RESEARCH REPORT

1. Name: Dustin Adams	（ID No.: SP12001）

2. Current affiliation: University of California, Santa Cruz

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: IBM Research - Tokyo

5. Host researcher: Chieko Asakawa, PhD

6. Description of your current research

While photography within the blind community is becoming more popular, there is a lack of accessibility for people who are blind to access photos once the photos have been taken. Since a person who is blind cannot rely on the photo's visual content to identify the photo, they must use other clues about the photo with which to identify it, such as a description, time, date, and location the photo was taken, or audio. Smart phones provide a framework to customize photo capturing capability to cater to needs of users from a wide range. Some current apps try to make accessing a single photo by blind users more accessible, however, they do not try to solve the problem of how a blind user browses a photo library. I have designed a new interaction technique that will allow blind users to easily browse through a photo library by examining current problems with other apps, as well as the needs by blind users to browse through photos. This app makes photo browsing finally accessible by blind photographers by reducing the number of steps involved to retrieve a photo, providing non-visual contextual information about the photo, as well as organizing the photos in a way that allows blind users to access photos just as fast as sighted users. Thus, blind users will be able to share their experiences with others both online and offline, face-to-face, as well has have a means to remember past events and significant moments.

7. Research implementation and results under the program

Title of your research plan:

Accessible Photo Library Browsing with a Smart Phone

Description of the research activities:

Held several brainstorming and discussion sessions to determine how to solve the issue of a blind person wanting to browse through a photo library. Once determining several key guidelines for building a library, and agreeing this library should be built using smart phone framework, we began designing the smart phone application (app). After designing the app, we began implementing it for iOS. Once we decided the current state of the app was testable by a user, we tested it with one blind iPhone user who used it for several days then gave many improvement ideas. We discussed these ideas, iterated on the prototype, and tested again with the same blind user. We continued this process several times, and are still continuing this process. We have discussed several ideas on how to move forward with this prototype, including a user study with prototype.

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

The types of food I have eaten has been the most interesting. I once ate raw horse meat, which is something I would have never have eaten in the US, but it turns out to be very good.

RESEARCH REPORT

1. Name: Dawn Barnes	（ID No.: SP12002）

2. Current affiliation: Emory University

3. Research fields and specialties:

    Biological Sciences

4. Host institution: Nagoya University

5. Host researcher: Dr. MAEDA Yuichiro

6. Description of your current research

We are studying the function of a complex of three proteins that regulate muscle contraction, in striated muscles. We are focusing on the function of a small region of one of the three proteins (TnI) because this region is present in both invertebrate muscle and vertebrate skeletal muscle, but it absent from vertebrate heart muscle. To understand the function of this domain in TnI, we are utilizing biochemical experiments to look at activity differences, as well as behavioral experiments to look at differences in muscle function when this region is mutated. The behavioral assays utilize *C. elegans*, a small round worm. The biochemical assays are also conducted on *C. elegans* proteins, expressed by bacteria. Functional results will be correlated with images of the protein structures so that we can understand the causes for differences in function.

7. Research implementation and results under the program

    Title of your research plan:

    How Protein Structure Plays a Role in the Contraction and Relaxation of Heart Muscle.

Description of the research activities:

We are studying the function of proteins that regulate muscle contraction. Three of these proteins form a functional unit, named troponin. To conducts biochemical and structural biology assays, proteins need to be expressed and purified in large quantities. I spent my summer working on the optimal expression systems for the three proteins (TnI, TnT, TnC) in my protein complex. We were able to express and roughly-purify two of the three proteins. To facilitate future purification, we also modified one of the proteins (TnT), during cloning, to have a small extension. In our attempts to optimize the expression system for the third protein (TnI), we utilized different bacteria strains, different plasmids for cloning, and different oxygenation and cell-density conditions. These variables are still being modified to achieve optimal expression of the TnI protein.

Although I did not purify all the proteins needed for structural biology studies. I was trained on how to prepare samples for and take images with the Electron Microscopy microscope. This training will aid me in my future structural biology experiments.

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

I did not have the opportunity to travel much during my fellowship in Japan so my principle cultural experiences were focused in the laboratory. I did not mind spending all my time in lab because my coworkers were such great company. I will take away the Japanese work-ethic and believe this to be a cultural-experience in itself. We also shared many great lunch breaks. My favorite times were when we cooked Japanese or American meals for each other. It was also a privilege to spend my summer with experts in both the research field and laboratory techniques related to my doctoral study.

