab and the people I met. I was honored to participate as a spectator at the annual Hiroshima Atomic Bomb Memorial on August 6th, 2014. I enjoyed exploring Buddhist sites and studying Japanese tea ceremony. One evening at sea at dusk, there was a crescent moon hanging above the crimson sea, lit up from the sunset. I saw dolphins off the bow of the ship, and I had an almost overwhelming experience of contentment and joy with the beauty of the moment.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Thom Davies
（ID No.: SP14101）

2. Current affiliation: School of Geography, Earth and Environmental Sciences: University of Birmingham

3. Research fields and specialties:

Humanities **Social Sciences** (Human Geography) 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 Urban Engineering: University of Tokyo

5. Host researcher: Professor Aya Kubota

6. Description of your current research

My current research investigates the social impacts of the 1986 nuclear disaster in Chernobyl, Ukraine. I have conducted ethnographic fieldwork in and around the Chernobyl border region, as well as more broadly within Ukraine. Using qualitative methods, including in-depth interview, participant-observation and photographic participation techniques, I am exploring how Chernobyl impacts upon everyday life in a nuclear landscape. Through de Certeau's emphasis on 'everyday life' (2002) and Agamben's notion of 'bare life' (1998), I examine state-society relations in post-Chernobyl society.

Interpreting Chernobyl as an on-going 'process' rather than an event – we can uncover the ways that risk understandings, informal economic 'tactics' of resistance (de Certeau 1984) and place attachment interact in Chernobyl's anti-therapeutic landscapes. My research has found that many people are 'exposed' multiple times, not only to the variously-understood risk of invisible radiation but also to a State which is perceived as indifferent to widespread marginalization.

The research undertaken in Japan explores how people affected by the Fukushima nuclear disaster have coped in the wake of 'the Chernobyl of the East'. The study reveals how Japan's nuclear landscape is understood and negotiated by those who live with it. Though the government has been quick to downplay and 'contain' the radiological health impacts of 3/11, what is less understood are the myriad impacts that the disaster is continuing to have on the everyday lives of people involved, such as their attitude towards radiation risk and their attachment to place.

The summer program has not only allowed me to develop comparisons between the two nuclear disasters, but also share my knowledge of Chernobyl with people in Japan who are interested in - or have been affected by - Fukushima.

7. Research implementation and results under the program

Title of your research plan:

'From Chernobyl to Fukushima: the social fallout of Japan's nuclear meltdown'

Description of the research activities:

- **Semi-structured interviews** with various people including:
  - Forced evacuees from the Fukushima Exclusion Zone (red and yellow zones)
  - 'Voluntary' Evacuees, such as 'Mothers of Fukushima'.
  - Farmer-Activists who continue to farm illegally inside the Zone.
  - NGO workers including head of 'SafeCast' charity and Fukushima Future Center for Regional Revitalization (FURE)
  - Ukrainian ambassador to Japan and head of Chernobyl-Fukushima partnership.
  - Displaced families who live in temporary accommodation within Fukushima prefecture.
  - Residents and Business owners from the stigmatized Fukushima landscape.
  - Policemen who looked for bodies and guarded abandoned homes after 3/11.

- **Visual Research**: Photovoice Project – involved giving disposable cameras to people affected by the Fukushima nuclear disaster, and asking them to make images that help describe the impact of the accident on their everyday lives. One camera collected so far with others still in process.

- **Participant observation**: Staying in temporary evacuation shelter in Minamisoma, in Fukushima Prefecture, sleeping/staying on 'semi-(il)legal' farms inside the Fukushima Exclusion Zone, visiting abandoned houses in the Red zone with their displaced owners.

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

Many cultural experiences, including discussing the Fukushima disaster with an interviewee while in an Onsen in the Fukushima mountains. The highlight however was being invited to stay with a family who live in temporary accommodation north of the Exclusion Zone, who had been evacuated from their home near the Fukushima reactor. I will never forget their hospitality and generosity. That weekend they took me to a Samurai horse festival that takes place on the edge of the Fukushima exclusion zone, including within the 'Yellow Zone' of the disaster zone. For some of my photographs of the event click here: http://t.co/7X4fuVkaIc

9. Advisor's remarks (if any)

RESEARCH REPORT

1. Name:William Joseph Foster
（ID No.: SP14102）

2. Current affiliation: Plymouth University

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Nagoya University Museum, Nagoya University

5. Host researcher: Prof. Tatsuo OJI

6. Description of your current research

The Late Permian mass extinction event about 252 million years ago was the most severe biotic crisis of the past 500 million years and occurred during an episode of global warming. The subsequent recovery of marine ecosystems is thought to have taken ~5 million years. The magnitude and pattern of recovery, however, has been shown to vary between different latitudes, regions and environmental settings. Additionally, following the late Permian extinction four further biotic crises have been proposed as delaying the biotic recovery. Sedimentary sequences representing the Early Triassic from Japan are not as well studied as European, American or Chinese deposits. Exposure of the Early Triassic along the Hiraiso Coast, Kitakami Massif (Japan), allows for the investigation of sediments from a different regional setting. Instigations of sediments in nearby Primorye, Russia, suggest that recovery along the eastern Panthalassan (Pacific Ocean) margin may have occurred earlier than European, American and Chinese sections previously suggest. At Nagoya University, I plan to quantitatively investigate the Early Triassic deposits of the Kitakami Massif looking at the role of region, environmental setting and further biotic crises on the subsequent recovery following the Late Permian mass extinction event.

7. Research implementation and results under the program

Title of your research plan:

Early Triassic Ecology and Climate Change in Northeast Japan.

Description of the research activities:

This research project, firstly, required field sampling in northern Japan. My host kindly arranged the fieldwork and we spent 10 days collecting samples on a remote coastline. In order to sample I had to log the clastic sediments so that we can infer the environmental conditions they were deposited under and then we would collect palaeontological samples for a quantitative understanding of benthic invertebrate distributions. We also sampled: ammonoids; plant material; and bulk rock for dissolution for conodonts; all which may help with determining an age of the sediments.

At the University Museum I used a rock saw, grinder and polisher to prepare the rocks so that the fossils inside could be identified. Due to limited time not all the data was collected and the samples have been sent back to the UK for continued data collection.

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

Life, food and research in Japan is very different to the UK. During my stay I got to taste a lot of different Japanese dishes among my favorite were ramen and tempura. I also used the weekends to travel to different parts of Japan some of which famous tourist destinations including Tokyo, Fujisan and Kyoto; although my favorite places were in the Japanese countryside. The most rememberable place, however, was Kesennuma and other parts of the Miyagi prefecture which were devastated by Tsunami in 2011, and where the devastation can still be observed.

Research life in Japan was very different: health and safety regulations are not as strict as Europe and sometimes it makes you feel vulnerable when using certain machines. Communication within the department was excellent with five hours of seminars during most weeks generally preceded by a friendly lunch and lots of discussion after the each presentation. My research group was extremely friendly always trying to make sure I make the most out of my time. Two of my group took time off work to ensure that I could climb Fujisan.

Life in Japan, to me, seemed very similar to the USA, in terms of shops and activities. Although a lot of traditional Japanese aspects did shine through. Embarrassingly, in my short time I never got to grips with Kanji, although the Japanese alphabets were easier to comprehend.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Samantha Gregory （ID No.: SP14103）

2. Current affiliation:

PhD student University of Aberdeen

3. Research fields and specialties:

Social Sciences

4. Host institution: Kyoto University

5. Host researcher: Professor Sakiko Yoshikawa

6. Description of your current research

Human faces display both person identity and social emotional information. This information is used by our memory systems; we encode person identity information into long-term memory (LTM), and use working memory (WM) in order to engage with the person in the moment.

Research using direct gaze faces demonstrates that memory for angry faces is better in WM and memory for happy faces is better in LTM. When eye gaze is averted, however, this appears to change.

In a LTM study conducted in Kyoto University, it was found that eye gaze did not affect participants' memory for happy faces, however, angry faces with direct gaze were remembered significantly better than angry faces with averted eye gaze.

Contrastingly, a WM replication in Aberdeen University found that eye gaze did not alter participants' memory for angry faces, however, happy faces with averted gaze were remembered significantly better than happy faces with direct gaze. Further, participants were asked to make judgments of social intent about the faces. It was found that the social intent judgments were not altered by eye gaze when the faces were angry, but that when faces were happy, the averted gaze caused participants to judge the social intent less favorably than for the direct gaze happy faces.

The research conducted in Japan intended to investigate if these different results were due to cultural or memory system differences by replicating the WM and social intent experiments.

7. Research implementation and results under the program

Title of your research plan:

Investigation into the effects of eye gaze on memory for faces showing happy and angry expressions: A cross cultural study.

Description of the research activities:

Procedure WM experiment:

An array of 2 faces appear side by side in the center of the computer screen for 2 seconds before disappearing. They both have the same expression and eye gaze (happy/angry, direct/averted). After a 1 second blank maintenance interval a neutral face appears in the center of the screen, showing the same eye-gaze as the previously presented faces. The participant must say if the face matches the identity of one of those seen previously or if it is new.

Procedure social intent experiment:

Participants see each face individually in its happy and angry state with both direct and averted eye gaze. They rate the faces on its social intent by answering 11 questions, assessing negative and positive social intent.

The experiment was run using the Japanese faces first.

Stimuli were created by manually editing the eye gaze of 6 male identities from the Japanese ATR face database.

The Japanese participants showed a very high degree of memory for the faces regardless of facial emotion or gaze. However, the social intent results for these faces matched those found in the UK.

It was then decided to run the experiment using the original Caucasian faces.

The faces were from the Ekman face database, everything else was identical. Here the participants did not show ceiling effects, and the results were found to replicate those found in Aberdeen, with the Happy averted gaze faces being remembered better than the happy direct. The social intent result was also replicated.

This provides evidence for the argument that the differences seen are due to memory system differences, and not cultural differences.

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

The highlight in terms of cultural trips was Hiroshima. The peace garden and museum are incredibly powerful and worth a visit for anyone who comes to Japan. Kyoto itself is also incredibly rich with culture and it has been a wonderful opportunity to work and live in such a beautiful area.

It has been wonderful to experience the Japanese research environment and everyone I have met has been incredibly friendly and interesting. I have had many opportunities to talk to fellow academics in informal settings and in doing so I have had the fantastic opportunity to hear of the many research projects going on here. It has been interesting to see how much the work compares to that done at home.

RESEARCH REPORT

1. Name: Elizabeth Kapasa （**ID No.: SP14** 104）

2. Current affiliation: University of Leeds

3. Research fields and specialties: Interdisciplinary and Frontier Sciences

4. Host institution: Tokyo Women's Medical University - Waseda University Joint Institution for Advanced Biomedical Sciences (TWIns), Tokyo Women's Medical University

5. Host researcher(s): Tatsuya SHIMIZU, Hironobu TAKAHASHI, Toshiyuki YOSHIDA, Teruo OKANO

6. Description of your current research

As life expectancy is increasing we are discovering the reality that the joy of living longer inevitably comes with the deterioration of our bones and increased chances of malfunction or loss of bone. Our continuously ageing population suffers from bone damage caused by trauma, cancer, congenital defects or common age-associated diseases, such as osteoporosis. There is an urgent clinical need to develop alternative approaches to efficaciously repair bone due to the limitations of current available technology. Tissue engineering and regenerative medicine has emerged as a new multidisciplinary field with huge potential to offer solutions for bone repair and regeneration. This will directly improve the patient's quality of life and help relieve the related social and economic burden on our society. Cell sheet (CS) engineering is a novel technology that uses temperature-responsive culture dishes (developed at TWIns) to provide intact monolayer sheets of confluent stem cells by simply altering the temperature. Multilayer cell sheets (MLCS) involve stacking these monolayers to make a 3D tissue graft. CS technology has many advantages compared to conventional approaches and cell culture methods that can engineer efficacious 3D tissues which can be used to restore normal function to damaged tissues. MLCS are already being clinically translated in regenerative therapies for other tissue types. Therefore this research will work in collaboration with the pioneering research group of this technology to develop MLCS for bone to meet the growing demand for bone regeneration from our ageing population.

7. Research implementation and results under the program

Title of your research plan: Bone tissue engineering *in vitro* and *in vivo* using a novel multilayer cell sheet technology

Description of the research activities:

The aim of this summer fellowship was to investigate the potential of using MLCS and stem cell therapy to improve the efficacy of bone tissue engineering. I successfully

achieved my objectives: A) To fabricate MLCS *in vitro* with different stacking methods, such as using a gelatin gel stamp; B) To investigate the osteogenic induction of CS *in vitro;* C) To manufacture patterned surface for MLCS.

Furthermore, I was really pleased that I was able to fabricate CSs and investigate osteogenic induction using peridontal ligament cells (PDLCs), rat bone marrow derived-mesenchymal stem cells (BM-MSCs), and porcine adipose stem cells. In particular I was delighted to work with rat BM-MSCs, since I will be using human BM-MSCs during my PhD. PDLCs are currently in clinical trial and require various quality control tests before transplantation (cell count, survival rate, PCR, flow cytometry). I performed these analytical tests on my CSs which successfully demonstrated osteogenic induction. This will provide good preliminary results for my PhD. I also had the opportunity to partake in primary cell harvesting, isolation, culture and transplantation into *in vivo* models. These were great experiences that will be very useful for my PhD when translating the research through pre-clinical studies. In addition I gave a presentation at TWIns on my previous research. It was beneficial for me to experience research in Japan, meet and work with my collaborators, and strengthen the collaboration between our two universities. This summer fellowship was invaluable and will provide an excellent foundation of knowledge and skills for my PhD by learning first hand from the experts and pioneers of CS technology

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

This fellowship was not only instrumental for my research, but it has been an amazing, eye-opening cultural experience. Japanese culture is very rich and different to western culture, which has been fascinating to experience from the very traditional to the cutting-edge modern. The JSPS Summer Programme started off with a rare and untraditional cultural experience of being able to meet the Emperor and Empress of Japan, which was very special. The Japanese people are really lovely and I know I have made good friends during my time here. It was great to meet with other JSPS fellows to go to shrines, temples, festivals (祭) and to the famous Sumidagawa fireworks. I have also had fun trying to learn and practice Japanese. One of my favourite experiences was going to the Sumo Championships in Nagoya, which was a really exciting atmosphere and I would highly recommend it to everyone. After the fellowship, I will be travelling to Okinawa, Osaka, Kyoto, Nara and Nikko, which I am sure will be even better than I have been told. Overall I absolutely loved this summer experience; it has been unforgettable and I hope I have the opportunity to return to Japan in the future.

RESEARCH REPORT

1. Name:

Mhairi Matheson （ID No.: SP14 105 ）

2. Current affiliation: University of Glasgow

3. Research fields and specialties:

Chemistry

4. Host institution: Tokyo Institute of Technology

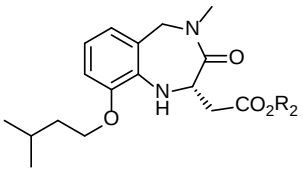
5. Host researcher: Prof Keisuke Suzuki

6. Description of your current research

At the interface between synthetic organic chemistry, medicinal chemistry, and molecular and cell biology, the Marquez group are designing, synthesising and testing new drugs which promote wound healing. It has been shown that compound **1** promotes wound healing both *in vitro* and *in vivo*; most notably in C57BLKs/Bom diabetic mice where healing was increased to around 77% of levels displayed by healthy mice.

The focus of my studies has been on developing a fast efficient and enantioselective synthesis of **1** as well as a number of analogues with various tags to allow investigation into the molecular mode of action of these compounds via ligand immobilisation, fluorophores and iodine tracing studies.

This fascinating and challenging research has increased my passion for synthetic chemistry projects that have medicinal and biological applications, and as such I am eager to gain wider experience of projects of this nature.



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7. Research implementation and results under the program

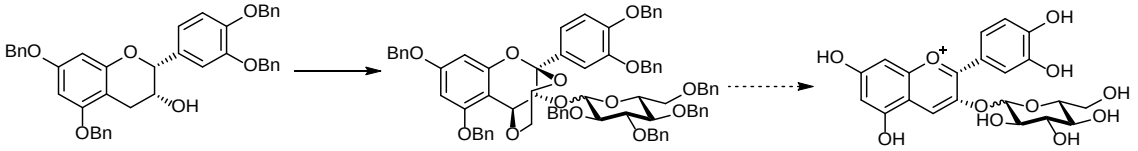
Title of your research plan:

Initial Studies Towards the Synthesis of Cyanidin 3-*O*-*β*-D-Glucoside from Benzylated Epi catechin Precursor

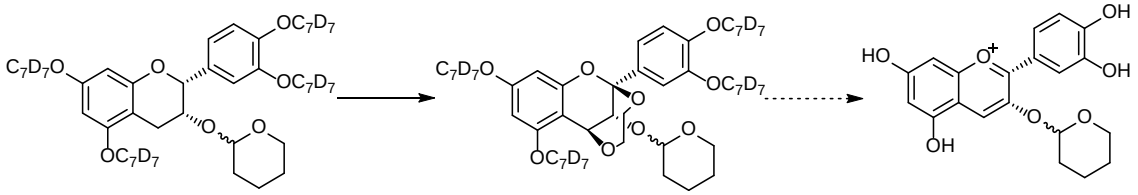
Description of the research activities:

My time in the Suzuki-Ohmori laboratory was spent on the synthesis of natural product cyanidin 3-*O*-*β*-D-glucoside (**4**). This molecule falls into the wider anthocyanin family that have been increasingly studied due to their strong colour, and their nutritional and medicinal properties.

Initial steps towards the synthesis of this molecule began with benzylated epi-catechin (**2**). Early stage synthetic steps (trichloroacetimidate alkylation and DDQ oxidation) gave enigmatic analytical data (NMR, mass spectra, IR) and it was not certain that desired intermediate **3** had formed. It became clear that a simplified system should be employed to afford clarity on the viability of the proposed route (DDQ/ benzyl group side reactions were of particular concern).



The system was simplified by using deuterated benzyl groups and THP in place of the glucose moiety, and analytical data showed that subsequent steps (DDQ oxidation followed by acetal formation) were successful in synthesising key intermediate compound **6**. Removal of the benzyl groups proceeded with enough success to attempt the final step in the route of the model system. Further optimisation of reaction conditions will need to occur in order for us to gain understanding of the products of this final reaction (*in situ* formation of HCl used to promote aromatisation), however, we are encouraged by the deep pink colour formed, as this is characteristic of our desired compound (shown below).



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: Jill McColl （ID No.: SP14106）

2. Current affiliation: University of Glasgow

3. Research fields and specialties:
Biological Sciences

4. Host institution: Hokkaido University

5. Host researcher: Prof. Osamu SEKI

6. Description of your current research

A better understanding of decadal to centennial climate variability is vital to improve the accuracy of near future climate prediction. To fully understand and predict future climate change requires geographically widespread records of natural climate variability in order to test the accuracy of climate models. This is on the basis that if climate models can accurately model past climate variability well, they are more likely to model the future. In particular, reliable and accurate reconstructions of temperature and rainfall are required from all over the world to test climate models and better predict future climate variability.
Hokkaido represents a region which has limited paleo-climate data and is sensitive to climate change. Instrumental data shows a good correlation between the temporal variability of temperature and rainfall with the Pacific Decadal Oscillation (PDO), the Arctic Oscillation (AO) and the East Asian Summer Monsoon (EASM) however instrumental data is limited to the past ~150 years. Therefore down-core reconstructions of temperature and precipitation prior to instrumental records are required to provide a better understand the long-term behaviour of the PDO and EASM systems in this region.
The accuracy of down-core reconstructions depends on the quality of data used to test them. Proxies from lake sediments provide unique, continuous and high resolution sedimentary archives which enables us to analyse climate change at high temporal resolutions.

This project exploits biomarkers (chemical fossils) preserved in a unique lacustrine geological archive in Hokkaido (Japan) in order to reconstruct records of past temperature and precipitation over the past 1000 years. Lake Toyoni (42°05’N; 143°16’E, water depth: 19m) is a promising paleoclimate archive due to the presence of specific algal lipids (alkenones) and higher plant waxes. A 2.5m sedimentary archive represents ~1000 years of sedimentation based on preliminary radiocarbon dates. The presence of algal lipids (alkenones) and higher plant waxes in Lake Toyoni facilitates the development of high-resolution (i.e. 1cm contains 3-5 years of sedimentation) temperature and hydrological reconstructions for the Hokkaido region which can be used to infer climate

variability and responses to variations in external forcing (e.g. solar radiation), internal forcing (e.g. East Asian monsoon) and feedback mechanisms.