I was able to steal away for a trip to the neighboring cities of Kyoto and Osaka. I enjoyed the fusion of old and new in Kyoto. Osaka was a lively commercial city with an amazing city- view at night. I also enjoyed regular beer gatherings with international students at Nagoya University. Nagoya University has a ballroom dance club; it was interesting to attend their final practice. to see the differences and similarities to dance class in the United States. Everybody was so kind. Through a combination of their basic English, my basic Japanese, and translator tools, we were able to communicate. It was a great immersion experience.

RESEARCH REPORT

1. Name: Natalie Beckman-Ross	（ID No.: SP12003）

2. Current affiliation: Colorado State University, Fort Collins, CO

3. Research fields and specialties:

　　Biological Sciences

4. Host institution: Hokkaido University

5. Host researcher: Dr. Futoshi NAKAMURA

6. Description of your current research

Instream wood has been shown to play an especially important role in the ecology and geomorphology of mountain streams.　Wood recruitment and transport can occur on time scales ranging from hours to decades, and is therefore difficult to observe in the field. Instead, various methods have been proposed to infer temporal dynamics and process controls using the physical characteristics of instream wood.　We hypothesize that transport limited reaches retain wood for longer periods of time than comparable supply limited reaches, and therefore the wood in transport limited reaches will have a longer time to decay in place.　If this hypothesis holds true, then logs within transport limited reaches should demonstrate an overall greater amount of decay than logs in comparable supply limited reaches.　Previous studies by Dr. Nakamura and his collaborators have used data from Japan to test this hypothesis, but the dataset contained confounding differences in climate and decay rates.　I test the hypothesis using a dataset of field measurements in 30 reaches along Colorado's Front Range, including a total of 6091 logs.

In addition to decay distribution, reaches are compared based on disturbance history, stream characteristics, and forest age.　Reaches draining old growth spruce-fir forest are compared to reaches draining recently disturbed old growth forest and forest which has regenerated after logging.　Old growth and disturbed old growth are hypothesized to be transport limited, and therefore we expect to see a greater proportion of logs which have high decay classifications.　Conversely, we hypothesize that forests which are regenerating after logging do not provide as much wood to the channel and therefore instream wood is supply limited.　We expect wood in these streams to have lower decay rates.　If these hypotheses hold true, then comparative decay classification may be a valid tool for establishing process control of instream wood.　Once process control has been established, it may be possible to use the basin characteristics to draw additional conclusions about the morphological differences between supply and transport limited reaches.

7. Research implementation and results under the program

Title of your research plan:

Log decay as an indication of process control in mountain streams

Description of the research activities:

During this summer I assisted Japanese colleagues with field work by helping to electrofish in the Tokachi region and survey the Tyubetsu River near Higashikawa.

In addition, I collated my own dataset from Colorado to test the hypothesis described above.   I researched statistical methods which are appropriate for the type of data and desired results, and implemented them on 10 of the 30 streams.   Although my research is not complete, based on preliminary results I submitted and abstract of this research to the American Geophysical Union for presentation at their annual conference in December.

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

My host and officemates at Hokkaido University have invited me along weekend trips.   I have hiked and camped in National Parks, including Daisetsuzan and Rishiri Mountain where you can look across the sea to Russia, and I have been really spoiled by trips to onsen!   Hokkaido is much more beautiful and relaxed than I expected, and I'm grateful to my Japanese colleagues for helping me explore the natural beauty of northern Japan.

RESEARCH REPORT

1. Name: David J. Bodine	（ID No.: SP12004）

2. Current affiliation: University of Oklahoma

3. Research fields and specialties: Meteorology

4. Host institution: Kyoto University   5. Host researcher: Professor Takashi Maruyama

6. Description of your current research

Before coming to Kyoto University, my research at the University of Oklahoma focused on studying tornadic debris using polarimetric radar.   Polarimetric radar has shown many interesting signatures associated with debris and precipitation in tornadoes.   The tornadic debris signature is produced by the backscattered signals of lofted debris.   This signature is evident in most tornadoes, and sometimes extends to the maximum height of the thunderstorm.   In my previous work, I showed that increasing tornado damage severity is associated with increased debris lofting and lofting of debris to higher altitudes.   My research has also shown that negative differential reflectivity values sometimes occur in tornadoes, indicating either a preferential alignment of debris in tornadoes or effects of Mie scattering.   Another interesting polarimetric radar observation is a ring of small drops that surrounded a tornado.   In my previous work, we hypothesized that this small drop ring was caused by the central downdraft present in some tornadoes.

My research at Kyoto University is designed to improve our understanding of these unique radar signatures using a large-eddy simulation (LES) model developed by Professor Maruyama at Kyoto University.   The LES model provides an opportunity to investigate the three-dimensional motion of debris and precipitation within tornadoes under varying tornado flow conditions and for various debris and precipitation types. The goal of this project is to investigate how the three-dimensional distribution of debris and precipitation vary as a function of swirl ratio (i.e., for a one-cell vortex, vortex breakdown, two-cell vortex, and for suction vortices).   The LES model provides a sophisticated handling of turbulence, which likely increases the variability of tornadic debris and precipitation trajectories.

7. Research implementation and results under the program

Title of your research plan:

Understanding the motion of debris and precipitation in tornadoes

Description of the research activities: My research activities at Kyoto University have focused on learning the LES model and performing simulations of tornadic debris and precipitation using the LES model.   Since I had no prior experience performing numerical simulations, I devoted time to learning the principles of computational fluid dynamics (CFD) so I could adapt the existing LES code for the experiments.   This experience has given me a good understanding of CFD and will broaden my future research activities.   After learning the principles of CFD, I have performed simulations of debris and precipitation for one-cell vortex, vortex breakdown, two-cell vortex, and suction vortex cases.   These simulations investigate debris distributions including a range of debris types from very small debris (e.g., dust) to large, dense debris (e.g., large rocks).   Simulations with both small (1-mm diameter) and large drops (4-mm diameter) have been performed using the LES simulation as well.   In addition to my research at Kyoto University, I have given presentations at Tokyo University, and will be giving presentations at Kyoto University and the Meteorological Research Institute during the last week of August. I will remain at Kyoto University until December and continue this research with Professor Maruyama.   During this time, we plan to expand the scope of my research to investigate the three-dimensional distributions of non-spherical debris types, examine the feedback of debris on the three-dimensional tornado wind field, and incorporate radar or storm-scale model data into the LES model.

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

I enjoyed my homestay with my host family very much, and look forward to staying in touch with them and hopefully visiting them again.   I also visited many places in Kyoto and nearby cities in my free time, and really enjoyed the opportunity to live near Kyoto. Finally, I have enjoyed the opportunity to develop friendships with the Japanese students in my lab and other Japanese people I have met throughout my experience in Japan.

RESEARCH REPORT

1. Name: Austin J. BROCKMEIER	（ID No.: SP12005）

2. Current affiliation: University of Florida

3. Research fields and specialties:

Mathematical and Physical Sciences, Engineering Sciences

4. Host institution: RIKEN Brain Science Institute

5. Host researcher: Prof. Andrzej CICHOCKI

6. Description of your current research

Matrix decompositions are useful to identify factors in linear models of data. For signal processing at least one of the dimensions of the data is time or space, but there may be additional dimensions. In these cases, matrix factorization may be inefficient; alternatively, tensor factorization can provide a natural model of any multi-linear structure in the data. Besides original applications in chemometrics and psychometrics, tensor factorization methods can be applied to signal types such as grayscale and color images, video, and audio recordings, making them quite relevant to the signal processing community. My current research is developing and applying tensor factorization for neural signals, specifically recordings of electrical potential from the scalp electroencephalogram (EEG) or the internal local field potential (LFP), where, besides space and time, additional dimensions include trials or subjects. Previously, I had worked on unsupervised analysis of neural data using matrix-based techniques. This summer, I have developed algorithms for tensor factorizations and applied them on EEG and LFP datasets.

7. Research implementation and results under the program

Title of your research plan:

Signal processing techniques to separate and analyze brainwaves

Description of the research activities:

Prof. Cichocki's laboratory is active in advancing state-of-art methods for tensor decompositions. I had the chance to both learn from and contribute to their work. Initially, I worked on understanding the theory and algorithms for various tensor decompositions, and then applied these algorithms to the task of identifying patterns in EEG recordings of brain waves that were associated with sensory processing.