7. Research implementation and results under the program

Title of your research plan:

Compound specific D/H ratios and molecular distributions of higher plant leaf waxes as paleohydrological indicators in Lake Toyoni, Japan

Description of the research activities:

n-Alkanes are straight-chained hydrocarbons produced by many organisms in both aquatic and terrestrial environments. Aquatic algae are dominated by short chain homologues (C_{17}–C_{21} *n*-alkanes), the mid-chain homologues (C_{23}, C_{24} and/or C_{25} *n*-alkanes) are a dominant component of submerged aquatic macrophytes and long-chain *n*-alkanes (C_{25}–C_{33} *n*-alkanes) are a main component of the epicuticular waxes of higher plants. These long chained *n*-alkanes are removed by rain and wind and are transported to lacustrine sediments via water or wind erosion. The dominant chain lengths, carbon number distributions and isotopic compositions vary depending on the source organism and growth environment. As a result, the molecular distributions and isotopic compositions of n-alkanes provide a wealth of paleo-environmental information. The dominant *n*-alkanes in Lake Toyoni are long chained (C_{25}-C_{33}) and are characterized by odd over even distribution. The source of long chained n-alkanes are therefore from the surrounding terrestrial higher plants. It has been demonstrated that the hydrogen isotopes of n-alkanes record the hydrogen isotope value of precipitation and site-specific meteorological conditions, such as evapotranspiration, relative humidity and soil moisture. Compound-specific hydrogen isotopes on 70 samples down-core found large fluctuations (~40‰) representing hydrological changes in this region over the past 1000 years.

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

When I was not in the lab, I enjoyed sightseeing and trying all different types of Japanese food. My favorite type was “soup-curry” which is a dish that is very popular in Hokkaido. This is something I will definitely miss when I return to the U.K. The home-stay visit was one of the most special experiences I had in Japan. My host family were very friendly and made me feel at home. I am still in touch with them and have met them a couple of times since the home stay. In addition, I enjoyed hiking, going to baseball games, the sunshine (something we don’t see often in Scotland!) and of course nights out for karaoke!

RESEARCH REPORT

1. Name: Judith Runnels （ID No.: SP14107 ）

2. Current affiliation: University of Bedfordshire

3. Research fields and specialties:

Social Sciences

4. Host institution: Osaka University

5. Host researcher: Fergus O'Dwyer

6. Description of your current research

The Common European Framework of Reference (CEFR) is the description of the Council of Europe's language policy, produced for the purposes of increasing collaboration and cooperation in language education between European educational institutions. The CEFR is best known for its descriptors of language proficiency, or can-do statements, which are divided according to language sub-skill across six levels. Each can do statements describes what a language user is able to do in their language of study. Despite its global impact, the CEFR has been shown to have had the least impact within the classroom - arguably where it should be making the biggest difference. As many scholars note, there is a significant need for the publication of case studies containing descriptions of the development of CEFR-based curricula, materials and classroom practices. This need also exists in Japan, where there is significant interest in using the CEFR at tertiary, secondary and primary institutions. The study of perceptions and beliefs about the CEFR, as well as its impact on classroom practice in Japan was therefore the primary focus of this research project.

7. Research implementation and results under the program

Title of your research plan:

The conceptualization and operationalization of the CEFR by tertiary level language teachers in Japan

The purpose of this research is to investigate the impact of the CEFR in language education in Japan, including how language teachers are interpreting and incorporating the language framework into their practice. Recently, the Japanese

government's Ministry of Education, Culture, Sports, Science and Technology (MEXT) has mandated the use of can do lists as language learning attainment targets in junior and senior high schools of Japan although many questions have been raised as to how the measures should be put into practice as no guidelines have been provided. Essentially, both the idea of CAN-DO lists and the process of putting them into practice was confusing for teachers and institutions who were supposed to be using them in their own classes, and this provided much of the rationale for the current research.

Description of the research activities:

Seven interviews with CEFR users from several universities across Japan were performed to explore teacher's rationale behind adopting the framework for their own purposes. A survey was also developed and administered to teachers at two universities in Japan. The survey intends to examine how the framework is being interpreted, and the features of it which led to its usage and is acting as pilot study. The results from this pilot study will be used as a foundation for data collection for inclusion as a chapter into an edited volume on the topic (details available at: https://sites.google.com/site/flpsig/critical-constructive-assessment-of-cefr).

My host researcher and I also completed a series of classroom observations which have resulted in two manuscripts on the topic of CEFR-informed learning cycles (one of which is under review for the journal Studies in Self-Access Learning, and the second of which is nearly ready for submission and will be submitted to a journal shortly). My host researcher also consulted on third article for which I am sole author which has been submitted to the online journal Language and Public Policy. The results of the interviews and pilot surveys described above will be used as a preliminary pilot study in my Ph.D. thesis.

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

On several weekends throughout the programme, I took the time to travel to other cities in Japan. I visited Nagoya during the sumo, Kyoto, Hiroshima and Tokushima on Shikoku in addition to exploring Osaka (where I was based).

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Steven T. G. STREET （ID No.: SP14108 ）

2. Current affiliation: University of Bristol

3. Research fields and specialties:
Chemistry

4. Host institution: Kyoto University

5. Host researcher: Prof. Jun-ichi YOSHIDA

6. Description of your current research

The initial aim of my research in Prof. Yoshida's group was to produce new biopolymers by initiating a living polymerization with glycosyl cations (carbohydrates) under flow micro-reactor conditions. This is quite an ambitious task, seeing as only a handful of carbohydrate polymers have ever been produced, and the resulting products are of vital use as new materials and as biological probes. This work builds on previous research by the Yoshida group, namely the 'indirect cation pool' method for the generation of glycosyl cations, where the electrochemical generation of a cationic aryl sulfide species goes on to react with a carbohydrate forming the glycosyl cation which can go onto react with other species e.g. another carbohydrate. The other area of work is the cation pool initiated living polymerization; where an electrochemically generated 'pool' of cations goes on to give polymers of highly defined molecular weight. The problems with using glycosyl cations in living polymerization involve the potential side reactions of an electrogenerated acid which is formed during electrolysis, as well as the competing reaction of the aryl sulfide cation.

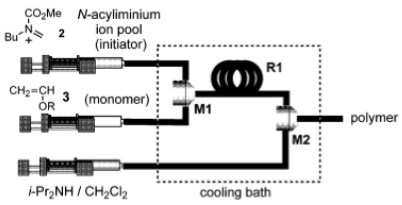


Figure 1. Microsystem for polymerization. M1 and M2: micromixers. R1: microtube reactor.

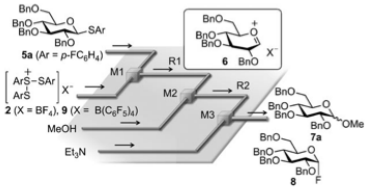


Figure 2. Integrated flow microreactor system for the glycosylation reaction of **5a** with MeOH. Bn = benzyl.

1. Left - The 'cation pool' method of living polymerization. Right - the generation and reaction of glycosyl cations in a flow micro-reactor.

Thus, my research was split into phases, each phase building in complexity over the previous. Firstly examining the ability of triflic acid to initiate the polymerization of vinyl ethers as a starting point. Secondly examining the electrochemical generation of an electrogenerated acid (EGA) and investigating its ability to initiate the polymerization of vinyl ethers, which would be a competing reaction to the desired glycosyl cation initiation. Thirdly, examining the electrolysis of an aryl sulfide to generate a cation pool before assessing its ability to initiate a polymerization itself, this would be another unwanted competing reaction. Finally the indirect generation of glycosyl cations by their reaction with the aryl sulfide cation pool and their subsequent polymerization of vinyl ethers would be investigated, potentially leading to the exploration of other monomers including carbohydrates if this worked well.

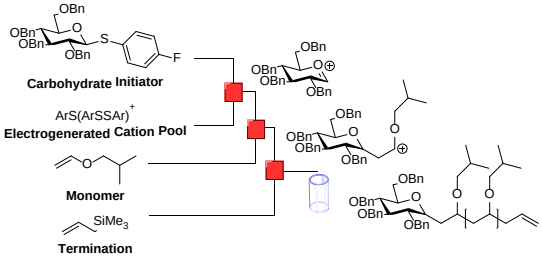
7. Research implementation and results under the program

Title of your research plan:

“Flow Micro-Reactor Based Cationic Living Polymerizations: Studies on Initiation by Electrogenerated Acid & Glycosyl Cations”

Description of the research activities:

The initial reaction of triflic acid worked well and gave polymers of precise molecular weight, and allowed us to optimize the conditions of the flow reactor. The electrochemical generation of the aryl sulfide cation went well and it was discovered that this was not responsible for initiating any polymerization; rather the polymer formed had been initiated by EGA instead. This was both good and bad, because it meant that whilst the aryl sulfide used to generate the glycosyl cation wouldn’t cause a polymerization itself, it did reveal that the electrogenerated acid formed was the strongest initiator of them all. The generation and reaction of EGA proceeded to produce an identical polymer to the ones created previously, proving the EGA initiation was a competing reaction and was responsible for the polymers obtained so far. As a final test, a carbohydrate initiator was synthesized and the generation and reaction of a glycosyl cation under the same conditions was attempted (see diagram). Again an acid initiated polymer was obtained with no sign of a carbohydrate terminus. Therefore to progress, we needed to stop the formation of this EGA; however the mechanism of formation of EGA is a mystery which has remained unsolved for over 30 years, so before we can stop its formation, research was undertaken into understanding how it’s produced. Having obtained the optimal conditions for the EGA initiated polymerization, the same conditions were used each time and each individual component of the system was changed one at a time, to locate the source. 14 different reactions were conducted, looking at the use of different electrolytes, different counterions, removing acid in the cathodic chamber, deuterium labelling of the solvent and trace water, washing with D_2O and more. From all of these results, the efficiency of the reaction was found to depend on both the choice of electrolyte, and the amount of trace water present, however the electrolyte was ruled out as the source of proton’s, leaving trace water as the most likely cause of the acid, which supports previous hypothesis about the nature of formation of EGA. In the process, conditions were discovered which severely hinder the generation of EGA, which would be useful for future work on the glycosyl cation initiated living polymerization.



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

Cycling the Shimanami Kaido, climbing to the summit of mount Fuji, watching the July Sumo tournament, seeing many of the temples and sights around Kyoto, staying in a Ryokan, experiencing an earthquake and a typhoon, travelling on a shinkansen, lots of Japanese food & much more!

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Christina WAYMAN （ID No.: SP14109 ）

2. Current affiliation: King's College London

3. Research fields and specialties:

Biological Sciences

4. Host institution: Tohoku University

5. Host researcher: Prof. Ryuta KAWASHIMA

6. Description of your current research

My PhD project is in the field of neurorestoration with a focus on stroke. I am assessing a clinically straightforward therapy (intramuscular infusion of the growth factor neurotrophin-3) for stroke pathologies in multiple experiments using rats and mice, using behavioural outcomes, molecular techniques, histology and neuroimaging to verify our findings.

Stroke is a debilitating disease that induces sensorimotor loss after an infarct in the brain, and half of survivors are left permanently disabled. Ongoing care of stroke patients costs the EU €38 billion each year, and represents a pressing need for new treatments. We have been using the diathermy middle cerebral artery occlusion (MCAO) model of stroke in young rats to test this hypothesis, and have also been using functional magnetic resonance imaging (fMRI) to monitor if there are any plastic changes in the somatosensory cortex after stroke.

fMRI works by measuring the haemodynamic response related to neural activity in the brain. Increased somatosensory activation (due to stimulation of a paw) leads to local changes in the relative concentration of oxyhaemoglobin and deoxyhaemoglobin, which results in the blood-oxygen-level dependent (BOLD) response. Movements of the stroke-affected hand in stroke patients are associated with enhanced neural activity not only in the lesioned hemisphere but also in the contralesional, less-affected hemisphere (Grefkes 2008). Contralesional activation following stroke may support hand function *via* direct projections to the spinal cord (Boudrias et al. 2010) and this contralesional activity may influence other cortical areas in surviving motor networks to support residual motor outputs (Cramer, 2008). I hope that using fMRI we will be able to show this in rodents and show changes to the pattern of activation after treatment.

7. Research implementation and results under the program

Title of your research plan:

Measuring brain waves and blood flow using simultaneous EEG-fMRI after stroke

Description of the research activities:

Professor Kawashima's lab at Tohoku University is the first lab to be able to perform full scalp EEG recording simultaneously with BOLD-fMRI in rats. They have developed and patented a cap that can be used in rodents. The cap has 31 electrodes fitted and enables the measurement of brain waves. Using this set-up, experiments can now be performed to discover more about the natural neuron to blood vessel interactions and default connectivity in the brain, as well as applying this technique to discover more about pathological changes after disease models including epilepsy and stroke. Unfortunately, some of the hardware that connects the EEG cap to the computer broke during my stay in Japan, so I was unable to complete the experiment I had planned, but I have learnt how to acquire and analyse this data, which has been very useful.

As a result, I designed a second experiment to utilise the resources available to me; I have performed voxel based morphometry (VBM) analysis of animals before and after stroke in a longitudinal study. This is a technique that I had aimed to learn previously in the UK, that allows structural changes in the brain to be measured in relation to specific structures in the brain. I will be able to apply this technique to my fMRI studies in the UK on my return.

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

I have felt very lucky to have participated in the JSPS Summer programme, and I have experienced a wide variety of excellent activities whilst in Japan, being fortunate enough to visit Hiroshima, the sumo wrestling in Nagoya, and some of the tsunami-affected areas of Fukushima among others. I have fallen in love with Japan and I cannot wait until my return.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Zayd Westcott （ID No.: SP14110）

2. Current affiliation: Nottingham Trent University

3. Research fields and specialties:

Chemistry Engineering Sciences Biological Sciences

4. Host institution: Japanese Foundation for Cancer Research

5. Host researcher: Professor Kiyotaka Shiba

6. Description of your current research

Currently I am conducting research into three different areas, (a) identification of peptide binders to metal organic framework materials using Phage Display, (b) studies of peptide binding to titanium dioxide and other materials and (c) the design and synthesis of peptides as potential binders working in collaboration with computational scientists.

Titania binding peptide studies are being performed using Quartz crystal microbalance with dissipation (QCM-D) measurements using a number of peptides identified by phage display (Ti1:QPYLFATDSLIK and Ti2: GHTHYHAVRTQ) that are chemically very different to those identified by the proposed hosting group (Professor Shiba) in Japan in their earlier studies. I am exploring how varying solution chemistry affects binding of these peptides to titania. During my stay in the Shiba group I have been able to learn how to make, handle and purify novel recombinant ferritins that incorporate sequence information from the peptides which I am currently studying at Nottingham Trent University, creating ferritin incorporated FTi-1 & FTi-2

7. Research implementation and results under the program

Title of your research plan: Studies at the biotic-abiotic interface

The results under the program have been encouraging. FTi-1 has been successfully synthesized and purified. Binding studies on this molecule have commenced using AFM.

FTi-2 has also been successfully synthesized and purification is currently ongoing.

Description of the research activities:

The project used molecular biology techniques to prepare recombinant ferritin L chains coupled to peptides Ti1 or Ti2. Recombinant apoferritin was reconstituted by expression in E. coli XLI-blue cells. The expressed protein was harvested from lysates following centrifugation coupled with sonication and thermal treatment to remove cell debris and host proteins. For purification; both ion exchange and gel filtration methods were used to purify the protein and salting out methods used to separate out monomeric apoferritin with peptide expressed on the surface. AFM was then used to measure molecules binding affinity.

MALDI-TOF mass spectrometry was used used to determine the molecular weights of the apoferritin subunits (to measure success of the approach). The yield of material was determined using absorption at 280nm with extinction coefficients calculated from the protein sequences. The Bradford assay will be used to determine the concentration of protein in solution using standard curves for each apoprotein. Q-sense E4 will be used for QCM-D measurements with sensors having specific titania surfaces.

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

Outside of the lab, I was able to travel to various regions of Japan, to present my research to other academic institutes whilst taking in the countries breathtaking sites and beauty. Kyoto's rich history & culture was particularly enjoyable & I also relished the memorable experience of Nagasaki.

Other particular cultural experiences of great enjoyment to me included Japanese cuisine, the stunning viewpoints of the natural environment & the world famous firework festivals of Summer.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Jordan Ricardo Lopez （ID No.: SP14111）

2. Current affiliation: Nottingham Trent University

3. Research fields and specialties:

Chemistry

4. Host institution: Tokyo Metropolitan University

5. Host researcher: Professor Kiochi Kikuchi

6. Description of your current research:

Development of devices for use in information technology is of paramount importance, including data storage, medical devices, displays and biosensors. However, as the nano-age evolves, one thing all areas have in common is the need for integrated chemical properties within a condensed space. The development of microelectronics on a molecular scale offers the prospect of devices with many times the efficiency of current technology. This project aims to tackle the need by producing multifunctional materials, in the form of organic-inorganic hybrid charge transfer salts, paying interest to the combination of chirality and conductivity within the same molecular lattice. The potential of producing materials which exhibit both chirality and conductivity was realised when Rikken et al.[1] discovered the Magneto Chiral Anisotropy Effect. A phenomenon in which chiral helical carbon nanotubes showed a difference in resistivity depending on the enantiomer being tested. Charge transfer salts can hold more than one property within the lattice, but synergistic characteristics can also arise from the interactions of two or more properties. The inclusion of chiral components in the materials synthesised is a step taken to induce a form of the MChA effect and also to investigate any other phenomena, including superconductivity, that could arise from this pairing. Each charge transfer salt will effectively be produced in three enantiomeric forms: the *S*, *R* and *racemic*, these notations refer to the three different forms a chiral molecule can adopt.
Two families of salts have been synthesised previously using the facilitites at Nottingham Trent university. One family containing a chiral molecular conductor (donor 18) and simple anions: ClO_4^- and PF_6^-. The other family contains an achiral molecular conductor and uses a boron complex synthesised using the handed malic acid ligand in order to introduce chirality into the system. These two families of salts need to be categorised both structurally and physically; the facilities at Tokyo Metropolitan University are ideal in order to complete this.

1. G. Rikken, K. Kan, M. Burghard, S. Roth, V. Krstic, J. Chem. Phys., 2002, 117(24), 1131-35.

7. Research implementation and results under the program

Title of your research plan:

Structure and Properties of Multifunctional Molecular Materials – The effect of combining chirality and conductivity within the same molecular lattice.

Description of the research activities:

Characterisation of charge transfer salts. The salts were synthesized previously in the laboratory of my home institution at Nottingham Trent University.

In the family of salts containing the chiral boron complex, two salts have been structurally analysed using the X-ray diffractometer. This includes full structures for the *S* and *racemic* salts. Conductivity measurements were not able to be completed due to time constraints.
The family of salts containing donor 18 and simple anions consists of six samples. Three containing PF_6^- and three containing the ClO_4^- anions. The penultimate structure needed (ClO_4.*R,R*donor18) was solved during the time here. Ambient pressure conductivity measurements on one sample of PF_6.*S,S*donor18 were completed showing the salt to be a semi-conductor. Other Samples of this family were attempted to be prepared for resistivity measurements under ambient, uni-axial and hydrostatic pressure. Due to time constraints the measurements were not able to be completed. However, this presents an opportunity for further collaboration as data could be collected in the coming weeks by a member of the research group at Tokyo Metropolitan University. Valuable techniques have been learned including the preparation of samples for resistivity measurements.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):
Visited Osaka University Chemistry department for one week to liaise with the research group and use the X-ray diffractometer under the supervision of Assistant Professor Hiroki Akutsu.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Benjamin May （ID No.:SP14112 ）

2. Current affiliation:

University of Sussex, UK

3. Research fields and specialties:

Biological Sciences

4. Host institution: Department of Biomedical Chemistry, Graduate School of Medicine, University of Tokyo.

5. Host researcher: Professor Kita

6. Description of your current research

The ultimate goal of my research is to fully understand the structure-function relationship of the plant, fungal and trypanosomal alternative oxidases in an attempt to understand why small changes cause a functional diversity. Subtle structural differences between the plant AOX and trypanosomal AOX (TAO) have led to difficulties in crystallising the plant protein; the two proteins also contain functional differences, such as the plant AOX is regulated by α-keto acids, whereas TAO appears unregulated and consequently possess a higher turnover number. Hence an understanding of the structural causes of these major differences in the same protein should provide important information with respect to how structure structure influences function. Furthermore in light of the growing importance of AOX as a specific drug target for treatment of anti-parasitic and fungal diseases (such as Ash Dieback), a part of my research is focused on the synthesis of potent AOX antagonists, which will eventually result in improved drug design.

7. Research implementation and results under the program

Title of your research plan:

Further investigations into the structure-function relationships of the alternative oxidase.

Description of the research activities:

- Successfully grew up *E. coli* expressing plant, fungal and trypanosomal AOX
- Successfully learnt the protocol for the purification of trypanosomal AOX from E. coli membranes
- Successfully adapted the above protocol to purify the plant AOX.
- Produced an efficient purification procedure for purifying the fungal AOX.
- Assayed the effect certain compounds have on increasing the quinol oxidation rate of different AOXs. Fungal is highly stimulated in the presence of GMP and Fe(II). Where plant is only somewhat stimulated by GMP and trypanosomal AOX is not stimulated by either.
- Purified sufficient quantities of fungal AOX for crystallization and set up a crystal screening in 3 different detergents and changing the pH and PEG concentration in the reservoir buffer.
- Developed a novel assay system for reconstituting the NADH/quinone cycle *in vitro* to determine the efficiency the AOX has for oxidizing natural and non-natural quinols.
- Attempted to reconstitute the NDi1 protein into liposomes with plant AOX to assay longer chain quinols that are insoluble in aqueous solutions.
- Tested the efficacy of known AOX inhibitors on the fungal AOX.