I implemented and tested several existing algorithms; in addition, while working with another researcher in the lab, we made novel extensions of the algorithms. The results and novel methods will be presented for conference and journal publications; thus, I will prepare multiple publications from my work in Japan. In addition, the code we have developed will be released to the signal processing community as an aptly named toolbox "Origami: multi-way folding for tensor and matrix factorization". We have developed a strong collaboration this summer to continue in the future.

In addition, I had the chance to discuss signal-processing techniques for neural data analysis with members of other labs.

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

The RIKEN Brain Science Institute (BSI) was an amazing host institute. I had the opportunity to meet with other researchers, both visiting and permanent, in a diverse range of neuroscience areas. I visited a professor who was a former lab member on a trip to Nagoya and met with another professor from University of Tsukuba. In addition, RIKEN BSI had a weeklong summer school seminar series and many additional seminars during the summer. I also took the opportunity for Japanese language course offered by RIKEN. It was very similar to the one at orientation but had a smaller class size and met twice a week.

For cultural travel, Kyoto and Kamukura's temples and shrines, Uji's scenery and history, and Nagoya's sumo tournament were all very rewarding. My host dad visited me at RIKEN and I will return for to his home for a second visit. Memorable moments include a couple of epic mountain hikes, fireworks festivals, a beach trip, a kayak trip, Tokyo art museums, and a tea ceremony. I have also enjoyed the thoughtful and helpful people, the delicious food, and working on learning the language.

RESEARCH REPORT

1. Name: Ellenor J. Brown	（ID No.: SP12006）

2. Current affiliation:　Georgia Institute of Technology

3. Research fields and specialties:

　Engineering Sciences

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

5. Host researcher: Tsukasa OGASAWARA

6. Description of your current research

My current research at the Georgia Institute of Technology focuses on modeling of human muscle activity during arm motion.　The project involves: 1) studying human muscle mechanical properties and activity, 2) creating a model of arm muscle activity during point-to-point horizontal reaching, and 3) designing, implementing, and testing a robotic actuation system which mimics human muscle.　The overarching goal is to create human-like motion: straight or slightly curved trajectories with bell-shaped velocity curves. It is hypothesized that human motor planning involves minimization of cost functions. My research is based on the idea that motor planning is based on the minimization of hand deviations from an "optimal" trajectory.　Deviations cause the hands trajectory to vary from the target.　This "minimum variance" approach is tied to the commonly observed tradeoff between speed and accuracy. Increasing speed is achieved via increasing motor command, or signaling from the brain.　Increased motor command is linked to a proportional increase in signal noise and decreased accuracy of movement.　According to the theory of minimum variance, the optimal trajectory minimizes this signal dependent noise (SDN) over a given movement duration. It has been hypothesized that SDN is attributable to muscle mechanics, particularly the coordination of muscle subunits called motor units.　Investigating the relationship between motor unit activity and SDN will provide information on how to design a biomimetic actuation system from human-like motion in robots.

7. Research implementation and results under the program

Title of your research plan:

Muscle Training Effects from Physical Interaction with a Non-Wearable Robotic System

Description of the research activities:

For this summer, I joined an ongoing project on modeling of human arm muscle activity for use in pin-pointed muscle control.   My participation involved planning movement tasks for human subject testing and developing algorithms for data analysis. For the human trials, subjects are asked to grasp a robotic manipulator and hold a given arm posture while the manipulator applies forces and torques to the arm. The applied loads are calculated based on the desired muscle activation patterns for a nominal case compared with a test case.   For example, a subject is asked to perform a nominal trial that simulates holding a 10N weight with the elbow flexed to 90deg and the wrist in full supination. To double the activity of the biceps, the experimenter must enter the joint angles for the arm posture, the nominal task (10N) loading, the target muscle (biceps), the test/nominal case activation ratio (2), and the degrees of freedom of the robot into a model of the arm and torso.   The model outputs the loads needed to achieve the desired muscle activation. The success of the model is verified by measured muscle activation via surface electromyography (EMG) and muscle stiffness via ultrasound videos.   To process the ultrasound video data, I improved the reliability of existing image processing code and added the ability to distinguish between muscle and connective tissue.

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

This summer, I have had the privilege to work on innovative research and to visit Kamakura, Nagoya, Kyoto, Uji, coastal Kii peninsula, Nara, Osaka, Kobe, Hiroshima, Miyajima, Iwakuni, and Kanoya, with Tokyo and Okinawa planned before I depart for the USA.   Though a homebody by nature, I was compelled by the richness of the culture, the beauty of the landscapes and the kindness of strangers. I experienced sumo, fireworks, festivals, and many new, delicious foods. Still, some of the most memorable experiences were "Eleanor Rigby" karaoke and watching the Olympic women's soccer final, USA vs Japan, with my male Japanese labmates at 3:45am.   I had a tremendous time and met a number of wonderful people.   I thank JSPS and NSF for allowing me to have this opportunity.

RESEARCH REPORT

1. Name: Michael A. CABALLERO	（ID No.: SP12007）

2. Current affiliation: Colorado State University

3. Research fields and specialties:

　　Biological Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Naoki SATO

6. Description of your current research

　　Secretion of free fatty acids (FFA) by cyanobacteria is an attractive strategy towards bioenergy production as conversion to drop-in fuel is relatively simple and generating biofuel directly from a photosynthetic organism improves sustainability. FFA may be generated in two ways: directly from fatty acid synthase or indirectly from membrane recycling by lipases. Prominent bioengineering strategies prefer enhanced direct production; however, as the acyl-acyl carrier protein pool is also used for membrane synthesis, competitive inhibition may occur, potentially disrupting lipid composition. In *E. coli*, enhanced direct production of FFA resulted in upregulation of lipid synthesis genes, possibly suggesting a cellular lipid deficit. As such, the primary objective of this fellowship was to survey lipid profiles and determine the contributions of direct and indirect synthesis to FFA production in cyanobacteria engineered to overproduce FFA.

　　Three strains were assessed: *Synechocystis* sp. PCC 6803 GT and two engineered strains, *Δslr1609* and TesA'. The *Δslr1609* mutant is a long-chain acyl-coenzyme A synthetase knockout, which prevents metabolic re-integration of FFA. The TesA' mutant places *E. coli* thioesterase I in the place of the long-chain acyl-coenzyme A synthetase, which further increases FFA production. *E. coli* thioesterase I produces a particular C12-14 profile, permitting immediate analysis with gas chromatography. However, it has been suggested that carbon-length specificity might not be maintained between organisms. Nevertheless, relative contributions of lipid classes may be determined, including FFA, allowing for comparison between strains.

7. Research implementation and results under the program

　　Title of your research plan:

　　Lipid profiles and metabolic sources of free fatty acid in bioengineered cyanobacteria

Description of the research activities:

Synechocystis sp. PCC 6803 GT and the two engineered strains, *Δslr1609* and TesA', were all grown in BG-11 media and supplemented with filter sterilized $NaHCO_3$ to a concentration of 45mM. 35mL cultures were bubbled with 1% CO_2 enriched air and grown at a light irradiance of 75 μmol photons m^{-2} s^{-1}. Cells were harvested during late log, at approximately an OD_{750} of 3. Lipids were extracted following the Bligh-Dyer method. This extract was then processed by thin layer chromatography to separate various classes of lipids. These separations were converted to fatty acid methyl esters with 2.5% HCl/methanol and heat. Fatty acid methyl esters were analyzed by gas chromatography. Based on an internal standard, lipid profiles and FFA production could be quantified from gas chromatography results. 13C labeling provided a complementary perspective to the objective of this study. Fluorescence microscopy and spectroscopy was additionally performed.

It was determined that cell-associated FFA increased from 1% in the wild-type to 3% in the engineered strains. There was no major difference in lipid profile or FFA production between the *Δslr1609* and TesA' strains, suggesting a non-functional thioesterase, as unpublished qPCR data has demonstrated transcriptional activity. Codon optimization for *Synechocystis* may allow for proper folding but may be the source of altered carbon-length specificity. 16:0 and 18:0 represent over 80% of the FFA lipid profiles, indicative of the dominance of direct synthesis, as unsaturated lipids, particularly 18:2 and 18:3(6,9,12), are major constituents of the prominent membrane lipid class MGDG. Initial analysis of 13C labeling suggests a slow to stationary production rate of FFA in the TesA' strain.