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

- Fantastic placement with exceptional supervision.
- I have learnt plenty of new techniques, improved old techniques and developed as a scientist.
- The work hours were very long which was an original shock but actually allowed me to achieve more than I would have done in a typical 9-5 day.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Richard Taylor
（ID No.: SP14113）

2. Current affiliation: The University of Sheffield

3. Research fields and specialties:
Engineering Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Yoshi Nakano and Takuo Tanemura

6. Description of your current research

Semiconductor lasers are at the heart of many of the photonic systems which enable a huge and diverse range of applications from communications through to sensing, imaging, and industrial processing. However, existing semiconductor laser devices emit beams of radiation which are usually highly divergent, with linear polarization dictated by the device design, and limited single-mode power and hence low brightness. The brightness of a laser is defined as the power divided by the solid angle hence high brightness requires high power and low divergence.

Photonic crystal surface emitting lasers (PCSELs) offer ultimate control over emission properties as well as having power that scales with device area. By design of the photonic crystal (PC) it is possible to control device operation wavelength, polarization, beam shape and divergence ($\sim 1^0$), while giving high power through device scaling. In order to obtain high brightness, strong coupling between the photonic crystal and the in-plane wave-guided mode is required. Such devices not only offer high brightness, but also the ultimate in control in laser beam polarisation, shape, and wavelength, for many commercial areas including; telecommunications, optical computing, printing, and optical displays.

In Sheffield, regrowth was optimised to eliminate the appearance of voids within the photonic crystal layer. Devices manufactured with this process gave room temperature lasing with low divergence. The lasing wavelength was shown to vary with photonic crystal pitch, demonstrating that control in lasing properties had been achieved. Additionally, I was able to confirm the accuracy of modelled data and I have been able to develop modells to allow consideration of device coupling and polarisation as well as the photonic band structure.

7. Research implementation and results under the program

Title of your research plan:

Development Photonic Crystal Surface Emitting Lasers

Description of the research activities:

In photonics, many simulation methods (such as FDTD and PWE) solve the forward problem, they start with a structure and solve maxwell's equations to give resulting fields. Inverse design, by contrast, asks: for a desired electromagnetic field, what is the required geometry? By solving problems in this manner simulation time can be rapidly reduced and a wider range of parameters can be considered. There are however limitations, it is not necessarily the case that a solution exists or that that it will be possible to implement that solution.

In Tokyo, Professor Tanemura introduced me to a form of inverse method known as adjoint method My work has continued to focus on the optimization of photonic structures. I have developed a program that will interface with existing modeling software (MEEP) to enable the adjoint method to be applied to photonic crystal design. This required understanding the adjoint method and being able to follow the mathematics involved, exploring the simulation packages available to generate the required fields, performing the mathematics on the fields generated and interfacing the mathematics with MEEP.

We are now at a stage where we will be to use this program to design many photonic structures, including photonic crystals, which I hope will be a continued collaboration with Tokyo University.

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

During my stay I was invited to Kobe to give a seminar on my research and I took the opportunity to see Kobe, Kyoto and to climb Fuji on the way back.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Malick Camara （ID No.: SP14 201 ）

2. Current affiliation: Institut Mathématiques de Jussieu

3. Research fields and specialties: Mathematical and Physical

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:Hiroshi Iritani

6. Description of your current research

The moduli spaces of curves are objects studied in mathematics and physics. They interest different domains of mathematics and have an important role in string theory. Their cohomology ring is not known well but we can study a subring where yields most of the objects of current interest in mathematics and physics. We call this one the tautological ring and it my subject of research. With my advisor in France we try to describe this one completely. For now, I am more focused on the degree g-1 of the tautological ring of the moduli spaces of curves of genus g which is the object of one of my advisor's conjecture.

7. Research implementation and results under the program

Title of your research plan:

Tautological relations via 3-spin structures.

Description of the research activities:

We have been studying Cohomological field theories, Witten's class and Frobenius manifolds in order to understand how they yield to non-trivial relations in the tautological. In other words we studied the annulation of some polynomials in cohomological classes. This permit to describe the cohomology of moduli spaces. In particula, we studied in details an article gathering the big notions involved in the study of the cohomology of the moduli space of curves.

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

There is a lot to say about my cultural experience in Japan. It has been very rich. Professionally I appreciated a lot the atmosphere and I found it was a good one to work.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: CARLIER Capucine

（ID No.: SP14202 ）

2. Current affiliation: PhD student , Laboratory of Mechanics and civil Engineering (LMGC), University Montpellier 2, France

3. Research fields and specialties:

Wood Sciences

4. Host institution: Main institution : Graduate School of Bioagricultural Sciences and School of Agricultural Sciences, Nagoya University, Japan

5. Host researcher: : YAMAMOTO, Hiroyuki

MATSUO, Miyuki

6. Description of your current research

Wood as raw material of many musical instruments plays an essential role in their acoustic, aesthetic or technical quality therefore in their identity. Among the many woods used in musical instruments, the term «resonance wood " is employed to describe those used for the soundboard of string instrument (spruce) and for the resonator box. The “resonance woods” for the making of violin family have benefited from more research than other instrument making woods, however often not taking into account the interactions between different disciplines and domains of expertise. The objective of my Phd is to improve the understanding of the interactions between physic-mechanical properties of resonance wood, their natural variability, and the actual expertise of violin makers in the selection and qualification of their raw material. To do so, my work consists in a characterization of the physical and vibrational properties (density, anisotropic specific moduli and damping coefficients), acoustical “performance indexes”, and visual/structural characteristics (growth-ring uniformity and percentage of latewood) of the wood. We also designed of a socio-technical survey to identify violin makers’ opinions and practices on both qualitative and quantitative grounds and we will conduct a complete psycho-sensory evaluation of wood choice by instrument makers.

7. Research implementation and results under the program

Title of your research plan:

Precising structure-properties relation of resonance woods and determining its visual perception by users and its-mechanical-acoustical properties.

Description of the research activities:

Wood for violin making is very finely pre-selected, so it is a good material to do precise structure-properties research. The main part of the proposed research plan in Japan was to conduct experiments in the Graduate School of Bioagricultural Sciences and School of Agricultural Sciences at Nagoya University to determine the microfibrille angle (MFA) of cell wall for “resonance spruce” by using X-Ray diffraction. Prof. Dr. Yamamoto is a well-known expert on relations between wood cell-wall features and mechanical behavior, and Assist. Prof. Matsuo research works include both wood physic-chemistry, wood in cultural heritage, and link between wood surface analysis and visual features. So we characterized the MFA of Earlywood and Latewood taking into account the variability in the plate and the different quality of the resonance spruce according to the wood supplier.

The stay in japan was also the opportunity to improve our methods for assessing visual perception of violin-making wood. The aesthetical perception of the wavy maple used for the violin is an important criteria to choose the wood for the bottom of the violin. Assist. Prof. Matsuo introduced me to Prof. Nakamura, the main specialist of visual perception of wood, for a short visit at Kyoto University. We discussed on different methods to evaluate the appearance and aesthetic visual properties of wood, and on the evaluation of visual differences among wood. To access the noticeable features and the change of appearance of wavy grain on our plates, we captured images of violin figures by gonio-photometric technique and then we analyzed our images by multi-resolution contrast analyses (MRCA).

To improve our knowledge on vibrational properties of resonance wood, we also took good advices, by visiting Prof. Obataya (University of Tsukuba) as an expert on vibrational properties of wood. I measured vibrational properties of some of my samples by torsional vibration in his Lab and confronted it with the results obtained in France by free-free flexural vibration method. We also discuss on the possibility to duplicate his torsional vibration experiment in my lab in Montpellier which could lead to more collaborations between our labs.

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

Being able to work in three different laboratories was a great opportunity for me. This allowed me to see and learn a lot, and to have amazing discussion (in a scientific and cultural point of view). This very nice experience was permitted only thanks to the fantastic warm welcome and assistance of the three labs.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Di Molfetta Giuseppe (ID No.: SP14 203)

2. Current affiliation: LERMA - Observatoire de Paris, CNRS - UPMC

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Department of Theoretical and Computational Molecular Science - Shikano Group - NINS - Okazaki

5. Host researcher: Yutaka Shikano

6. Description of your current research

My PhD research is focused on quantum walks, both linear and non-linear. Linear quantum walks have been introduced by Aharanov (Phys. Rev. A, 48:1687(1993)) as formal analogues of classical random walks. They are very useful models of coherent quantum transport in a large variety of contexts, ranging from optical systems and nano-materials like graphene to complexes of algae. Quantum walks are also fundamental bricks for quantum algorithmic.

During the first year of my PhD, I have revisited the continuous limit of quantum walks in one and two spatial dimensions and I have shown that walks in homogeneous media can be interpreted as sermonic transport in artificial electromagnetic and gravitational fields. The groups of Professor P Mataloni and F Sciarrino in Rome is currently planning an experiment based on this theoretical result.

On the numerical side, I have developed new codes which make it possible to simulate both linear and non-linear quantum walks through pseudo-spectral methods and I have started using these codes to study noise-induced decoherence of linear quantum walks.

7. Research implementation and results under the program

Title of your research plan: Non linear quantum walks

Description of the research activities:

I have investigated deeply a non linear quantum walk model introduced by Yutaka Shikano and others in 2013 and I have generalized it. I focused firstly on the features of the discrete time model and then studied the continuous limit of this model.

In particular the continuous limit of such a model suggests us that the latter can be understood as a massless Dirac fermion propagation interacting with a gravitational metric and an electric potential auto-induced by the particle density itself. This is a very important result because underlines some importants connections between non linear quantum walks and general relativity. This results will be submitted in a letter communication signed by me, Yutaka Shikano (IMS), Marc Etien Brachet (LPS-ENS, Paris), Fabrice Debbasch (LERMA, Observatoire de Paris).

In addition to this in the first part of the JSPS program I had the honor to be the mentor of the internship of two Australian students at IMS, about a particular family of non-homogeneous quantum walks, the aperiodic quantum walks, introduced by P. Ribeiro in 2004. The results of that project are submitted as a letter communication signed by me, Yutaka Shikano (IMS), Lauchlan Honter and Ben B. Luo (School of Physics, The University of Western Australia), Tatsuaki Wada (Ibaraki University).

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

The work experience at IMS, in Shikano Group is very instructive and reach. The group is very dynamic and implements several international relationships. I have also visited, during a conference, the Yukawa Institute at Kyoto university and it was really an interesting scientific meeting with many brilliant scientists.

About the cultural experience, Japanese people are mysteriously very difference from us. They put in advance the respect without prejudice. This is really relaxing for your/our mind and spirit.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Jonathan FOUINEAU （ID No.: SP14204 ）

2. Current affiliation: Université Denis Diderot (Paris 7), ITODYS laboratory

3. Research fields and specialties:

Chemistry

4. Host institution: Tohoku University, IMRAM

5. Host researcher: Prof. Kozo SHINODA

6. Description of your current research

The goal of my thesis is to obtain highly reliable hybrid thermoelectric materials by grafting conducting oligomers onto bismuth chalcogenide nanoparticle surface. The combinations of inorganic nanoparticles with a conducting polymer are expected to show synergetic properties.

The first part of my thesis consisted in synthesizing nanoparticles of a well-known and an efficient thermoelectric materials: Bi_2Te_3 using the polyol route. This cheap and scalable soft chemistry synthesis route, permits the preparation of well-controlled (in size and shape) nanoparticles thanks to complexing and reducing properties of polyol solvents. I have developed a procedure to obtain Bi_2Te_3 nanoparticles. Micro-hollow spheres constituted of single-crystal Bi_2Te_3 nanoplatellets were obtained with the addition of a non-miscible alkanethiol. This compound forms bubbles in glycol under appropriate stirring, serving as template for the formation of the hollow spheres.
Besides Bi_2Te_3 crystals, we chose to replace part of the expensive and toxic Te element by the abundant and cheap sulfur element. Modeling studies performed by one of our collaborator has recently shown that doping Bi_2Te_3 with S could reduce the gap and then increase the conductivity compared to Bi_2Te_3.

The preparation of conductive oligomers funtionalized with thiol ends have also been carried out and currently, I am working on the preparation of hybrid materials.

I am also working on the optimization of the sintering of the inorganic nanoparticles in order to determine their thermoelectric properties which would serve as a base of comparison with the hybrid materials.

7. Research implementation and results under the program

Title of your research plan:

Effect of the Sulphur doping on the Bi_2Te_3 structure using Extended X-ray Absorption Fine Structure (EXAFS) spectroscopies.

Description of the research activities:

Using the Institute of Multidisciplinary Research for Advanced Materials (IMRAM) equipments, I have been able to reproduce the Bi_2Te_3 nanoparticles synthesis that I have developed in my laboratory. Subsequently, I have worked on the sulfur and selenium doping of the particles. Professor Kozo Shinoda introduced me to Dr. Takahashi working on the sulfidation of nanomaterials in the Prof. Tohji laboratory, Tohoku University. Dr Takahashi allowed me to try a sulfidized treatment experiment on my Bi_2Te_3 nanoparticles. After that, I was able to compare the size and the shape of the particles using TEM and the cell parameters of the Bi_2Te_3 crystal by XRD, before and after treatment. I have also characterized the presence of sulfur on the nanopaticles after treatment by XPS.

EXAFS equipment of the IMRAM allowed me to reach the energy region of Bi L3 (13.4keV) and L1 (16.4keV) to solve the materials structure of Bi_2Te_3 doped materials. A modification of the Bismuth environment in the doped materials could be identified. The results are still under investigation to study the influence of the Sulphur and the Selenium content.

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

I would like to thank my host, the professor Kozo Shinoda and his entire team for their warm welcome, for their help in the laboratory and to have made me discover this beautiful city of Sendai.

I have had the opportunity to go at the synchrotron station Spring-8 to discover their facilities.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: GOTHIÉ Jean-David （ID No.: SP14205 ）

2. Current affiliation:

Muséum National d'Histoire Naturelle
MNHN USM 501, Dept. "Régulations, Développement et Diversité Moléculaire"
7 rue Cuvier, CP32
75231 Paris Cedex , FRANCE

3. Research fields and specialties:

Biological Sciences

4. Host institution:

Laboratory of Molecular Biology
Main Bldg. 3F No. 333-338
Graduate School of Pharmaceutical Sciences, The University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

5. Host researcher: Pr. Y. GOTOH

6. Description of your current research

Thyroid hormones (THs) modulate maturation of both neurons and oligodendrocytes. Our team showed that THs contribute to controlling neural stem cell (NSC) proliferation and commitment in the adult murine subventricular zone (SVZ), one of the major neurogenic niches in the mammalian brain (Lemkine, G. F., et al., 2005; López-Juárez, et al., 2012). However little is known about how THs affect adult neurogenesis and early cell fate decision between oligodendrocyte and neuronal lineages.

We aim to understand what factors are decisive for the commitment of progenitor cells (derived from NSCs) and the influence of THs in this process. After identifying potential key genes through sequencing, in vivo gain and loss of function experiments will be done together with modulation of the expression of different actors of THs pathways to analyze consequences on the cell fate switch neuron *vs* oligodendrocyte.

We also know that THs influence energy metabolism (especially, mitochondrial activity), an important regulator of adult NSC biology. We plan to analyse how THs and energy metabolism cooperate to regulate the progenitor cell fate choice, through comparing mitochondrial activity and structure in neuronal and oligodendrocyte precursor cells.

Results are expected to provide greater biological perspectives to better define the optimal hormonal contexts for stem cell-based therapeutic approaches for stroke and neurodegenerative pathologies.

7. Research implementation and results under the program

Title of your research plan:

Influence of thyroid hormones (THs) on adult neural stem cells (NSCs) formation, activation and differentiation

Description of the research activities:

Thyroid hormones deficiency during specific time windows of the brain development can lead to irreversible brain damages, but the impact of THs on adult NSCs generation in the developing brain is unknown. We thus began here a study of perinatal hypothyroidism impact on neural stem cell formation. Besides, THs and p57 actions both being of capital importance for adult neurogenesis, we also decided to investigate if a cross-talk exists between these two factors for adult neurogenesis regulation.

1. Influence of THs in adult NSC formation

Pregnant mice have been fed with iodine-deficient food to prevent them from producing THs as from embryonic day 11.5 (E11.5). Brains of the pups have been dissected at post-embyronic day 1 (P1), P15 and P28. Immuno-histochemistry stainings for specific cell markers have been performed to identify the NSCs but need to be improved. The number of adult neural stem cells in hypothyroid and control pup brains will then be compared.

2. Influence of THs on p57 control of adult NSC quiescence

Two-month old adult mice have been fed with iodine-deficient or normal food and divided in two groups : a control group in small cages and a group in large cages with access to running wheels. It has been shown that running will indeed induce neurogenesis by abrogating NSC quiescence, involving a decrease in p57 gene expression in NSCs (Lugert S, et al., 2010; Furutachi, S, et al. 2013). Immuno-histochemistry stainings have been performed around the SVZ to identify proliferative cells, cells engaged in the neuronal differentiation process, and cells producing p57 and/or thyroid hormone receptor alpha (Thra) proteins. Counting of the different cell markers need to be completed in order to determine if the absence of THs had an impact on aNSC proliferation. A co-staining of Thra and p57 has been implemented and shows an interesting expression pattern near the SVZ that will need further investigations.

3. Influence of THs on embryonic and adult NSC cultures *in vitro*

Both embryonic and adult NSCs have been cultured with or without addition of active thyroid hormone at different concentrations to study the impact on NSC proliferation and differentiation. After 3 days culture, gene expression analyses by qPCR have been performed on the cell populations, showing a potential impact on expression of deiodinases (enzymes controlling THs activity) and nestin (marker of NSCs). Results analyses need to be completed to confirm expression changes in those and other analyzed genes. Immuno-cytochemistry stainings are ongoing to determine the impact on cell differentiation.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): A formidable experience in a lab with a very motivating work environment and very helpful people.

9. Advisor’s remarks (if any): Jean-David is a very motivated, smart and hardworking visiting student whose presence stimulated everybody in the lab both culturally and scientifically. I look forward to our future interactions and his great accomplishments.

RESEARCH REPORT

1. Name: Hadrien Grasland

（ID No.: SP14206 ）

2. Current affiliation:

Univ. Grenoble Alpes, Inst NEEL, F-38042 Grenoble, France

CNRS, Inst NEEL, F-38042 Grenoble, France

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:

Material Science Research Laboratory, Central Research Institute of Electric Power Industry (CRIEPI), Tokyo

5. Host researcher:

Shimpei ONO

6. Description of your current research

Superconductivity is known to be strongly enhanced in low-dimensional, layered materials, such as cuprates, ion pnictides, and transition metal dichalcogenides, where there is a strong interplay between magnetic, charge, and lattice degrees of freedom. However, in spite of decades of research, the physical origin of this enhancement remains ill-understood. My PhD work is dedicated to the experimental study of the magnetic and electrical properties of these materials.

One of the main techniques that are used to this end is Scanning Hall Probe Microscopy, which allows for large-scale imaging of a sample's magnetic response with high field resolution, on a large temperature range. It is a particularly valuable tool when studying vortex trapping and relaxation dynamics in type II superconductors.

The other main technique that is being used is Point Contact Spectroscopy, which provides information on the superconducting gaps and the electronic interactions that either give rise to superconductivity or compete with it.

I have taken part in the development of the experimental setup that is used to these ends, which allows both measurements to be carried out on a single sample without any direct sample manipulation occuring inbetween.

7. Research implementation and results under the program

Title of your research plan:

Electrolyte gating of the superconductor $TiSe_2$ using an ionic liquid

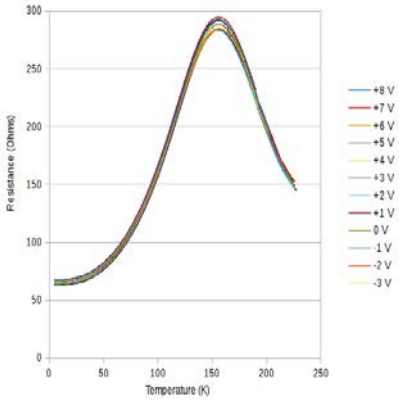
Description of the research activities:

The properties of superconductors depend on the amount of charge carriers, such as electrons, inside of them. This property is usually tuned by altering the chemical composition of a material. But such substitutional or interstitial doping always induces some structural disorder, giving unnecessary complexity to the system.

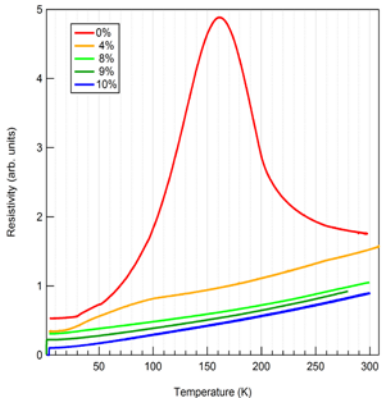
Recently, much effort has thus been dedicated to the alternate approach of field-effect doping, which offers in-situ, electrical control of charge carrier density. This summer, I used this technique on $TiSe_2$, which exhibits superconductivity upon chemical copper doping, to compare the effect of both doping methods.

Since field-effect doping only has an effect close to the surface of a cristal, $TiSe_2$ crystals with various copper dopings were first exfoliated into thin flakes. The electrical resistance of the flakes was then studied as a function of temperature. After that, field-effect doping was applied, using an ionic liquid as an electrolyte. Its effect could thus be compared to that of copper doping.

The effect of field-effect doping on resistivity turned out to be remarkably small, compared to that of copper doping. As copper doping does not only modulate carrier density, but also distorts $TiSe_2$ crystals, these results hint at the possibility that this structural distortion may be indispensable to achieve superconductivity in this system. Further studies would be required to investigate what may be a major discovery about the physics of $TiSe_2$.



Effect of gating on $TiSe_2$ flake resistance



Effect of Cu doping on $TiSe_2$ flake resistance

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: HOSTACHY Sarah （ID No.: SP14207 ）

2. Current affiliation:

PhD Student, Laboratoire des Biomolécules (UMR7203), Université Pierre et Marie Curie, Paris, France

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:

Department of Synthetic Chemistry and Biological Chemistry, Kyoto University

5. Host researcher: Pr Itaru Hamachi

6. Description of your current research

The imaging of biomolecules inside cells or tissues is a powerful tool to understand biological processes since it allows observing the biomolecules in real-time. Fluorescence microscopy imaging is widely used in biology, but alternative techniques of imaging, like infrared imaging, are also emerging. However, imaging biomolecules in their environment requires to label them selectively with a probe.

Recently, our group developed molecular probes that could be detected by fluorescence and infrared microscopies, thus taking advantage of the complementarity of both techniques. As a PhD student in the Laboratory of Biomolecules, I aim at labeling proteins with these bimodal probes, also called SCoMPI (Single Core Multimodal Probes for Imaging).

The group of Pr Itaru Hamachi develops strategies to label selectively native proteins with small molecular probes in complex media like cells. We chose to use one of these strategies, called “Ligand-Directed Acyl-Imidazole” (LDAI) strategy (see Figure 1), to label Carbonic Anhydrases IX and XII, two membrane proteins overexpressed in some cancers, with our bimodal probe.

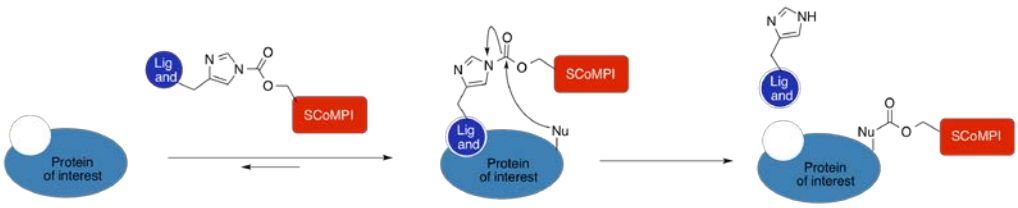


Figure 1 Principle of the LDAI strategy

7. Research implementation and results under the program

Title of your research plan:

Labeling of proteins in living cells for Infrared and Fluorescence Imaging

Description of the research activities:

First, I synthesized four LDAI-SCoMPI labeling reagents with various properties (ligand, linker, etc.), in order to test their labeling efficiency. Then, I performed *in vitro* labeling experiments on Carbonic Anhydrase I (CA I), a water-soluble isoform of Carbonic Anhydrases IX and XII (CA IX and CA XII). For each synthesized compound, the labeling efficiency was determined at different incubation times both by MALDI Mass Spectrometry and SDS-PAGE gel analysis. These *in vitro* experiments allowed us to determine the best candidates for the labeling of endogenous CA IX and XII in living cells. We could then perform *in vivo* experiments on A549 cells. Under hypoxic conditions, these cells overexpress CA IX and XII. After incubation in presence of our LDAI-SCoMPI reagent, we were able to observe membrane luminescence on living cells, due to the labeling of endogenous membrane-bound CA IX and XII. Finally, we will prepare samples for infrared microscopy that will be imaged in France.

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

Living and working in Japan has been a wonderful experience. I feel very grateful for this opportunity that was given to me, and for the kind welcome in my host laboratory. During my stay, I could learn a lot of techniques and interact with Japanese colleagues about science, but also Japanese (and French!) cultures. The orientation week was also a highly valuable experience. I am looking forward to coming back!

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Sylvaine JACQUART （ID No.: SP14208 ）

2. Current affiliation: Institut Carnot CIRIMAT (Toulouse, France)

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: Keio University

5. Host researcher: Pr. Testsuhiko ISOBE

6. Description of your current research

Bone is a composite material whose mineral phase is a calcium phosphate: hydroxyapatite. This compound has great interest, first because of this biomimeticity that induce high biological properties such as biocompatibility and resorbability in vivo. But apatite is also an exciting compound in terms of physico-chemical properties: its structure has certain flexibility and allows substitutions by many kind of ions. In the CIRIMAT Institute were developed different way of apatite synthesis, especially nanoparticles whose size and crystallinity can be controlled. For all these reasons, we chose to use apatite as a biocompatible matrix for developing luminescent particles for medical imaging, by adding dopants into the material. Eu^{3+} doped apatite compounds were studied in CIRIMAT Institute the idea was to determine if Mn^{2+} could be another interesting candidate for inducing red luminescence properties to the materials. I performed a preliminary study both in CIRIMAT Institute in France and in Goa University in India about the feasibility of colloidal and non-colloidal suspensions of Mn-doped apatite adjusting different parameters of the usual precipitation synthesis pathway such as manganese content, pH of solutions, maturation time, etc.

7. Research implementation and results under the program

Title of your research plan:

Photoluminescence study of Mn-doped apatite

Description of the research activities:

During this summer program, I analyzed the photoluminescence (PL) properties of compounds synthesized during my preliminary study. Given the low luminescence intensity obtained on those first samples, I worked on adjusting progressively the composition by series of synthesis. Besides manganese, cerium and sodium were added as co-dopants, the first playing a role in an energy transfer mechanism and sodium to ease the Ca^{2+} substitution by Ca^{2+} by Ce^{3+} by equilibrating charges. Concentration quenching effects of the different ions were observed, leading to optimization of the dopants content. On the other hand, it was evidenced that hydroxyl groups quench cerium and manganese luminescence, thus fluorine was introduced as a reactant in order to substitute these OH-groups. A study of OH content in the different synthesis was carried out by mathematical decomposition of Fourier Transformed Infrared (FTIR) spectra and I tried to establish a correlation between these data and the emission intensity of the luminescent centers.

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

Japan was for me a great discovery, I knew really few before coming and I enjoyed every moments I have spent here!

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Laure KONNERT (ID No.: SP14209)

2. Current affiliation:

Institut des Biomolécules Max Mousseron, Université Montpellier 2

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 University, Department of Synthetic Chemistry and Biological Chemistry, Graduate School of Engineering

5. Host researcher: Pr. Michinori SUGINOME

6. Description of your current research

My research project is focused on green chemistry and particularly on solventless organic synthesis via mechanochemistry.

The first part of the project dealt with the solventless N- and C-protection of amino acids.

The solventless synthesis of bioactive molecules are now under investigation, using enabling technologies as ball-milling, microwaves and continuous flow process.

7. Research implementation and results under the program

Title of your research plan:

Asymmetric Suzuki-Miyaura cross-coupling using helical polymer-based ligand PQXPhos.

Description of the research activities:

My research in Japan focused on the asymmetric Suzuki coupling of various boronic acids with alkyl and aryl bromonaphtoates, using the helical and chiral polymer-based ligand which was developed in my host institution.

Starting on preliminary results, I made a scope of naphtyl bromides in the asymmetric cross-coupling reaction with o-toluene boronic acid. I determined for three bromides the best ligand and optimal conditions to use in the reaction. Based on these results, I then made a scope of boronic acids in the asymmetric cross-coupling with two of the selected bromides. The results of these experiments enabled me to explore the dependence of the enantioselectivity of the final compounds on the bulkiness of the substrates.

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: Eric Maestri (ID No.: SP14210)

2. Current affiliation: University of Strasbourg

3. Research fields and specialties:
Humanities

4. Host institution: Graduate School of Information Science, Nagoya University

5. Host researcher: Prof. Akiba Fuminori

6. Description of your current research

This research period is dedicated to describe and analyse the contact point between musical score and tactile score. The hypothesis is that touch sense is at the base of both ways of writing (as prescribing) intentional actions.

Questions

Is there a correspondence between ways of listening and ways of writing? Can we talk of a causal paradigm in music?

Is there a direct link between ways of listening and ways of writing? Is there a relationship between the ontological futures of sounds and way of scoring? Can we sketch a connection between disambiguation and the prescriptive notation of scores and programs? Can we also try to describe the cycle that includes composer, instrument and notation? In the specific case of an hybrid art form as mixed music can we trace some aesthetic relationship about the sum of electronic and instrumental sound and their original futures?

Our hypothesis is that ways of listening and writing belong to same causal sound process. The causal process that rest behind production and diffusion of sound includes notation and perception of sound.

Can we conceive scores as an interfaces for music mediation?

Scores are the result of the interaction in an environment and that scores are goal oriented and have a prescriptive dimension also in electronic mixed music.

The concept of environment is related with the concept of perception and action in a determined context. How electronic sounds interacts with instrumental sounds and how this interaction is based on objective futures of sounds? Is the score the result of these objective futures constraints? How it works in the case of technology music mediation? This amount of questions must be reduced to the fundamental question of

external perception and internal intentionality.

7. Research implementation and results under the program

Title of your research plan: **Ways of listening and writing in mixed music**

Description of the research activities:

In music we can find examples of direct relationship between representation and music – instead of thinking of a casual and cultural relationship.

For instance we can try to define how the sounds employed define programming and notational choices. Temporal pivots in Stroppa's music reveal the close connection between conceiving sound and conceiving scores and interaction. The continued sound of the spectral composers need a metronomic synchronization because of the lack of possible temporal pivots or clear perceptive events. The hierarchical organisation of spectral sounds is not enough defined to be the base of the interaction, sound itself hasn't enough information to guide a performance.

The score could be conceived as the result of an action-reaction cycling between the possibilities of the instruments and the possible synthesis of sound complexity; the ratchet effect conduct to define a score that is the at the middle point between the constraints of meaning, sound and possible realization of it.

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

During the permanence in Nagoya University I could have many contact with the japanese research system and I have the occasion to visit important collections and museums of musical instruments, icons and cultural history of Japan that complete the researches made in the seminars discussion. The model of the seminar with brain storming on the subject of my research was extremely useful and hopefully can continue in some forms in the future.

9. Advisor’s remarks (if any):

In these two months Mr. Maestri has proven himself to be a highly motivated and productive scholar with a broad knowledge in musicology and wide experience as composer. Especially he proposes a creative interpretation on our 'tactile score.' His efforts in Japan will surely bear fruit in the near future.

RESEARCH REPORT

1. Name: Mamane Alexandre
（ID No.: SP14211 ）

2. Current affiliation:

Institut Curie, Paris, France

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 of Mishima

5. Host researcher: Akatsuki Kimura

6. Description of your current research

My PhD subject is the Collective behavior of molecular motors within biological functions. The ongoing project we work on with Akatsuki Kimura is based on experiments performed in his laboratory on the meiotic cytoplasmic streaming (MCS) in C.elegans oocyte.This phenomenon implies kinesin molecular motors walking on microtubules in the cortical region of the cell, which synchronize their activity through mechanical interactions, leading to the emergence of a cell scale flow. I am deveopping a model to describe the phenomenon and the effects of experimental modifications (inhibition of kinesin, disruption of ER, modification of microtubules dynamics by katanin) on the flow. We also want to understand how this cortical flow shears the cytoplasm. It is indeed a question of interest because the group has shown that the MCS is necessary for proper exocytosis of cortical granules, which generates an egg-shell that protects the oocyte from mechanical and osmotic stress.

7. Research implementation and results under the program

Title of your research plan: Modelling meiotic cytoplasmic streaming in C.elegans oocyte.

Description of the research activities:

- I had set the equations describing the flow in planar geometry before to come. I projected them on an ellipsoid surface geometry in order to reproduce the flow profile obsereved experimentally. It is an interesting example to study how geometry influences the self organization of the flow.
- We progressed on the redaction of the first article to be published on these experiments, and for my part in the redaction of the theoretical section, and in the drawing of the figures.
- I started observing how the equation is modified when 3rd dimension of the layer is taken into account.
- We started a new collaboration with Tomo Kondo, post doctoral student in A.Kimura'as team, on the mechanical interaction between mutiple microtubule asters in vivo (model system C.elegans). Some effects due to the high number of centrosome seem to be new and interesting.
- I realised first measurements on the compression of a 1 cell stage C.elegansembryo in glass tube, to study the effect of mechanical constraints on the division dynamics and on the cleavage pattern. Ths experiment will be conducted by another student of the team in the future.

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

I find the lifestyle in Japan very interesting, I think people receive an education which is different from my country, I want to know more about it and bring this different experience to my country.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Sabine PASDELOU
（ID No.: SP14212 ）

2. Current affiliation: University of Paris Ouest Nanterre La Défense (France)

3. Research fields and specialties:
Cultural & Social Sciences

4. Host institution: University of Tokyo, Department of Comparative Literature and Culture, Graduate School of Arts and Sciences – Komaba

5. Host researcher: Prof. Atsushi MIURA

6. Description of your current research

My doctoral project is focused on the study of japonism in French pottery factories between 1861 and 1939. I explore the japonism expansion in the context of decorative arts for the masses. Indeed, this thesis project deals with one particular aspect: the Japanese productions produced on a large-scale. Industrialization brings cheap products to all classes. These inexpensive items had to correspond to several aesthetics and practices and fit all the sensibilities of the *petite bourgeoisie* (according to their personal histories, their education and their social environments). By focusing in the same style as collective motion, the different social and artistic environments provided producers with a direction to follow in making models. Business strategy of manufacturing has been shaped accordingly.

For this project I have to study the mediation of the ceramics as commodity thanks to the stores. Indeed, this reflection allows analyzing the massive distribution network on the French territory. Several department store, curious shops and ceramics shops furnished both Japanese curios and Japanese-style ceramics. For this analysis, I study the catalogues stores, bills and bankruptcy records. A couple of these documents give both the types of objects which were sold and highlight the network. The catalogues of the stores propose furniture according to the fashion of the time and at reasonable price: so the public could adhere in mass. There are also decoration handbooks which devote many lines to ceramics. Japanese art and Far East art were perceived as being the model to be followed for the decoration of the home, because of the aesthetics quality and its adequacy with these theories of furnishing at reasonable prices. We can see the same speeches on decoration handbooks, the press, decoration periodicals, women’s magazines, photography, illustrations and movies. Moreover, I compare these sources with bills, bankruptcy files of several types of professional activity because it’s offer an interesting and global viewpoint of the reception of Japanese art and Japanese-style ceramics since 1880 to 1939. Finally, the reception and social uses of these commodities will make possible to think about topography of the objects in the home.

7. Research implementation and results under the program

Title of your research plan:

From Japan to France: trade and consumption of curios between the middle of the 19th and early 20th century

Description of the research activities:

My research under the JSPS Summer program was focused on the understanding of Japanese crafts production and the study of the trade of Japanese curios and ceramics between France and Japan. I studied the diplomatic archives at the cities of Yokohama, Nagasaki and Kobe where several documents dealing with the foreign trade are kept. I could obtain the total of commodities (value of export/import by year) and defined the various actors who intervened in the trade. These archives both in French and English are precious witnesses of the development of the curio market between Japan and France. It makes possible to compare these data and the French contemporary literature to understand the economic issues and artistic exchanges between France and Japan. The growing interest of French people for Japanese curios underlines the impact of this consumption on the French pottery production.

This program gave me the opportunity to meet researchers of the University of Tokyo, the members of the Society for the study of japonism (composed of researchers of several universities, curators.) and some directors of museums. I could travel and discover a great numbers of museums which are important for my research. I could take a further look my knowledge of Japanese art and crafts: Japan folk crafts museum, Tokyo national museum, Edo-Tokyo museum, etc. I could visit several historic ceramic production sites: Kyoto, Arita, Imari and Bizen.

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

My stay was a great experience for my understanding of popular and traditional culture. I could meet potters (traditional at Bizen / modern at Fukutsu) and I could be able to confront contemporary Japanese art with more traditional art. The moments with my host family were very interesting and efficient too for my understanding of the Japanese culture (I tried yukata, kimono and saw a hanabi).

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: ZERNIK （ID No.: SP14213）

2. Current affiliation: Ecole Nationale Supérieure des Beaux-arts de Paris

3. Research fields and specialties:

Humanities

4. Host institution:

Tokyo University, Faculty of Letters, Graduate School of Humanities and Sociology.

5. Host researcher:

Kan Nozaki

6. Description of your current research

My project seeks to study the various artistic forms generated by artists to depict the invisible presence of the nuclear threat. I am observing the threatening of the aesthetic object by studying categories of suspense and suspension that bypass the notion of representation. In my view, the Fukushima disaster requires a paradigm shift in how we conceptualize the object and challenges the act of artistic representation. In fact, the disaster seems to overwhelm all categories of understanding and of imagination. Moreover, it is also a question of tangibility and visibility. How can we help to make sense of a disaster with such grave consequences and the epoch-changing break it represents? Post-Fukushima artists are now tasked with facing this new and dizzying challenge. The question is how exactly artists can hope to grapple with this challenge, in the context of current reality, when existing frames of reference have been exploded. How can they sensibly identify, discuss and represent such an unspeakable reality? In order to understand this, I have made a lot of contact with artists, curators and art critics for whom the disaster of 2011 was a real rupture, which has shifted unequivocally the ordinary work of representation.

7. Research implementation and results under the program

Title of your research plan:

The Object in Suspense: Post-Fukushima Art

Description of the research activities:

During my stay, I have met a lot of very important personalities of art world in Tokyo. Thanks to my host, Kan Nozaki, and to my former contacts, I could have really interesting meetings with, for example, Fram Kitagawa, director of Echigo-Tsumari Festival and Art Front Gallery, curators - Tetsuya Osaki, Reiko Tsubaki, Yuko Shiomi, Mami Kataoka -, and artists -Igarashi Taro, Naoya Hatakeyama and Ushiro Ryuta of Chim Pom. I also went to contemporary art Triennale or exhibition, such as Yokohama Triennale, Naoshima art Island and Echigo-Tsumari art field, in order to experiment the place of 11.03 in the artistic production.

After these various meetings and experiences, I notice four aspects in the influence of Fukushima on Japanese contemporary art: 1/ For the artists and curators, “Fukushima” isn’t a name of a disaster as it is in foreign countries but a name of a town, and the tsunami disaster is more obvious than nuclear threat. 2/ 11.03 disaster is really a central point in the artistic consciousness, as we can observe in such big manifestations as Aichi Triennale or Mori Museum exhibitions. 3/ The question asked by Fukushima disaster is not so much an aesthetic question than a social question: artists after Fukushima would like to know what art can make, how art can be useful? Thus implementations of artists are more focused on social, architectural renaissance and reconstruction than on aesthetic devices. On the contrary, beauty is suspected of being an instrumentalization of horror and asks moral questions. 4/ The question of Fukushima is now in Japan a question of remembrance, not of atomic threat. ‘Fukushima project’ and mediatheque in Sendai are a sign of the will of remembering the past and rebuilding the future.

It was really important to understand these points; without this stay in Japan I would be victim of a lot of misunderstandings.

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

During my stay, I also visited some really important places for my research as Hiroshima and Nagasaki. I visited an exhibition on tsunami in Tohoku at Onomichi Museum. These various experiences have built a cultural background of comprehension and perspective.

Cultural experiences and stimulating research environment were both linked to make this stay very productive.

RESEARCH REPORT

1. Name: Christian Reiner Boehm
（ ID No.: SP14301 ）

2. Current affiliation: University of Cambridge

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

4. Host institution: Kyoto University

5. Host researcher: Professor Takayuki Kohchi

6. Description of your current research: [CONFIDENTIAL please]

My doctoral research is dedicated to the design a synthetic transcriptional AND gate for heterologous gene expression in the *Marchantia polymorpha* chloroplast. The logic gate will be based on a nuclear-encoded and chloroplast-targeted split T7 RNA polymerase system. A plastid-encoded fluorescent reporter under control of a T7 promoter will only be expressed if both the C- and N-terminal fragment of split T7 RNA polymerase, induced by two different input signals in the nucleus, are targeted to the chloroplast at the same time. As the two independent input signals of the AND gate may be chosen arbitrarily, this system has tremendous potential for various future applications in plant development and metabolic engineering where spatio-temporal control of gene expression in the plastid is desired.