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

Having studied Japanese art history, several experiences vividly stand out. The Tokyo National Museum has an incredible gallery displaying the nation's art history, from Kofun pottery to Edo ukiyo-e. The Hachiman shrine statuary was a great reaffirmation as I recognized most of the deities by stylistic detail. Next time I see a depiction of Nachi Falls, I will surely recall its powerful sound and mysterious appearance on a cold, misty Japanese afternoon.

9. Advisor's remarks (if any):

Michael is working on the analysis of lipids in cyanobacteria during his stay in Tokyo. For the first month, it was necessary to adjust culture conditions to reconcile different experimental conditions in Colorado and Tokyo. However, he rapidly got used to the laboratory work in Tokyo, and we proceeded even to labeling experiments. I think this is a good start of collaboration, and we will be able to publish a short report in a near future.

RESEARCH REPORT

1. Name: Colleen Carlston 　　　　　　　　　　　　（ID No.: SP12009）
2. Current affiliation: Watson School of Biological Sciences, Cold Spring Harbor Laboratory
3. Research fields and specialties: 　Biological Sciences
4. Host institution: Kyoto University   5. Host researcher: Prof. Kiyokazu AGATA
6. Description of your current research 　　　I am examining the role of planarian DEAD-box helicase CBC-1 (Chromatoid body component 1) in *Dugesia japonica* gene regulation, specifically in learning and memory. CBC-1 is a ubiquitously expressed RNA-binding protein that modulates messenger RNA expression and facilitates de-capping and degradation of mRNAs in cytoplasmic loci called chromatoid bodies. CBC-1 associates with the RNA-induced silencing complex (RISC) to repress mRNA (messenger RNA) translation, and is especially highly expressed in neoblasts (planarian stem cells), gametes, and neurons. 　　　Much of what is known about the biochemical and structural properties of CBC-1 is inferred from its sequence similarity to the *Drosophila* homolog Me31b and *Caenorhabditis elegans* (*C. elegans*) homolog CGH-1. For example, structurally the protein CBC-1 contains a conserved nine amino acid sequence called a Q-motif that is bordered by two prolines that act as helix-breakers to protrude a serine. This serine can be phosphorylated post-translationally and presumably modulates the enzymatic activity of CBC-1. This suggests that helicases are regulated spatially and temporally via phosphorylation to appropriately relinquish mRNA inhibition. Work with *D. japonica* offers an unparalleled opportunity to investigate mRNA regulation during regeneration, and perhaps of especial interest, during regeneration of a functional nervous system. This is because controversial work performed 50 years ago by James McConnell in planaria produced the unlikely hypothesis that memory RNAs allowed the transfer of learning between individuals. While this conclusion remains suspect, as we begin to unravel the multifaceted biological roles of RNA, it may be worth reinvestigating the relationship between RNA and learning. Working with a new organisms requires adapting techniques to work in that system, and since my previous research experience was with *C. elegans*, my primary goal in the Agata lab was to acquire the techniques in planaria that would allow me to investigate this question in this system.

7. Research implementation and results under the program

Title of your research plan:

Post-transcriptionals gene regulation in planarian negative phototaxis

Description of the research activities:

I first synthesized double stranded RNA of EGFP (enhanced green fluorescent protein) as a negative control since this is not an endogenous gene in planaria, as well as dsRNA of planarian genes CBC-1, FMRP-1 (fragile X mental retardation protein 1), and ATX-1 (ataxin 2). All are thought to associate with RISC as well as have established nervous system roles, which made them ideal candidates. I learned about planarian maintenance as well as RNAi protocols for RNAi via feeding and RNAi via injection. I was able to perform both methods successfully as confimed via quantitative PCR of target genes as well as in-situ hybridization co-staining with piwi (a cell marker of planaria neoblasts) and CBC-1. There were no gross morphological defects associated with any of the RNAi candidates in the regenerated brains. Unfortunately, although I attempted to use the phosphospecific antibodies developed against *C. elegans* CGH-1 against planarian CBC-1 (9/10 amino acids identical) the cross-reactivity was poor and I could not draw any conclusions about the phosphorylation status of CBC-1. Also, negative phototaxis did not appear to be impaired in any animals, but I was not able to recreate long-term light habituation.

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

Students and professors in my Japanese host lab welcomed me and were extremely friendly and helpful with my research. Many took time to show me around as well as to teach me techniques. I am very grateful for their support and assistance.