7. Research implementation and results under the program

Title of your research plan:

Towards a simple model plant with chloroplast-encoded fluorescent reporters

Description of the research activities:

The primary aim of my work at Professor Takayuki Kohchi's laboratory at Kyoto University was to learn the technique of biolistic transformation of chloroplasts in Marchantia polymorpha. With a view to my doctoral research (see above), this technique is essential to introduce a fluorescent reporter into the chloroplast genome of the model plant in question, and based thereupon enable quantification of the genetic logic gate's function by means of fluorescence microscopy.
Though the success of biolistic transformation can conclusively be confirmed only after approximately 3 months of culture under selective conditions following the initial experiment, there is strong evidence that this undertaking has been successful: Following bombardment of germinating spores with DNA-coated nanoparticles, 42 antibiotic-resistant plantlets were recovered, over 90% of which contain tissue exhibiting activity of the introduced fluorescent protein which is significantly greater than of the negative control. Furthermore, a weak band indicating integration of the foreign DNA into the plants' chloroplast genome was detected by means of PCR.
Second, I refined a genetic construct enabling targeting of a yellow fluorescent protein expressed in the nucleus of Marchantia polymorpha to its chloroplast. The first-generation construct assembled at my home institution gives rise only to a minor fraction of protein targeted to the chloroplast (and the majority remaining in the cytoplasm and nucleus). However, removal of a secondary start codon of this construct at Kyoto University greatly improved its targeting efficiency as observed by means of fluorescence microscopy. With a view to my doctoral research, this transit peptide will allow translation of a nuclear switching mechanism into a chloroplast-localized output signal.

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

I am grateful for the opportunity to visit several Japanese cities (i.e. Narita, Kamakura, Odawara, Osaka, Nara, Kurama, Otsu, and Tokyo), enjoy Japanese festivals (i.e. Gion Matsuri, Tenjin Matsuri, Sumidagawa Hanabi Taikai, Biwako Dai-Hanabi Taikai, Kyo no Tanabata, Daimonji), and experience the sunrise from the top of Fuji-san – my personal highlight of my stay in Japan.

9. Advisor's remarks (if any):

Mr. Boehm is a mature graduate student, and has worked hard for his PhD studies in the lab. He has performed many different experiments and got ideas during his stay. He seems to enjoy his stay in Japan not just for science but also for cultural exchanges. His stay in my lab has been mutually beneficial. The laboratory members including undergraduates and graduate students are stimulated by discussions and cultural exchanges with Mr. Boehm. We thank JSPS to support his stay in my lab.

RESEARCH REPORT

1. Name: Max F. FRENZEL （ID No.: SP14302）

2. Current affiliation: Imperial College London

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Takahiro SAGAWA

6. Description of your current research

Thermodynamics is one of the oldest and most well established areas of physics, dating back as early as the 17th century. It is the study of heat and its relation to other energy forms such as work, and it employs statistical methods to describe macroscopic systems and their average properties such as entropy and temperature. This intrinsic macroscopicity might suggest that thermodynamics as we know it is not applicable to quantum systems. Yet, there is a large desire to define and understand concepts such as heat and work on the quantum scale in order to keep up the rapid advances in nanotechnology, as well as foster progress in other fields such as microbiology. Most importantly though, it would provide us with new insights into fundamental physics.

My research is focused on further bridging the gap between classical and quantum thermodynamics. My current main interests are work extraction processes and finding a more operational definition for work at the quantum scale. I am also interested in closely related topics such as quantum heat engines, fluctuation theorems, and feedback control.

Most recently we were able to for the first time provide a fully quantum mechanical description of a work extraction protocol that has, in a semi-classical version, been known and employed in the literature for several decades. We explicitly showed the differences that arise when all the systems involved are treated as quantum systems. We were able to prove that the extractable work in the quantum case is always less than if some of the systems are treated classically, giving an upper bound on the efficiency of quantum work extraction.

7. Research implementation and results under the program

Title of your research plan:

Information Thermodynamics on Quantum Networks

Description of the research activities:

My work at Tokyo University focused on developing a generalized quantum fluctuation theorem, which would be applicable to most thermodynamic protocols involving quantum systems. A similar result has recently been derived by my host researcher Prof. Sagawa and his colleagues for classical systems, and our goal during the program was to generalize these results to quantum systems. Fluctuation theorems relate probabilities of different processes in thermodynamical protocols, and form a generalization of the well known second law of thermodynamics.
I began my research in Tokyo by reexamining all the existing research, both the extensive classical results, as well as the few existing approaches to the quantum mechanical case. Based on this we tried to build a toy model for the most general setup in the quantum scenario, and using this, define a quantity known as transfer entropy which plays a crucial role in the classical results, but is much more difficult to define for quantum processes, due to e.g. the non-trivial effect of measurements on quantum systems ("collapse of the wavefunction"). From the beginning we were aware that our goal was very ambitious and unlikely to be achieved within the timeframe of the summer program. This has proven to be true, but we were able to rule out a various potential approaches and were able to narrow down our search effort. We are now in a good position to go forward and, building on the work we did during my stay in Japan, establish a long term collaboration to further study the topic of quantum fluctuation theorems, as well as related topics in quantum thermodynamics.

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

I had a wonderful time in Japan during my stay here. Everyone was incredibly welcoming and I made many new friends, both within the academic community as well as outside. A workshop I attended at the Yukawa Institute in Kyoto also proved to be very fruitful, since I got to know two Japanese researchers there who were very interested in future collaborations.
Culturally I also had a great experience, from amazing food, to wearing a Yukata watching the Sumidagawa Hanabi Taikai while having a barbecue on the roof of a friend's house, discovering the incredibly good but very hidden underground music scenes of Tokyo, and many more. I hope to be able to come back to Japan as soon as possible.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Nils HANEKLAUS (ID No.: SP14303)

2. Current affiliation:

ENEN

3. Research fields and specialties:

Engineering Sciences

4. Host institution:

JAEA

5. Host researcher:

Kazuhiko KUNITOMI, Hirofumi OHASHI

6. Description of your current research

Process heat applications of High Temperature Reactors (HTRs)

7. Research implementation and results under the program

Using High Temperature Gas-cooled Reactors for Energy Neutral Mineral Development Processes:

High Temperature Gas-cooled Reactors (HTGRs) such as the High Temperature Engineering Test Reactor (HTTR) in Oarai-Machi, Japan, operated by the Japan Atomic Energy Agency (JAEA) reach outlet temperatures as high as 950 ˚C. These relatively high outlet temperatures enable the reactors use for efficient electricity generation and/or direct process heat application (e.g. for hydrogen production).

Both options have been and both options are a topic of past and present research at various institutions including JAEA in Japan. HTGRs could among other High Temperature Reactors (HTRs) be deployed to power energy intensive mineral development processes. Some ores such as phosphate-, copper- and gold ores contain considerable amounts of accompanying uranium and/or thorium that could be extracted during processing and used as raw materials to manufacture reactor fuel that could again be consumed by the HTGR enabling “energy neutral” processing.

In Japan I could familiarize myself with JAEAs latest HTGR-designs and there use for “energy neutral” mineral development processing.

Description of the research activities:

Data analysis

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: Ingrid Irmer (ID No.: SP14304)

2. Current affiliation: Florida State University

3. Research fields and specialties:

Mathematics

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

5. Host researcher: Prof. Nariya Kawazumi

6. Description of your current research

A mapping class group is a group of isotopy classes of diffeomorphisms of a surface onto itself; often called the"symmetry group" of a surface. The Torelli group is the kernel of an important representation of the mapping class group, and as the "non-linear" part of the mapping class group, very little is known about it. The most important structure for studying the Torelli group is the Johnson homomorphism. A homomorphism is a structure preserving map; in this case from the Torelli group onto a much simpler space.

Curve complexes are locally non-compact, simplicial complexes whose vertices represent isotopy classes of simple curves on the surface, and whose higher dimensional simplices represent intersection relations on the curves. These intersection relations are preserved by the action of the mapping class group, hence there is an action of the mapping class group on curve complexes. Curve complexes have traditionally been used to study the *mapping class group* and related geometric objects - for example, for obtaining presentations and proving theorems about coarse geometry. However, for technical reasons, these techniques or similar do not apply to the Torelli group, which is much more difficult to study. Surprisingly, however, a recent paper suggests that the Johnson homomorphism might be studied using a particular family of curve complexes.

Typically, invariants such as the Johnson homomorphism and it's higher order generalisations are computed by constructing a combinatorial model for them. In this project, methods from low dimensional topology, algebra and geometric group theory are used to construct a combinatorial model for the Johnson homomorphism using curve complexes.

7. Research implementation and results under the program

Title of your research plan:

A combinatorial model for the Johnson homomorphism

Description of the research results:

We are finalising the details of a model for the Johnson homomorphism coming from a family of curve complexes. This is achieved by assigning each edge of a curve graph a tensorial label, coming from the integral homology of the subsurface it represents. The Johnson homomorphism is then described as a "tensor valued" translation length of the action of an element of the Torelli group on the curve complexes.

One of the major difficulties in the proof is actually computing the sum of edge labels along a path connecting two vertices in a curve complex. Once computed, a surgery argument is used to show that this sum does not depend on the choice of path. To show that the sum of edge labels is equal to what we would like it to be, we use the fact that a path in the curve complexes represents a closed, embedded surface in the mapping torus of the element of the Torelli group in question. The sum of edge labels is then shown to be an invariant of the entire second homology class in the mapping torus - not just representatives coming from curve complex paths. This makes calculation of the sum of edge lengths much easier, because we are not restricted to working with simple curves that representing vertices of curve complexes.

It would be interesting to relate the Johnson homomorphism with second integral homology classes in mapping tori because this could perhaps explain some of the parallels between generalisations of Thurston fibered face theory to free groups, and Johnson homomorphism theory.

We had hoped to be able to use our approach to give a combinatorial model for Morita's generalisation of the Johnson homomorphism to the entire mapping class group, but unfortunately, we were able to show this can not be done.

Other research highlights were discussions with a colleague on the subject of Morse theory for manifolds with boundary - there is a beautiful recent paper on the subject that is intimately connected to another project I have been thinking about. Also, a large, week long conference in my research area was held at my host university.

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

It was a particularly good time to visit Japan, with many people coming for the ICM in Korea!!

RESEARCH REPORT

1. Name: Martin R. Lichtenthaler (ID No.: SP14305)

2. Current affiliation: Institute for Inorganic and Analytical Chemistry, Albert-Ludwigs-Universität Freiburg, 79104 Freiburg i. Br., Germany

3. Research fields and specialties:

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

4. Host institution: Emergent Molecular Function Research Team, RIKEN, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan

5. Host researcher: Prof. Dr. Kazuo Takimiya

6. Description of your current research

In 2010, our group developed a simple route to univalent gallium salts by oxidizing elemental gallium with the silver(I) salt of the weakly coordinating $[Al(OR^F)_4]^-$ anion (R^F = $C(CF_3)_3$). Herein, the gallium(I) cations are η^6-coordinated by two fluorobenzene (C_6H_5F) molecules and weakly interact with the corresponding $[Al(OR^F)_4]^-$ anion. The $[Ga(C_6H_5F)_2]^+$ cations have not only proven to be an excellent starting material for further gallium(I) chemistry, but also an efficient catalyst for the polymerization of isobutylene.

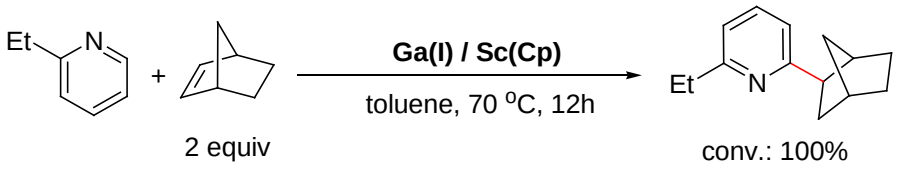
7. Research implementation and results under the program

Title of your research plan: Gallium(I) Salts as potential Catalysts for the Synthesis of Thienoacene Materials

To further expand the scope of polymerizable monomers, we intended to establish a close collaboration with Prof. Dr. Kazuo Takimiya, who is an expert in designing functional organic molecules, such as semiconducting thienoacenes. As the packing structure of thienoacenes is correlated to their carrier transport properties, controlled syntheses of the latter are crucial. Within this context, we believed our gallium(I) salts to open up a new catalytic route for synthesizing well defined thienoacenes, without relying on expensive transition metals. Preliminary density functional investigations showed constructive interactions of the frontier molecular orbitals of different thienoacenes precursors and the $[Ga(C_6H_5F)_2]^+$ complex.

Description of the research activities:

As the gallium(I) salts are very liable, the inert conditions at Takimiya's lab proved to be not sufficient enough to successfully catalyze the syntheses of thienoacenes. Yet, we were able to establish a collaboration with Prof. Dr. Zhaomin Hou, head of the Organometallic Chemistry Lab at RIKEN, who could provide us with sufficient inert conditions. Doing so, we were able to successfully catalyze a C-H activation of norbornene



2 equiv

conv.: 100%

Running the same reaction without the co-catalyzing Sc(Cp) complex (Cp = $[C_5H_5]^-$) however, conversions (conv.) dropped to 0%. In addition, a distinct change in color from colorless to brown and red was observed when the gallium(I) salt and Sc(Cp) were applied together. We therefore believe that the catalytical activity is attributable to decomposition product(s) of the gallium(I) salt. To prove this hypothesis, further experiments in flame sealed NMR tubes will be conducted upon my return to Germany.

Profiting from the Japanese working discipline, I used the remaining time to draft a manuscript which soon should be ready for publication in a sound peer-review journal.

In addition to the research conducted at RIKEN, I attended the XXVI International Conference on Organometallic Chemistry (ICOMC) in Sapporo. On this occasion, I was able to successfully represent my research and to strengthen international ties with Japanese, Taiwanese and European colleagues. After the conference, I visited the lab of Prof. Masaya Sawamura at Hokkaido University and had a fruitful discussion with his co-workers as well as a memorable nomikai.

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

Right from the beginning, I had a very warm welcome to the research group of Takimiya-sensei. I will keep the welcoming party at an Izakaya, the Japanese barbeque, our visit to a baseball game and the farewell party in very good memory! At RIKEN, I also attended a Japanese conversation class twice a week, which turned out to be very handy on a daily basis (fukuro wa irimasen). In addition, I was able to partake in a rehearsal of the Orchestra Chimica (the orchestra of the Japanese Chemical Society), allowing me to network with a broad range of Japanese chemists. The overall hospitality and kindness of the Japanese people, the rich cultural heritage, the oishii tabemono and the fascinating language have long convinced me to come back, to experience more of Nippon and to actually learn true Nihongo.

9. Advisor's remarks (if any):

Just after his arrival, Martin has been integrated as an important member in my group; a colleague in chemistry and, at the same time, a good personal friend of Posdocs and Ph.D students. In fact, catalytic reactions including the cross-couplings are the most vital reactions in my group, and thus his strong background on this field can provide us new viewpoints for catalytic reactions. Unfortunately, our chemistry environment is not sufficient for his air- and moisture sensitive catalytic system, he has managed to carry out some reactions and found some basic knowledge on this issue as he above mentioned.

On the other hand, his open personality really helps my people to communicate with him, and this opportunity should be a precious time for them to learn proper attitude to be integrated into people with other cultural backgrounds and langue. For these reasons, his stay in my group is really fruitful for both sides, and we really miss him just after such enjoyable days with him.

RESEARCH REPORT

1. Name: Carolin Mengel
(ID No.: SP14306)

2. Current affiliation:

University of Göttingen (Research Associate)

3. Research fields and specialties:

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

4. Host institution: University of Tokyo, Department of Global Agricultural Sciences

5. Host researcher: Nobuyuki Yagi (Ph.D. MBA.)

6. Description of your current research

The research on price transmission aims to improve our understanding on how prices changes are transmitted between markets and what determines these dynamics. Case studies are employed to shed light on price transmission from different perspectives. Based on price transmission estimates from collected price data, we seek to identify regional- and product-specific differences and political, cultural and geographical influences. One central question is whether distance has an impact on price transmission between spatially separated markets. The analyses combine in innovative ways market analyses with up-to-date methods such as threshold cointegration and threshold error correction. The findings contribute with empirical evidence to the theoretical considerations about the determinants of price transmission.

7. Research implementation and results under the program

Title of your research plan:

Spatial price transmission under the presence of transaction costs in Japanese agricultural markets

Description of the research activities:

The aim of the study is to examine spatial relationships between agricultural markets in Japan using price transmission analysis. We examine a homogenous, relevant and largely traded food product, with the product choice being subject to availability of high frequency price data. Market integration is typically reflected in the the co-movement of prices over time (cointegration). In reality, we rarely observe the prices in equilibrium but rather constantly adjusting to short-run deviations caused by demand or supply shocks. This is formally represented with error correction mechanisms (VECM). The presence of cointegration, the strength of the equilibrium and the speed of adjustment to price shocks provide insight into the market integration dynamics. Following more recent applications in spatial price transmission literature, we incorporate spatial transaction costs into the modeling framework. If a price deviation exceeds the estimated transaction costs (threshold), the price adjustment changes and typically becomes faster. Below the threshold value, arbitrage may not be profitable and price transmission is slow or null. We estimate a three regime TVECM with asymmetric thresholds estimated with a Bayesian grid search (Greb et al., 2013). The specification tested with an extended Hansen-Seo test (Hansen and Seo, 2002) proposed by (Larsen, 2012). We will interprete all estimated coefficients and gauge the results to approximate transaction costs between the markets.

During the research stay, the respective price data were collected, cleaned and prepared for the estimation. The distinctive difference between cereal markets and the more traditionally structured fish markets are reflected in data quality and data availability across Japan. While cereal markets are often largely traded and with low product differentiation, this is not the case for fish. The product is highly differentiated in terms of weight per unit and origin i.e. landing port. Several species are only traded seasonally, for example the oyster season lasts only 6 months per

year. Another difficulty is the price differentiation per weight. The per kilo price for smaller fish is sometimes higher than for larger fish, a fact that corrobates the notion that larger fish are more popular because it provides more filet per item. Digitally collected comparable and easily accessible high frequency price data does not exist. Therefore the data collection was labour intensive with up to four student assistants working on the task.

In a first step, Professor Nobuyuki Yagi kindly obtained a large database of daily retail price data for 963 fish products in 235 Japanese supermarkets in 6 regions, about 1095 days (334594 observations). Closer examination of the data however produced numberous missing values indicating that none of the products was sold on a daily basis. Without being able to construct daily price series from it, this data base had to be omitted for this study. In a second step, we focused instead on wholesale markets in Tokyo, Osaka and Nagoya, with data provided by Jiji Press. The provider could not inform us about the number of missing values for the respective species so that we did not take the risk of spending a large proportion of the research budget on these data. In a third step, we narrowed down the market choice to Tokyo and Osaka where daily data is published freely available by the respective metropolitain governments. Frozen big eye tuna and mackerel in both markets are traded throughout the year. However, the Osaka data collection differs substantially from the Tokyo data in that, that prices are disaggregated by landing ports. Aggregating the prices would lead to biases in the series because the real distributions of the prices are unknown. Only the mode price is reported, that is the most common market price. In a last step we decided to limit the project to three Tokyo markets, namely Tsukiji, Adachi and Oota, where the data stem from one source and are comparable. The data were collected by up to four student assistants and are now complete, cleaned and ready for estimation. The data cover the market days from January 1, 2012 to July 26, 2012, overall 697 observations. On 241 days the three markets were closed and therefore no price data were collected. The estimation will be conducted on a super computer by the University of Göttingen (GWDG cluster computing).

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

I was amazed and positively surprised by the kind and very helpful support by Professor Nobuyuki Yagi and his team. We were meeting on a regularly basis and almost every researcher contributed with their expertise at some point to the ongoing project. Not only helped they with the tedious work of clicking through the webpages for each one of the 697 market days for each of the three markets and copied the data. Also, they helped calling and meeting with data providers and shared their in-depth knowledge about for example eel markets and wholesale fish trading. One student kindly organized a visit at Tsukiji market in the wholesale area and explained me every detail about trading, auctioning and processing the fish.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Aiko Julia Moehwald
（ID No.: SP14307）

2. Current affiliation: University of Freiburg

3. Research fields and specialties:
Social Sciences

4. Host institution: University of Tsukuba

5. Host researcher: Prof. Yoshinori OKADE

6. Description of your current research

Teachers' feedback in context of physical education (PE) is important in two respects. On the one hand, the feedback is important for motivational aspects (e.g. students being aware they are recognized by the teacher). In general, it is better to give a positive and/or corrective feedback than a negative one. Positive feedback can create a positive atmosphere in classroom and thus enhance students' motivation to perform. On the other hand, teachers' feedback in PE is fundamental for the correction and improvement of the students' movement skills. With regard to improving students' skills it is more effective to give specific feedback. But most PE teachers (especially in elementary schools) give general feedback as a result of lack content knowledge (CK). In addition, PE requires a lot of organizational challenges as it is held in a gymnasium, where a lot of activities occur simultaneously. To give constructive feedback to plenty students, PE teachers need to also have good observational skills. To give (positive) feedback also questions one's value orientation and belief. Besides teachers' personal knowledge and belief there are also some organizational manners, which can influence the chance to give (positive) feedback. If teachers have not set appropriate tasks for their students (e.g. the task is too difficult), it is nearly impossible to give authentic feedback. Last but not least, the school context plays a decisive role for the acceptance of giving a lot of positive and specific feedback.

In this study we wanted to examine and analyze PE teachers' feedback culture in elementary schools considering these influencing factors.

7. Research implementation and results under the program

Title of your research plan:

Feedback culture of Japanese PE teachers in elementary school – a case-study

Description of the research activities:

In my two-month research stay at the University of Tsukuba, I conducted field studies in Japanese PE classes and videotaped the lessons. From June 19th through July 16th I visited three different elementary schools and observed 9 PE classes. The aim of the research was to gain special insight into the feedback culture of Japanese PE teachers. But beyond this specific focus I have enhanced my knowledge about the general school system and PE system in Japan. I attended Japanese school-based lesson studies in PE, which are a part of continual professional development (CPD). This special concept was unknown to me and it was very impressive to witness the Japanese elementary teachers' dedication to maintaining high quality (PE) classes. After having collected my data (video of PE lesson, lesson plans, semi-structured interviews with teachers), I analyzed it under the focus of teachers' feedback. In a deductive way I extracted all situations where feedback was given. This descriptive data was analyzed in consideration of the school context and teachers' value orientation. It was possible to explore under which specific conditions teachers' are able to give a lot of positive feedback in their PE lessons.

Besides data collection and analysis, I went to two conferences in Sendai (June21st and 22th) and Morioka (August 8th until 10th). The first conference was held by the "Japan Society for the Pedagogy in PE", the second by the "Japan Society of Lesson Study in PE". I have met a lot of the leading Japanese sport scientists in the area of pedagogy at both conferences. Moreover I had the pleasure to accompany Prof. Okade to a meeting at the Ministry of Education, Culture, Sports, Science and Technology in Japan (MEXT). These experiences completed my research stay at the University of Tsukuba.

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

I am very grateful to Professor Okade for accepting my application, for providing guidance during my project and introducing me to a lot of interesting and top-class people of science, education and ministry. Thank you very much. I would also like to thank the entire group for their friendly company. I have been highly impressed by this research group and feel extremely lucky to have spent time with them and learning their ways of working. I have had an enriching summer in Tsukuba. Last but not least, many thanks to JSPS and the nominating authority DAAD for organizing this worthwhile program.

9. Advisor's remarks (if any):

Accepting Aiko was very thought provoking and rewarding for our students, for fellow graduate students but also for me. I gave her several opportunities to get to know Japanese teachers for improving quality of PE lesson. I hope it will contribute to her research in the future.

RESEARCH REPORT

1. Name: Benjamin NIEDNER
（ID No.: SP14308）

2. Current affiliation: University of Oxford

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Yukawa Institute for Theoretical Physics, Kyoto University

5. Host researcher: Prof. Hiroshi KUNITOMO and Hirotaka IRIE

6. Description of your current research

The research of my PhD studies concerns so-called “matrix models” which are quantum mechanical systems in which the dynamical variables are Hermitian matrices. These toy models successfully unify quantum theory and gravity in a simplified setting which allows for exact computations which are currently impossible in the full physically realistic setting. An important quantity one would like to be able to compute in a quantum theory of gravity is the amplitude for the creation of a universe in a particular configuration from nothing, as originally devised by Hartle and Hawking. Concretely, my work involved computing such quantities – in this context referred to as “boundary states” - using a particular matrix model which describes a matter system referred to as the Potts model interacting with gravity. This model is of particular interest due to the presence of an extended symmetry which may prohibit decays of various quantum states due to conservation of charge. The main achievement of the investigations so far is the exact solution for a new boundary state which had not been computed previously. Together with my collaborator Dr Max Atkin I was moreover able to show that two such boundary states can be encoded in a single algebraic equation and that at a certain interaction strength the matrix model undergoes a phase transition at which a continuous spacetime geometry emerges in the same fashion as was previously observed in simpler matrix models with fewer degrees of freedom.

Presently I am attempting to extract more detailed information about the above-mentioned phase transition to provide evidence for the conjecture that this critical point can be described by a particular so-called “conformal field theory”, starting directly from the traditional continuous field theory formalism of gravity. This would moreover allow for a check of a conjecture made in the literature that some of these states may be identified if one analytically continues one of the coupling constants of the theory to complex values and that hence the number of possible configurations of these simplified universes had previously been overcounted in more naïve analyses. Physically speaking, this would imply that quantum effects can render matter and space-time geometry indistinguishable.

7. Research implementation and results under the program

Title of your research plan:

Microscopic Origin of Cardy Branes and Wronksians

Description of the research activities:

Together with Dr. Hirotaka Irie I investigated the mathematical structure arising when several of the above-mentioned boundary states are brought into a Schroedinger's cat-like quantum superposition. The motivation for this consideration is that on the one hand, the conformal field theory formalism suggests the existence of more independent possible matter configurations in the toy-model universe than are present naively in the corresponding matrix model, whilst on the other hand the matrix model has additional solutions whose physical interpretation has so far remained elusive. Starting from the insight that quantum superpositions of boundary states are governed by a generalisation of what mathematicians call a "Wronskian", we were able to derive a one-to-one correspondence between the additional states of the conformal field theory on the one hand, and particular quantum superpositions of the matrix model boundary states. In other words, we achieved a first-principles derivation of the structure known from the effective conformal field theory directly from the matrix model, allowing for a physical interpretation of the previously ill-understood additional solutions.

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

Besides a very productive research process, I much enjoyed the city of Kyoto with all the historical sights and cultural highlights it offers; particularly memorable events include the Gion Matsuri and Obon festivals. Moreover, I highly appreciated the homestay with a Japanese family in Chigasaki as organised by JSPS and was deeply moved by the honor the summer program participants received when the emperor and empress of Japan paid us a visit during the well-organised introduction week.

RESEARCH REPORT

1. Name: Ralph Günther PFLANZER （ID No.: SP14309 ）

2. Current affiliation: Goethe University Frankfurt

3. Research fields and specialties:

Biological Sciences

4. Host institution: Tohoku University, Dept. of Biomedical Engineering

5. Host researcher: Prof. Yoshifumi SAIJO

6. Description of your current research

My current research, starting out under the framework of the LOEWE-Praebionics Network funded by the State of Hesse, is focusing on the biomechanical behavior and characterization of solid tumor xenografts in a preclinical setup. Foremost, the research is aimed at a better understanding of the elevated tumor interstitial fluid pressure (TIFP), that is developed during growth of certain tumor entities (e.g. A431 vulva-carcinoma and A549 lung carcinoma - derived cancer types). An elevated TIFP is hampering an effective chemotherapy because substances of higher molecular weight such as anti-cancer agents, - which are transported rather by convectional than diffusional transport mechanisms -, cannot overcome the outwardly directed pressure barrier and are flushed out before accumulating at their target location. Until present, TIFP has only been characterized with invasive methods based on hydrostatic pressure measurements which would be unfavorable for a potential clinical setting in future. I have proposed a non-invasive method to determine TIFP using ultrasound microscopy signals from a Scanning Acoustic Microscope (SAM) after signal correlation with a one-time and fast needle-injection based calibration. The necessary mechanical tools for a manipulation-free handling of the pressure-sensitive excised tumors had to be developed as well in the course of my investigations. Though the aim of a completely non-invasive prediction of tumor-dependent TIFP is clearly defined, yet the overall biomechanical characterization of our tissue samples remained to be resolved.

As I am working with a subcutaneously grown tumor model in nude mice, the biomechanical properties of skin as such are of specific interest to me. In our laboratories, we have also developed an organotypic tissue cultured skin equivalent model (TCSE) which is morphologically and physiologically characterized at different time points during differentiation. Ultrasound could offer a way to better understand the biomechanical differences between these stages as well.

7. Research implementation and results under the program

Title of your research plan:

Non-invasive characterization of the biomechanical properties of xenograft tumor samples and skin-equivalent models via ultrasound microscopy

Description of the research activities:

The research in the 8-week summer program has been focused on using the AMS-50SI ultrasound microscope (Honda Electronics) to characterize and compare the biomechanical properties of A431(control/and 30mm Hg released pressure)- and A549 derived tumor tissue samples, as well as to characterize different stages of TCSE skin model samples. About 40 different 10µm cut histological slide samples have been scanned at 80MHz ultrasound center frequency. After deparaffinization and x-y ultrasound scan, individual images had to be stitched from up to 18 single scans via ImageJ because samples were larger than the active scan area. Intensity (gray-value), sound speed, attenuation and thickness maps have been obtained for each tumor respectively skin model sample. First analysis hints at overall higher sound speed values in A549 tumors than in A431 tumors, which would indicate higher stiffness. Additionally, the microscopes impedance mode has been used to characterize 3D tumor samples directly on petri dish – analysis of these results is ongoing. Furthermore, consecutive B-mode scanning of these samples has been performed and revealed structural details which have to be characterized.

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

I had the opportunity to visit collaborating laboratories in the field of ultrasonic investigation on biological samples (biomedical engineering), not only on campus but also at the CFME at Chiba university, which was a nice experience. Additionally, I could participate at a conference on biomedical engineering and loved to see the diverse activities of the Open Campus Days at Tohoku University. Sendais rich cultural heritage, including Japans biggest Tanabata festival and fireworks, was equally impressive!

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Tobias Schaub（ID No.:SP14310)

2. Current affiliation: Department of Chemistry, University Erlangen-Nürnberg, D-91054 Erlangen, Henkestrasse 42, Germany

3. Research fields and specialties: Chemistry

4. Host institution: Institute of Transformative Bio-Molecules (WPI-ITbM) and Department of Chemistry, Nagoya University, Japan

5. Host researcher: Prof. Shigehiro Yamaguchi

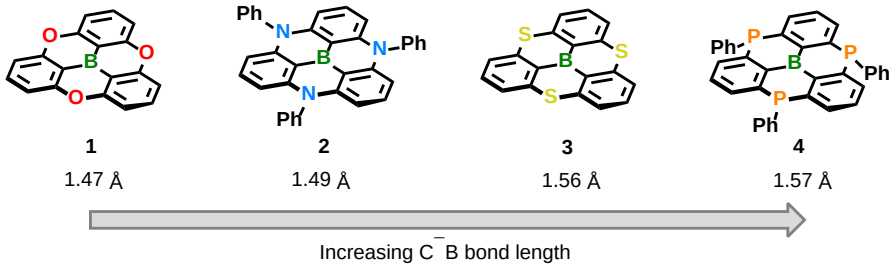
6. Description of your current research: The main focus of the research activity is laid on the synthesis of heteroatom-rich polycyclic aromatic hydrocarbons and the exploration of their physicochemical properties for application in optoelectronic devices.

7. Research implementation and results under the program:

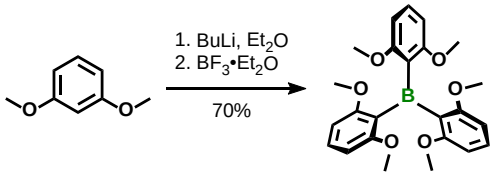
Title of your research plan: Heteroatom-rich Polyaromatic Architectures for the Application in Organic Electronics

Description of the research activities:

In the first part of the research theoretical predictions of based on *ab initio* density-functional-theory calculations has been performed and suggested the O, N, S, and P-bridged target compounds **1**-**4** to show sufficient stability for preparation. According to these results, the stabilization of the inherent Lewis acidic B-center is realized by i) pronounced delocalization of the adjacent aromatic π-system into the vacant p-orbitals of the B-atom as withdrawn from the predicted short C-B bond lengths and ii) efficient electronic communication of the electron-donating heteroatom-bridges.



In order to gain access to these target compounds, the key precursor tris(2,6-dimethoxyphenyl)borane (**5**) and tris(2,6-difluorophenyl)borane (**6**) were synthesized on a gram-scale in good yields in a one-step synthesis, respectively.



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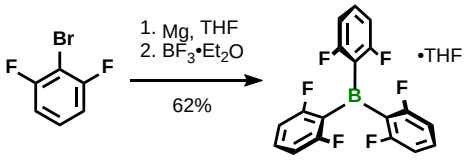

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In summary, by means of comparison to known tethered triarylboranes, theoretical predictions based on *ab initio* calculations suggested the O- and N-bridged target compounds **1** and **2** to show sufficient stability to be prepared, while S- and P-tethered triphenylboranes **3** and **4** are predicted to suffer from insufficient shielding of the reactive B-core. To gain access to the class of heteroatom-bridged triphenylboranes, the key precursors tris(*2,6*-dimethoxyphenyl)borane (**5**) and tris(*2,6*-difluorophenyl)borane (**6**) were synthesized on a gram-scale in good yields in an one-step synthesis, respectively. Synthetic efforts during the time in Japan, however, did not lead to O, N, or S-bridged target compounds **1**-**3**, whereas time constraints did not allow for attempts to synthesize P-tethered borane **4**. The failure of the attempted synthesis could be traced back to i) the hydrolytic instability of the precursor molecules **5** and **6** yielding the corresponding borinic and boronic acids upon contact with H_2O, ii) kinetic reasons, rendering the C-B bond labile at elevated temperatures in the presence of N-nucleophiles, and iii) the inherent Lewis-acidity of precursor **5** and **6** favouring one-electron reduction rather than nucleophilic aromatic substitution.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): For all of you with sufficiently steady nerves I recommend to explore some ‘Haikyo’ - abandoned buildings and villages. They can be found all over Japan, so keep your eyes open. I also had a great time exploring the local music scene as there are many small locations with live acts, at least in Nagoya.

RESEARCH REPORT

1. Name: Tobias D. SCHMIDT （ID No.: SP14311）

2. Current affiliation: University of Augsburg, Germany

3. Research fields and specialties:
Physical Sciences

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

5. Host researcher: Prof. Hisao Ishii

6. Description of your current research

The energy revolution is an ambitious project in Europe and especially in Germany. Keeping in mind that about 15-20% of the global electrical power is consumed by lighting applications, it is crucial to develop energy-saving, long-lived technologies. Hence, the European Union has prohibited almost all incandescent light bulbs, which are very inefficient in converting electrical energy into light. Thus, more and more fluorescent and energy-saving lamps have entered people's homes and public buildings. However, the problems with these techniques are miscellaneous as they have still too low efficiencies and poor color rendering as well as trouble with recycling or waste disposal.

Promising new lighting applications rely on solid state technologies using organic and inorganic light-emitting diodes (LEDs) which can already easily compete with conventionally used products mentioned above.

In particular, organic light-emitting diodes (OLEDs) are promising new light sources for both display as well as general lighting applications on their way to commercial products. However, there is still much room for improvement in terms of device efficiency and long-term stability under electrical operation.

My current research is focusing on both aspects. Understanding the basic physical mechanisms behind the creation of light is mandatory for future improvement of efficiency and simultaneously of operational lifetime. Time-resolved optical spectroscopy allows for a comprehensive analysis of excited states energy dissipation to different optical (loss) channels present in an OLED cavity and the changes during electrical operation. With this method it is possible to investigate current induced modifications of both the radiative and the non-radiative rates inside a complex OLED structure. In addition, a characterization of the electrical properties is required to ensure a deeper understanding of the creation of excited states and possible troubles concerning the charge transport and recombination of the injected charge carriers as well as polaron induced quenching processes. Investigations of these processes can be carried out using e.g. impedance spectroscopy (IS) and displacement current measurements (DCM).

7. Research implementation and results under the program

Title of your research plan:

Analyzing degradation effects in organic light-emitting diodes via transient optical and electrical measurements

Description of the research activities:

Previously achieved degradation results of organic light-emitting diodes indicate that two different degradation mechanisms have to be taken into account to explain the complete ageing behavior. To analyze these results in more detail, displacement current measurements (DCM) during an accelerated aging protocol have been carried out at Chiba University. Two electrical changes can be identified during degradation: creation of positively charged trap states inside the emission layer and changes of the interface potential between the electron transport and the emission layer. Analyzing the results more in detail allows for a correlation of the creation of the trap states with the reduction of the excited states lifetime (phosphorescence quenching) and therewith of the efficiency of the emitting system. Additionally, the second, degradation mechanism was also identified to be a decrease of the charge carrier balance of the device due to a reduced electron conductivity and/or electron injection into the emission layer caused by reorientation effect of the electron transporting molecules resulting in a decrease in charge recombination.

Altogether, it was possible to achieve a comprehensive description of the degradation mechanisms of a green phosphorescent OLED, with an accuracy not reported in the literature until now (publication in preparation).

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: Thomas J. Spiegel （ID No.: SP14312 ）

2. Current affiliation: University of Leipzig, PhD student

3. Research fields and specialties:
Humanities (Philosophy)

4. Host institution: Keio University

5. Host researcher: Prof. Dr. Wolfgang Ertl

6. Description of your current research

My PhD project is about philosophical quietism. Quietism is the metaphilosophical view that constructing positive theories in philosophy about a certain concept or area of inquiry is pointless or useless. Tentatively phrased as a question, Quietism asks us: “How much theory, if any, ought there to be in philosophy?”. This is novel and in stark contrast to the two most influential metaphilosophical views: philosophical foundationalism and philosophical naturalism. Philosophical *foundationalism* is the view that philosophy provides the foundations for science, either by determining the conditions of possibility for science (a version sometimes attributed to Kant´s *Critique of Pure Reason*), or, perhaps, by supplying clarification of those concepts used in the sciences (sometimes ascribed to members of the Vienna Circle). Second, common to philosophical *naturalism*, while there are several distinct kinds, is the notion that philosophy has no priority over science, but should rather cede areas of inquiry to science whenever possible, thereby drastically limiting philosophy´s competence. Quietism purports to offer an alternative to both foundationalism and naturalism: Quietism is directed against views of philosophy as being a discipline that claims to coherently produce theories in a fashion similar to the sciences.

The project is an inquiry into the content and truth-value of quietism; it seeks to answer what quietism means and entails in detail and aims to provide a basis to see whether it´s true. I planned to do this in three parts: (i) analyzing the somewhat chaotic debate around and construct a uniform, workable definition of quietism. (ii) reconstructing and critically assessing the main arguments for quietism proposed by Huw Price and John McDowell. (iii) investigating the positive picture quietism offers, i.e. providing a description of a new philosophical practice.

7. Research implementation and results under the program

Title of your research plan:

Quietism and Naturalism

Description of the research activities:

There are three different aspects of my research activities in Japan.

1) As planned from the beginning, I continued working on my PhD thesis with my supervisor at Keio University, Prof. Dr. Ertl. I was supposed to work on the metaphysical foundations of quietism. Metaphysics is the study of the basic structure and make-up of the world, the “furnishing” of the world if you will. Prof. Ertl as a scholar of Kantian philosophy was suited well for to supervise me in this endeavor.

2) However, during my work at Keio University, I realized I had to slightly reconceive my project by way of rethinking a basic assumption. I started investigating the relationship between naturalism (as described above) and quietism more strongly. It turns out that quietism is best understood as a response to naturalism, hence there is an internal link between those two thoughts. Naturalism is currently the common orthodoxy at least in the Anglophone world. One of the core ideas of naturalism is that we can reduce all there is to just natural, i.e. physical, entities by providing a philosophical theory or account. Quietism is an expression of discontentment with that since quietists stress that naturalism´s reductive enterprise has either absurd consequences or unsatisfactory outcomes. As a result, halfway through my research experience at Keio University, I started conceiving and drafting an additional chapter which is probably going to be the beginning chapter of my PhD thesis. I feel that this addition will significantly improve my work since it will most likely contain a novel approach and argument which cannot be found in the current state of research on this topic. More specifically, it will contain a general, yet clear formulation of the argument whose conclusion is the quietist doctrine. Prof. Ertl kindly supported me in taking this new direction.

3) My academic background German and British (BA at Free University of Berlin, Mphil at King´s College London). One of the reasons I came to Japan was the hope to find fresh approaches to the topic of my research by scholars who have a different academic background than me and the people I usually interact with. I was surprised to find that both the so-called Continental (European) tradition and the Analytic (Anglo-Saxon) tradition are prevalent in Japan such that there is not that much of a difference in background after all.

However, I am still very happy to have contacted and met different Japanese scholars, they all greeted me with kindness and interest. We talked about my research topic as well as getting advice about a possible career in Japan later on. These scholars are, for example, I initiated contact with Takashi Yagisawa (Kyoto University), Ryo Uehara (Osaka University), Masahiko Igashira (Hitotsubashi University), and Mathieu Marion (University of Montreal / Keio University). I hope these people shall become important again in the future, either as research collaborators or general advisors.

I feel that the eight weeks long stay at Keio University has afforded me with invaluable experience, academically, professionally, and culturally.

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

The different cultural experiences I had during these months are too manifold to list them all. I met and befriended many people, both Japanese natives and other members of the JSPS summer program. I tried to soak up as much Japanese culture as I could, trying to exit the stage of just being a tourist, which is why I constantly asked locals about things to do. I tried to rely as little as possible on information resources for foreigners. I have also created, I hope, lasting bonds with my homestay family, the Imazekis, who invited me several times after the homestay weekend.

RESEARCH REPORT

1. Name: Susanne VAAßEN （ID No.: SP14313）

2. Current affiliation: Philipps-Universität Marburg, Germany

3. Research fields and specialties:
Humanities

4. Host institution: Graduate School of Arts and Sciences, Department of Interdisciplinary Cultural Studies, University of Tokyo

5. Host researcher: Prof. Shinji Kajitani

6. Description of your current research

Currently my study is focused on the uprising questions in biomedical-ethics about the limits and realm of invasive biomedical- and biotechnical intervention in human nature, thus the philosophical reflection of the *moral status* of *human nature*. The term “nature” can be seen as a philosophical “problem-expression”, because there is no exact definition for it. However, a large number of various meanings and descriptions has been used in different culture throughout the history to describe it. In general, there are three primary expressions for the nature: the private “daily experience” (nature[1]), natural scientific (natur[2]), and humanistic scientific (nature[3]). These three expressions refer to different aspects of nature. Since the modern era the objective view of natural scientific nature has been generalized to explain nature in a reductionist, materialistic method with models, data, diagrams and curves. This understanding and perception of nature may be useful and correct in natural sciences and research but its generalization is inadequate for the philosophical reflection about the moral status of human nature. Therefor the current biomedical discussions necessitate an alternative expression for nature, a non-reductionist subjective view of nature. In my thesis, based on a phenomenological approach, nature is described in terms of phenomena, intentionality and meanings that include the subjective perception of our own nature as an emotional living species. The modern phenomenology seeks to investigate perception of phenomena without the constraints of the natural scientific perspective through considering particular biographic aspects of the subject and his “felt-body”. It opens up new possibilities to gain experiences, adopt a more open attitude towards reality and, at the same time, build up solid scepticism towards hasty or sweeping generalisations. Therefore, the modern phenomenology is an essential key to the development of a new anthropological concept of nature that does not oppose against a natural scientific concept of nature but that offers an alternative to its domination that is inadequate in biomedical ethics. The aim of this approach is not to replace the scientific expression of nature but to provide a non-reductionist expression of it that can be implemented in the current biomedical discussions.

7. Research implementation and results under the program

Titel of your research plan: Naturalism, Reductionism and Subjectivity

Description of the research activities:

In order to strengthen the phenomenological approach for a new anthropological concept of (human) nature I criticized prominent current naturalistic, materialistic and reductionist concepts of it. My research activities were mainly focused on three philosophers: Hermann Schmitz, Thomas Nagel ("Mind and Cosmos") and Peter Janich ("Information"). They all highlight the huge process of transformation and thus change of paradigms that take place due to the vast influence of the natural scientific perspective that is (under a methodical naturalistic perspective) said to be the only adequate way to explain phenomena and thus objective reality. Hermann Schmitz argues that the naturalistic paradigm lacks of the subjective perspective. To gain objectivity, it´s necessary to minus all subjective characteristics of a phenomena. The so gained "rare facts" of the phenomena may be adequate for the scientific and quantitative description of a phenomenon, but they say nothing about the quality of a phenomena and its subjective character, that is essential for ethical questions about how men want to experience human nature in future. Thomas Nagel tries to find out an alternative approach to the scientific reductionist explanation of phenomena between the two choices of a monistic Materialism and monistic Idealism and hereby focuses on the appearance of mind during the process of the evolution. He argues that it cannot be explained sufficiently by physical laws and chemical reactions (even if they are necessary). Therefore another explanation must be (at least) discussed: He compares different theories as the effect of "emergence" and "autopoieses" but results in the "lack of explanation" which ranges between the materialistic and idealistic explanation of phenomena that cannot be overcome. It is the result of the fact of the unreflect use of terms and expressions in natural scientific explanations. Peter Janich focusses on that appearance and use of terms and expressions of description in the natural sciences. By using them to describe scientific research results or hypothesis without taking in account that they are originally based on philosophical and metaphorical interpretation (such as "life", "mind", "conscious", …) we miss that these expressions cannot give final but only interpretative explanations of phenomena. During my research period at the University of Todai, I closely cooperated with Prof. Shinji Kajitani and my second advisor Prof. Guido Rappe in order to discuss the different positions and perspectives of these three philosophers.

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

Working with Japanese philosophers and phenomenologists gave me a unique opportunity to investigate the intercultural and interdisciplinary aspects of a new and modern phenomenology.

RESEARCH REPORT

1. Name: Petter Bertilsson Forsberg
（ID No.:SP14501）

2. Current affiliation: Uppsala University

3. Research fields and specialties:
Social Sciences

4. Host institution: Meiji University

5. Host researcher: Prof. Katsuki Aoki

6. Description of your current research

The focus for my PhD-project is on the interaction and cooperation between academia and industry. Almost all of the larger top-ranked universities in the world have Technology Transfer Offices (TTO), units responsible for commercialization/utilization of the research being done at the universities. These units have traditionally taken inspiration from a US-context working primarily to stimulate spin-off companies or licensing as means to fulfill their mission. Sweden is one of the few countries in the world were a discovery made is owned solely by the individual researcher.

Because of this Sweden's TTOs have over time put increased efforts towards facilitating *cooperation* between industry and academia in order to achieve their mission. Collaborations between industry and academia as such have also been given an increase focused on policy level as it though to be an important part in the innovation process.

Within the boundaries of my PhD I have access to a work conducted at Uppsala University TTO, *UU Innovation.* For the past 3 years I have been following a joint collaboration-project between Uppsala University (UU) and the Swedish University of Agricultural Sciences (acronym in Swedish, SLU) running between 2011 and the beginning of 2014 with the aim of enhancing small businesses' development and long-term survival by improving their relationships with the universities of Uppsala. The target groups were SMEs within life science, material sciences, sustainable technologies and in the knowledge-intensive social science service sector. These industries were chosen to reflect and match the expertise of UU's and SLU's researchers. The project aimed to create a platform that facilitated and financed *cooperation* between a SME and a researcher manifested in concrete research projects. Because of the very broad spectrum of business involved in the project I have been interested in trying to understand both in theory as well as empirically what *cooperation* truly encompasses.

Trust could be said to be the precondition for cooperation, and also the product of successful cooperation. Cooperation occurs when acting together, collectively, aiming for a common goal that cannot be reached individually by each of them. The success of each depends on the actions others and therefore trust becomes even more important. This is the reason for my deep interest in trust; it is the key factor in any type of work that humans do together.

7. Research implementation and results under the program

Title of your research plan: Cooperation between industry and academia: the role of interpersonal trust

Description of the research activities:

Coming to japan I sought to try and find cooperation activities between industry partners and researchers. During the summer and with great help from my Japanese contacts I interviewed key actors at *Meiji University incubation unit*. I was also able to visit *Graduate school for the creation of new photonics industries* (GPI) in Hamamatsu. The visit to GPI turned out to be particularly fruitful as I was able to gather data from a number of on going cooperation projects between industry and academia. Three on-going projects between researcher and entrepreneur proved to be of particular interest and the plan is to try to follow these three projects over the years to come. I also hope to publish papers or conference proceedings with data from my time in Japan.

Apart from the empirical data gathered I have also initiated two separate research projects with researchers I met here in Japan. The projects are separate but the overall theme of both of them is a focus on interpersonal trust and cooperation. The plan is that we eventually will produce high standard publishable articles. I believe that this is by far the most important product of my stay in Japan as it provides me with novel insights on the theory of trust and access to data that I on my own never would have had a chance to obtain.

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

The visit in Japan has been one of the best trips of my life. The food, the people and the city of Tokyo has been just wonderful. I was overwhelmed by the hospitality of both my host and other Japanese people I have met here. I have also made some close friends through the program that I hope to stay in touch with for a long time. I leave Japan wanting for more and I believe I will come back many times.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Erik ELIASSON （ID No.: SP14502）

2. Current affiliation: Chalmers University of Technology

3. Research fields and specialties:
Engineering Sciences

4. Host institution: Japan Automobile Research Institute, JARI

5. Host researcher: Jacobo ANTONA-MAKOSHI

6. Description of your current research

Traumatic brain injuries comprise half of the 1.3 million annual traffic related fatalities reported Worldwide. Accident avoidance systems will mitigate future accident severities, motivating a focus shift towards moderate and mild traumatic brain injuries (MTBI's). To evaluate safety improvements of consumer goods such as cars and helmets, injury criteria and thresholds are needed. The only criterion in use today predicts severe head injuries and no MTBI criteria are available. All this motivates further studies into the development of advanced head injury criteria. To support this development, rotational trauma experiments on rats have been carried out and reconstructed using Finite Element (FE) models of the specimens. Experimental studies have also shown that brain tissue material properties and the outcome of MTBI's change with age. As we face decades of ageing population, understanding and considering the effect of age on injury outcome will become crucial to take effective prevention countermeasures. The current research involves efforts both to improve the general understanding of brain injuries in rotational head trauma and to improve the understanding of different body type’s effect on the injury outcome (e.g. young, elderly, obese, skinny, tall, short, etc.).

7. Research implementation and results under the program

Title of your research plan:

EFFECT OF AGE ON BRAIN INJURY DISTRIBUTION IN ROTATIONAL HEAD TRAUMA
- A PARAMETER STUDY USING A RAT FINITE ELEMENT MODEL.

Description of the research activities:

A simulation based parametric study was conducted using a validated Finite Element (FE) model of the rat head and brain. The aim was to clarify the effect of age related intracranial changes on the outcome of Diffuse Axonal Injuries (DAI) under rotational head loading. Two age-dependent factors: brain atrophy and region specific brain material properties, were implemented in the model. The model was subjected to both injurious and non-injurious sagittal plane rotational acceleration levels. The simulation results showed that both age-dependent factors considered had an effect on the potential outcome of DAI as indicated by Cumulative Strain Damage Measure (CSDM). When older material properties were included, spread of strains towards the brain stem occurred, which is consistent with the experimental observations. This study provides valuable information on the effect of age related parameters that may contribute to different injury outcome observed in age-grouped rat experiments. Such information will guide future experimental studies in rotational head trauma and provides guidance concerning the parameters that need to be considered when developing age specific brain FE models.

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

The experiences in Japan have been intense and very good. I've tried to travel as much as possible during the weekends to see/experience Japan and its people while being focused at work during the weekdays. I feel that this has given me an interesting perspective on both the working and social life of Japan that I didn't have before.

9. Advisor's remarks (if any):

This was the first time we hosted a JSPS summer fellow at JARI and it turned out to be an excellent collaboration for our institution. The results achieved in such a short time were way above expectations. We will certainly keep in contact with Erik's group for future collaborations and will try to expand our JSPS applications in the coming years

RESEARCH REPORT

1. Name: Christopher Holmberg （ID No.: SP14503）

2. Current affiliation: University of Gothenburg

3. Research fields and specialties:

Social Sciences

4. Host institution: Department of Suicide Prevention; National Institute of Mental Health; National Center of Neurology and Psychiatry

5. Host researcher: Dr Tadashi Takeshima

6. Description of your current research

In contemporary young populations, communication of food and health messages is not exclusively tied to face-to-face communication, but also takes place online. This can affect adolescents' mental health in many ways, especially vulnerable groups of youths, e.g. adolescents undergoing treatment for obesity. However, in addition, social media technology can be employed to facilitate health promotion activities, such as dietary awareness, why the relationship between health and food communication transmitted through social media needs to be further explored.

Below is short description of each proposed study to be included in the doctoral thesis:

I. examine food and health communication between adolescents in a widely used social media application

II. conduct interviews with adolescents undergoing treatment for obesity, focusing on perceptions regarding dietary and health related communication in social media

III. participate in a junior high school-based health promoting intervention, where social media technology will be used as a tool to facilitate awareness and reflection concerning food and nutrition.

7. Research implementation and results under the program

Title of your research plan:

Adolescents' dietary and health-related communication in the era of social media - manifestations, perceptions and implications for interventions

Description of the research activities:

During the stay in Tokyo, I met several researchers pertinent to my research field. Particularly, Professor Masako Watanabe, who has been conducting a similar study as our third study. Masako provided me with tips and recommendations on how to approach the research questions at hand. We are talking about collaborating on a study involving both Japanese and Swedish participants and she is applying for a grant to conduct research in Gothenburg, Sweden.

In addition, Dr Takeshima and I scheduled numerous interviews with experts and researchers concerning my ongoing studies. These included a professor in Health Communication, Hirono Ishikawa from University of Tokyo. She was able to elaborate on how to use health communication as a theoretical framework in research studies. A psychologist researching adolescents' body image, Professor Satoshi Shimai of Japanese Red Cross Toyota College of Nursing, explained the concept of self-awareness and body perception among adolescents.

Furthermore, I conducted several study visits. For example, I met with the director of Kurihama Medical and Addiction Center, Dr Higuchi Susumu, to know more about this National Hospital Organization, and to meet patients undergoing treatment for Internet addiction.

Extracurricular research activities included being a designated speaker during a key suicide prevention meeting involving directors of suicide prevention from Japan, Korea and Taiwan. I also gave a guest lecture for graduate students and faculty members at Japan Lutheran College. Moreover, I held a presentation regarding my third study at Yahoo! Japan's headquarters. The presentation concerned how to use social media in health promotion, especially aimed at their special strategy, Yahoo! Kids, to foster a more inclusive and allowing online environment.

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

During the orientation week at Shonan Village Center I met the Emperor and Empress of Japan, this was as amazing as it was unanticipated. In addition, I attended a performance at the National Noh Theatre, attained the Adachi fireworks festival, and participated in a Bon Odori celebration at the American military base, camp Zama. I also got the chance to climb Mount Fuji which certainly was a once in a lifetime experience. When meeting different researchers, I also got to travel to some of their institutions, which included visits to Yokohama (Kurihama), Nagoya and Toyota-shi.

9. Advisor's remarks (if any):

Mr. Christopher Holmberg is a really motivated and thoughtful researcher with warm and open-hearted atmosphere. We could get a mutual benefit during his stay in our institute as follows; firstly, mutual stimulation for ongoing research and activities, secondly, increase of mutual understanding with regard to the historical and cultural context of health policy development including mental health policy between Japan and Sweden, lastly, finding clues for future research collaboration.

RESEARCH REPORT

1. Name: Martin Keller

（ID No.: SP14504 ）

2. Current affiliation: Chalmers University of Technology

3. Research fields and specialties:

Engineering

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

5. Host researcher: Dr. Koichi Matsuoka

6. Description of your current research

My current research revolves around the thermochemical conversion of solid fuels such as biomass or coal into gaseous fuels and/or electricity by gasification or combustion.

One way of increasing the efficiency of the gasification process is to carry out the gasification step at a lower temperature. However, at low temperatures, the complete conversion of a solid fuel into a synthesis gas with a high heating value presents a significant challenge. To attain a higher conversion, it is crucial to achieve a high degree of gasification of the char that is formed during the pyrolysis of the solid fuel. It has been shown that the exposure of the char to volatiles produced during the pyrolysis of the fuel decreases its reactivity and makes it more difficult to gasify. This decrease in reactivity can be avoided by minimizing the exposure of the char to volatiles by physically separating the char and the volatiles after the pyrolysis.

At Chalmers we are investigating ways of reducing the exposure of char to volatiles by constructive measures within the gasification reactor of a Circulating Fluidized Bed indirect gasification process.

Dr. Matsuoka and his colleagues at the Clean Gas Group at AIST in Japan have recently proposed and designed a unique triple-bed circulating fluidized bed (TBCFB) gasifier in order to reduce the exposure of char to volatiles, in which the pyrolysis of the solid fuel is conducted in an additional, separate downer reactor.

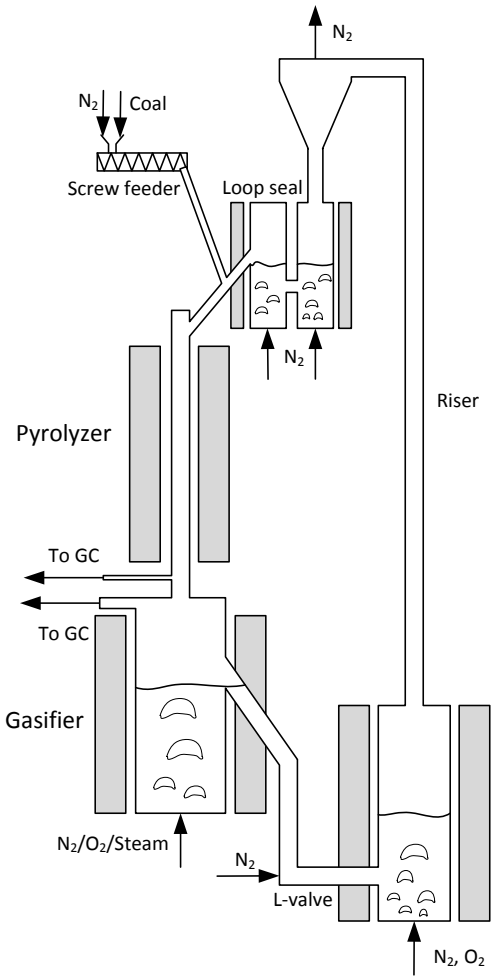
7. Research implementation and results under the program

Title of your research plan:

Influence of oxygen and steam co-feeding to the gasifier on the gasification rate and product gas yield of a triple-bed circulating fluidized bed (TBCFB) unit.

Description of the research activities:

We conducted research on a laboratory-scale TBCFB gasifier, which is illustrated in the figure below.



In comparison to previous experiments conducted in this system, the circulation of bed material and char in this unit was controlled by the aeration of the L-valve, which we managed to operate successfully. Oxygen was co-fed with steam to the gasifier and its effect on char conversion rate, product gas composition, tar yield and other parameters was investigated. An extensive series of experiments was performed by varying both the steam-to-carbon ratio and the oxygen-to-carbon ratio in the gasifier. Furthermore, the influence of the insertion point of the fuel (to the pyrolyzer as opposed to direct feeding to the gasifier) on the performance of the unit during oxygen co-feeding was investigated. The experimental results were compared to thermodynamic equilibrium calculations. Generally, the experiments were successful and we obtained interesting results which will be valuable for the further development of this technolog

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

My stay in Japan was not only of great professional value, but also included many interesting cultural experiences. Two of the highlights of my stay were the climbing of Mt. Fuji during night time, and, of course, the visit of the Emperor and the Empress of Japan in Shonan. As I am very fond of Japanese cuisine, I also enjoyed many wonderful meals during my stay.

9. Advisor’s remarks (if any):

RESEARCH REPORT

1. Name: Nuno João Santos Leal （ID No.: SP14505）

2. Current affiliation: Karolinska Institutet, Sweden

3. Research fields and specialties:
Biologial Science

4. Host institution: Osaka University

5. Host researcher: Professor Tamotsu Yoshimori

6. Description of your current research

Alzheimer's disease (AD) is the most common form of dementia in the world. The most accepted AD hypothesis is the intra and extracellular accumulation of amyloid β-peptide (Aβ) in the brain that leads to synapse loss and neuronal death. Damaged proteins in neurons can be degraded in an autophagosomal pathway. This is thought to be the main clearance system of Aβ oligomers as well. It has been shown that autophagosomes accumulate in postmortem AD patients. It has been suggested as well that this autophagosomes can act as an intracellular reservoir for the toxic Aβ.

Recently it has been shown that the impairment of ER-mitochondria contact sites leads to neuronal degeneration (Hedskog et al., 2013) and that autophagosomes form at the same contact sites (Hamasaki et al., 2013). It has been shown as well that Aβ can be produced in ER-mitochondria contact sites (Schreiner et al., 2014).

Our present research consists in studying the interplay of ER-mitochondria in AD. Our current research is focused mainly in the relationship between the ER-mitochondria contact sites and the Aβ-peptide production; furthermore, we want to understand the autophagosomal formation in this relationship.

Recently we were able to decrease the Aβ-peptide levels by modulation the ER-mitochondria contact sites by down-regulating Mitofusin-2 (tethering protein). We have been trying to understand as well what happens to the ER-mitochondria contact sites when primary hippocampal neurons (from mice) are incubated with a high concentration of Aβ-peptide. Preliminary data shows the dynamic of these structures, being hard to conclude a linear relation between Aβ incubation time and effect on ER-mitochondria contact sites.

Therefore, our main goal during the JSPS Summer Program was to study the effect of Aβ in the biogenesis of autophagosomes at ER-mitochondria contact sites since this is Professor Yoshimori's lab major research field. To try to understand this hypothesis we have suggested to disrupt the ER-mitochondria contact sites and check the effect in the biosynthesis of autophagosomes using several autophagosomal markers.

7. Research implementation and results under the program

Title of your research plan:

Mitochondria-ER Contact Sites: Where Amyloid β-peptide and autophagosomes are born.

Description of the research activities:

During these two months I perform several experiments where I check for the most common autophagosomal marker – LC3 – in a cell line over expressing Aβ from our group at Karolinska Instutitet.

I started by checking the autophagosomal levels in that cell line to test if this cell line behaved like the previous cell lines used by the group. Our data shown that the autophagy flux can be induced in the same way as previous cell lines used giving us green light to proceed with our experiments.

After, I start checking for autophagosomal markers in treated cells. I modulated the ER-mitochondria contact sites and using different methods (protein quantification and microscopy) I try to see differences between the autophagosomal makers. Unfortunately I didn't have the time to perform all the experiments I wanted to when I wrote the plan proposal.

Most of the results obtained were not consistent since the same treatment of the cell led to different results. But not everything was bad since I was able to detect LC3 bands since at Karolinska Institutet, after several tries, I could never detect these bands. Now, when I am back, I will repeat those experiments using the same protocols and techniques as I was taught here.

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

Japan is a different country to work at. I enjoyed most of my weekend traveling and sightseeing and coming back to the lab on Monday and knowing my colleagues spent the whole weekend working was a shock. This is the main reason why I will always say no to a job in Japan because I was raised in a different mentality where free time is need as well.

In other hand I will never forget how helpful people are, how different and interesting the culture is. Although everyone is extremely nice it is hard to communicate with people since the English is almost non-existent but I will never forget the lady who hand me an umbrella when the typhoon decide to strike in the middle of a sunny day.

RESEARCH REPORT

1. Name: Michael Charles Lue
（ID No.: SP14507）

2. Current affiliation: Swedish Institute of Space Physics (IRF); Umeå University (UmU)

3. Research fields and specialties:

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

4. Host institution: Institute of Space and Astronautical Sciences/Japan Aerospace Exploration Agency (ISAS/JAXA)

5. Host researcher: Dr. Yoshifumi Saito

6. Description of your current research

I study the solar wind-Moon interaction. I.e., the interaction between plasma from the Sun and the lunar surface and lunar crustal magnetic fields (magnetic anomalies). I analyze data from lunar orbiters (the Indian Chandrayaan-1 and now also the Japanese Kaguya). The data I use are measurements of ions and neutral atoms of energies within 10-3000 eV. Neutral atoms of these energies are called Energetic Neutral Atoms (ENA).

The lunar magnetic anomalies can, despite their small scale, decelerate, deflect, and reflect solar wind protons. The scale is special because it is comparable to- or smaller than the proton gyro radius, but much larger than the electron gyro radius. This means that the electrons can be reflected by the magnetic fields, while the protons rather react to the electric field towards the electrons. The plasma physics involved and the environment created at the magnetic anomalies on the Moon have caused a significant interest for this topic. My main contribution to this topic has been mapping the proton reflection from the magnetic anomalies [Lue et al. 2011, Geophys. Res. Lett., doi:10.1029/2010GL046215].

The lunar surface also reflects solar wind protons. Most of them pick up an electron from the surface and become hydrogen ENAs but some remain charged. The unique aspect of this interaction, compared to laboratory particle-surface interactions, is the extremely rough and porous lunar surface. The surface reflection is also very useful because it allows remote-sensing of solar wind precipitation onto the surface. My main contribution to this topic has been investigating how the charged fraction of the reflected particles relates to the solar wind speed [Lue et al. 2014, J. Geophys. Res., doi:10.1002/2013JE004582].

When the Moon is not in the undisturbed solar wind flow, but in the terrestrial magnetosheath, the properties of the solar wind change significantly. The effects of this on the two types of interactions are unclear. A recent study in the magnetosheath [Allegrini et al. 2013, Planet. Space Sci., doi:10.1016/j.pss.2013.06.014] found a seemingly increased ENA reflection efficiency that could be a geographic effect, an observational effect, or an effect of the plasma properties. My work in Japan has been focused on resolving this issue with the ENA reflection efficiency from the lunar surface in the magnetosheath.

7. Research implementation and results under the program

Title of your research plan:

The interaction between the Earth's Magnetosheath and the Moon

Description of the research activities:

Our strategy for getting accurate estimates of the ENA reflection efficiency in the magnetosheath has been to use observations from the Chandrayaan-1 spacecraft of the reflected hydrogen ENA flux and simultaneous observations from the Kaguya spacecraft of the incoming solar wind proton flux.

Tools for processing the ENA data were developed largely in preparation of the summer programme, but were also improved upon during the programme. The major part of the work during the programme consisted of getting to know the ion data of the Kaguya spacecraft and developing tools for the processing of these data.

I identified available time periods during which the Moon was in the magnetosheath and the relevant instruments on both spacecraft were operational, and obtained preliminary results in the form of energy-time spectrograms of the ion and ENA observations. I estimated the reflected ENA flux, and my host advisor Dr. Y. Saito estimated the incoming solar wind flux. Thereby, we obtained the reflection efficiencies for these periods.

The results will form the basis of a paper on the magnetosheath-Moon interaction. We may also investigate other aspects of the interaction in the magnetosheath with the tools that were developed during the summer programme.

Other activities consisted of scientific communication. I attended a meeting on magnetic anomalies in Tokyo, where I presented the results by me and my home institute, and was updated on the work by Japanese groups. I attended the AOGS meeting in Sapporo, where I presented my work on proton reflection from the lunar surface. I made a visit to Kanazawa University together with my PhD supervisor, presented our work and listened to very interesting presentations of their work. I have also attended many interesting and relevant seminars at ISAS/JAXA.

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

Getting to know and work closely with some of the key researchers in my field has been a very important, valuable and enjoyable experience. Also, to get to know the Japanese culture, at work and outside of work, and to visit many places in Japan has been great.

9. Advisor's remarks (if any):

The collaborative research with Charles has made great progress during his stay in ISAS. I would like to continue collaborating with him in the future, too.

RESEARCH REPORT

1. Name: **Matteo Molteni**
（ID No.: SP14508 ）

2. Current affiliation: **Department of Mathematical Sciences, Chalmers University of Technology, SE-41296, Gothenburg, Sweden**

3. Research fields and specialties: **Mathematical and Physical Sciences**

4. Host institution**: Department of Mathematical Informatics, Graduate School of Information Science and Technology, the University of Tokyo**.

5. Host researcher: **Takayasu Matsuo**

6. Description of your current research

My research focuses on a structure-preserving numerical method, known as the Discrete Variational Derivative Method (DVDM). This is based on a new class of "structure-preserving numerical methods", which improves the qualitative behaviour of the PDE solutions and allows for stable computing. I want to adapt the DVDM to solve the PDE (EPdiff equation) upon which a mathematical framework for image registration is based, by developing a computer program for solving it and by comparing its performance to the one of a FEM program currently developed at Chalmers. A mathematical analysis of the algorithm could also be initiated.

7. Research implementation and results under the program

Title of your research plan:

DISCRETE VARIATIONAL DERIVATIVE METHOD (DVDM) FOR IMAGE REGISTRATION

Description of the research activities:

During the first two weeks we focused on the equation itself, in order to gain a better understanding of it. Professor Matsuo achieved recently some remarkable results on the one-dimensional version of the equation. We therefore devoted some time to study similarities and difference between the mono and the multidimensional case, trying to proceed by analogy in order to realize whether or not a multidimensional counterpart to Matsuo's technique existed. The final outcome was a better understanding of the equation, together with an explicit formulation for it in Hamiltonian form, which allows the usage of the DVDM. This permitted a preliminary sketch of three possible energy preserving numerical schemes, the quality of which had to be empirically tested by direct implementation.

A first implementation phase followed. The three schemes have been tested with some known toy problem, recently used in some breakthrough peer-reviewed

papers on the same topic. It turns out that all our schemes are suitable candidates to solve the problem, although only two of them seem to be efficient enough to tackle a multidimensional problem. Most of the tests in this phase have been conducted on coarse grids and on a standard laptop. No special resources have been necessary.
A fourth scheme, based on recent research of professor Matsuo and a co-worker of him, professor Furihata, has also been adapted to our problem and implemented. This scheme is based on two of the schemes previously analyzed and fits naturally in the current framework. The encouraging results convinced us to keep it as an extra candidate in our study, even though it was not planned from beginning.
With 3 fast-performing schemes, suitable to solve our problem on fine grids, we started simulation on high dimensional data. The large dimension of the data (at each time step we need to solve linear system with dimension 2^21 * 2^21, and the number of time steps required is proportional to 2^10) required extra resources, that we found in Matsuo's facility. Every test on fine grids has indeed been conducted on the mainframe in the hosting laboratory at the Graduate School of Information Science and Technology.
The good results achieved in every model problem investigated encouraged us to get started with some further analysis of our algorithms, namely:
- Performance analysis.
- Convergence analysis.
- Energy preservation.
- Time reversibility.

The results of this analysis are extremely useful in order to better understand which of the schemes investigated might actually be applied in the concrete problem of image registration. It turns out, indeed, that out of 4 schemes originally studied:
- Two schemes are perfectly viable candidates to be used in the problem of image registration, each with its strength and drawback. Indeed, one of them is incredibly performing in terms of cost per iteration, but has the drawback of having a slightly smaller stability region than the other one, and, although being energy preserving, it does not preserve the energy as well as the other scheme does.
- One scheme is too expensive in terms of time required for each iteration, but it can be used as a “main ingredient” in order to construct the fourth scheme mentioned above.
- The fourth and last scheme might be a viable candidate too, even though it is not perfectly clear yet whether or not its non-optimal geometric properties might lead to further problems in future applications.

As a final outcome of the research carried out, we have a complete and thorough analysis of four different algorithms and a good insight in their properties. This constitutes an invaluable source of information upon which we can base a future research plan aimed directly to the problem of image registration.
All the relevant results have been gathered in a manuscript aimed for a possible publication in a peer-reviewed journal. A preprint is currently in progress and will soon be available.

RESEARCH REPORT

1. Name: Mariana Buongermino PEREIRA （ID No.: SP14 509 ）

2. Current affiliation: Chalmers University of Technology

3. Research fields and specialties:
Mathematical and Physical Sciences

4. Host institution: Keio University – Graduate School of Science and Technology

5. Host researcher: Professor Kengo SATO

6. Description of your current research

Antibiotics are efficient drugs against infections caused by bacteria. However, bacteria can become resistant against antibiotics, which requires new drugs to be constantly developed resulting in an expensive and inefficient process. Antibiotic resistance is often caused by the horizontal transfer of genes, a mechanism that allows bacteria to share genetic information between different organisms. In this way, antibiotic resistance can spread rapidly, causing untreatable infections all over the world. Identification and understanding of antibiotic resistance and how it spreads is important to keep the design of new antibiotics feasible and infections treatable.

As a graduate student at Chalmers University of Technology, my research focuses on creating probabilistic models to identify genes that have been horizontally transferred. For that, we model the attC site, a characteristic DNA motif that is found downstream of the inserted genes. This motif is involved in the gene insertion. During the insertion the motif folds its bottom strand acquiring a secondary structure similar to non-coding RNA.

Initially, we created hidden Markov models (HMM) to identify these motifs. Even though HMMs have presented good results for this problem, they are limited to deal with local dependencies in order to be tractable. The fold of biological sequences, such as RNA secondary structure, requires interactions of stretches that are far apart implying the existence of long-range dependencies.

At Keio University, the existing model was extended to incorporate secondary structure information. For that a different technique was used, namely stochastic context-free grammars (SCFG), which is an appropriate formalism to deal with palindromic structures present in the secondary structure of non-coding RNA. The grammar rules were used as features in conditional random fields (CRF). In this way, we have a model that includes all the available information about the attC sites.

7. Research implementation and results under the program

Title of your research plan:

Using conditional random fields to find antibiotic resistance genes

Description of the research activities:

In Japan, first the existing HMM was transformed into an equivalent CRF model. This includes coding the algorithms, running and debugging.

Next, in order to expand the model to deal with the complex, long-ranged dependencies I read about RNA secondary structure and stochastic context-free grammar.

Finally, the RNA grammar was adapted for my problem and I implemented a CRF using the SCRF as features for the model.

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

My overall opinion about my visit to Japan is highly positive. Regarding the science part, I am very satisfied with the supervision I received from Sato-sensei. He was always available to extensive and interesting discussions about my project. He has deep knowledge on my topic and gave me precise advices on how to conduct my project. I am very thankful. Culturally, I am impressed and honored with the treatment we received from JSPS. Also, the people I met in Japan, my labmates and society in general were very kind, friendly and polite to help me with all sort of information about Japan. I felt very welcomed and I will be happy to return to Japan some day! (^.^)

9. Advisor’s remarks (if any):

Mariana-san worked very hard to extend the model with SCFG in our lab. Although it is not easy to finish the project within the program, I want to continue the project with Mariana-san and her supervisor after the program. Then, I will be happy to start other projects with her and her supervisor.

RESEARCH REPORT

1. Name: Jochen Smolka
（ID No.: SP14510）

2. Current affiliation: Lund University, Lund, Sweden

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: The Graduate University of Advanced Studies (Sokendai)

5. Host researcher: Dr. Michiyo Kinoshita

6. Description of your current research

My main research interest is how animal senses and brains are specialised to extract relevant information from their sensory environment. In my doctoral thesis about fiddler crabs and my present research in dung beetles, I have been investigating the relationship between visually guided behaviour and the organization of animal eyes. Through these projects, I have realised that, to answer my core question, it is important to understand the neuronal network in the central brain. The laboratory of Prof. Dr. Arikawa and Dr. Kinoshita is one of the world-leading laboratories in the study of butterfly colour, brightness and polarisation vision on a behavioural, anatomical and physiological level. The group is an ideal place to learn methods of visual system histology.

During discussions with Dr. Kinoshita, I became interested in a brain area called the anterior optic tubercle (AOTu). In the insect brain, light information from the compound eyes undergoes basic processing in the optic lobes and is then sent to the central brain. Among the central brain areas, the AOTu is the main area processing purely visual information, suggesting that it contributes to sophisticated visual perception requiring integration of different visual modalities, i.e. colour, shape and motion. I therefore realised that the AOTu must be a key area for extracting relevant information related to specific visually-guided behaviours.

7. Research implementation and results under the program

Title of your research plan:

Visual processing in the butterfly brain

Description of the research activities:

Neural connections through the AOTu of the Japanese yellow swallowtail butterfly (*Papilio xuthus*, Fig. 1) were investigated by dye injections into distinct brain areas. I first traced neurons interconnecting the optic lobe and the AOTu by double injections of fluorescent dyes (Texas-Red and Neurobiotin) into different areas of the medulla (dorsal and ventral medulla in 8 animals, anterior and posterior medulla in 10 animals). After injections, the brains were dissected and sectioned, and the stained neurons visualised using histochemical protocols for light micrography.

Figure 1: The Japanese yellow swallowtail, *Papilio xuthus*.

I found that the dorsal-ventral axis of the medulla is projected retinotopically onto the medial-lateral axis of the ipsilateral AOTu (Fig. 2). Interestingly, a retinotopic projection of the anterior-posterior axis of the medulla was not found (Fig. 3).

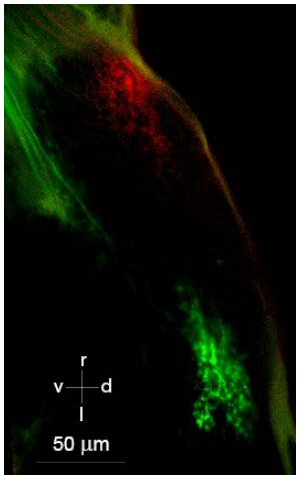
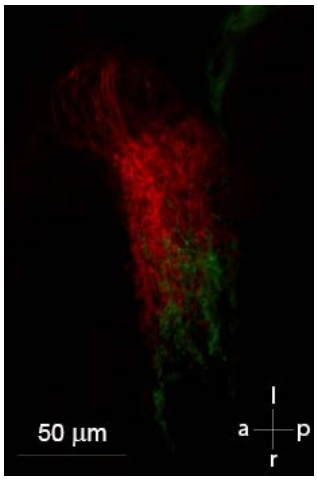


Figure 2 (left): Vertical section through the right right AOTu after dye injection into the ventral (green) and dorsal (red) right medulla. Target areas are clearly separated along the medial-lateral axis.

Figure 3 (right): Horizontal section through the left AOTu after injection into the posterior (red) (red) and anterior (green) left medulla. Target areas are largely overlapping, indicating no clear clear mapping of the anterior-posterior visual axis into the AOTu.



In a second set of experiments, I traced inputs and outputs of the AOTu by single or double injections into the AOTu in 7 animals. Micrographs of serial sections of these brains will be analysed to reveal the detailed neuroarchitecture of the AOTu in *Papilio*.

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: Inga Tuminaite （ID No.: SP14511）

2. Current affiliation: Lund University, Sweden

3. Research fields and specialties:

Biological Sciences

4. Host institution: NIPS, Okazaki

5. Host researcher: Prof. Makoto Tominaga

6. Description of your current research

Sensing temperature and avoiding potentially harmful temperature extremes is important for all organisms. The molecular mechanisms of thermosensation are still somewhat uncertain, especially for cold temperatures. Skin thermoreceptors are cation-permeable TRP channels in the membrane of sensory neurons. The channel TRPM8 is said to be the principal detector of environmental cold covering both pleasantly cool and noxious cold temperatures. It is also sensitive to menthol and therefore responsible for the cooling sensation one feels when exposed to menthol. A great deal of research is done to learn more about temperature sensitivity and transduction mechanisms of TRPM8. This work is however almost solely carried out on human and rodent homologs thus making the results hard to generalize for all mammals. Animals living in subarctic climates are often exposed to freezing temperatures climate is believed to be responsible for certain physiological adaptations, such as an altered temperature sensitivity

I have focused my research on dogs that live in the North of Sweden. These animals are exposed to low temperatures for prolonged periods of time during the winter months when the outside temperature can drop to -40 °C. It is unlikely that these animals perceive temperatures the same way we do, especially temperatures approaching 0 °C. I use thermography to non-invasively determine the temperature in glabrous skin (paws and rhinarium) in normally behaving dogs. The results obtained so far indicate an extended cold tolerance compared to the primate cold pain threshold of 12 °C. This has naturally led me to investigate the dog sensory neurons and thermoreceptors during my Master's degree project, by using mainly histology and immunofluorescence as well as bioinformatic methods.

7. Research implementation and results under the program

Title of your research plan:

Characterization of canine TRPM8

Description of the research activities:

In the Cell Signaling Division at NIPS (National Institute for Physiological Sciences, Okazaki), I worked on the dog TRPM8 channel. The cDNA encoding the ion channel was transfected in to HEK293 cells together with a fluorescent marker prior to every experiment.

The channel was then characterized 24 hours post transfection using calcium imaging or whole-cell patch clamp techniques. The main objective was to determine the temperature activation threshold of the channel when it is pre-exposed to different ambient temperatures.

Calcium imaging is a sensitive and widely used technique that monitors calcium levels in the cell using a fluorescent dye. Calcium ions are well known second messengers in the cell responsible of transduction of external signals, it is also the primary cation that is transferred by TRPM8. When the dye is bound to calcium it's excitation wavelength shifts indicating a calcium influx due to channel activation. I recorded the emission shift when the cells were exposed to a cold stimulus, different concentrations of menthol and the compound WS12 which is known to activate human and rodent TRPM8. The temperature activation threshold was estimated for pre-exposure temperatures of 40, 30 and 25 °C.

Whole-cell patch clamp is basically electrophysiology on single cells. An electrical current is caused by the flow of ions through the cell membrane. Therefore the current is a representation of ion channel activity in the cell. One uses a micropipette to gain access to the interior of the cell and to record current traces. I exposed the cells to cold stimulus and different concentrations of menthol. The temperature activation threshold was estimated for starting temperatures of 40, 30 and 25 °C. The data analysis included plotting the current and temperature data in Arrhenius plots which give a trustworthy estimate of the temperature activation threshold.

Both techniques allowed us to determine that, at the starting temperature of 25 and 30°C, a drop in temperature of 1-2°C was sufficient to activate the dog TRPM8, results similar to the one observed with human TRPM8. However, for the starting temperature of 40°C, no conclusive temperature activation threshold could be established. Further experiments will be needed to determine this and also to investigate the exposure to lower ambient temperature.

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

My stay in Japan was rewarding both professionally and personally. I didn't experience the working environment as any different from the one I am used to in Sweden except for the considerably longer working hours in Japan. The research team made me feel very welcomed and I am indeed very happy to have worked with them.

I tried to use the weekends and any other free time during the week to visit new places and experience the Japanese culture. Despite doing the typical tourist activities, like sightseeing in various cities, I climbed Mt Fuji and visited a sumo tournament, which both were extraordinary experiences. I also enjoyed the amazing Japanese cuisine and my moto has been to try everything at least once.

9. Advisor's remarks (if any):