RESEARCH REPORT

1. Name: Christiana Chang	（ID No.: SP12010）

2. Current affiliation: University of Houston

3. Research fields and specialties:

    Engineering Sciences

4. Host institution: Chiba University, Chiba, Japan

5. Host researcher: Prof. Ning HU

6. Description of your current research

The addition of carbon based nanofillers to a number of matrix materials, such as polymers and even cement, has been proposed in many fields to add additional functionalities, such as strain and temperature sensing, to common, well tested structural materials. Though the electrical behaviors of these materials have been demonstrated, robust models describing this electrical behavior are lacking and often overlook the strong influence of temperature on the effective electrical resistance of the nanocomposite. The current research aims to improve an existing Monte Carlo based numerical simulation of carbon nanotube (CNT)-polymer nanocomposite electrical resistivity to include compensation for changes in the bulk nanocomposite temperature. Bulk CNT-polymer composites have been shown to have an exponential relationship between temperature and electrical resistivity. The current research project plans to reproduce this exponential relationship from the microstructural level by introducing temperature compensation relationships for the inherent resistance of individual CNTs in the polymer, as well as between CNT-CNT tunneling junctions.

7. Research implementation and results under the program

Title of your research plan:

Effects of Temperature on Electronic Plastic Sensors

Description of the research activities:

First, I continued work and implementing temperature compensation into my existing computer simulation, predicting that as the temperature increases, the electrical resistance of the composite should decrease. To help identify the main mechanism for the change in electrical behavior of CNT-polymer materials with temperature and to verify my model, CNT-epoxy films were fabricated at Chiba University based on their well researched fabrication methodology. The completed films were heated in a temperature and humidity controlled environment while their electrical resistance was measured. The results indicated that the resistance increases nearly linearly up to around 65°C, where the resistance change rate suddenly increased. This behavior is opposite to the behavior predicted by my tunneling resistance dominated computer simulation, but matches the theory pursued by my host researcher at Chiba University. Comparison with their co-efficient of thermal expansion (CTE) model shows that around 65°C, the composite material has a drastic increase in CTE, resulting in a change in the composite's internal electrical circuit which would increase the effective resistance. The findings will lead me to change the focus of my computer simulation.

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

I've had a wonderful cultural experience, including seeing the Gion Festival in Kyoto and the Sumidagawa Fireworks Festival in Tokyo, learning traditional Japanese dance, climbing Mt. Fuji, and attending a summer music festival in Hiroshima, amongst other experiences. I was fortunate to visit research labs at Tokyo University, Nihon University, and other labs in Chiba University. Due to a language barrier in the lab, I've been challenged to communicate beyond the English language and to have the patience to understand and be understood.

9. Advisor's remarks (if any):

Ms. Chang has done very well in research during her stay in our lab. First, she has partially finished a Monte-Carlo based numerical simulation software for predicting the piezoresistivity of CNT/polymer nanocomposites. Second, with the help of other students in our lab, she fabricated some CNT/polymer nanocomposite samples and tested their piezoresistivity under temperature change. Some important physical phenomena have been identified in experiments which are valuable for her subsequent simulations. Third, she has also helped students in their international journal papers, such as modification of language. Finally, besides research, she has joined our lab's various events and actively communicated with other students. We enjoy the period when she stayed in our lab.

RESEARCH REPORT

1. Name: Hui-Yiing CHANG	（ID No.: SP12011）

2. Current affiliation: Vanderbilt University

3. Research fields and specialties:

    Mathematical and Physical Sciences

4. Host institution: University of Tokyo, Kavli Institute for the Physics and Mathematics of the Universe

5. Host researcher: Dr Shinji Mukohyama

6. Description of your current research

We examine several different cosmologies where the scalar field potentials are power law functions.   They end up with slow-roll behavior, tunneling or oscillating based on particular variances in the potential and other factors.   The examples of tunneling are Inflection Point Quintessence models of the universe.   Accelerated expansion occurs in some of these models, which presents the case for dark energy, a fundamental mystery in cosmology today.   Finally, our theoretical distance modulus is compared to the observational distance modulus obtained from Type Ia Supernovae using a chi−squared test, and a likelihood plot showing different confidence regions is presented.

7. Research implementation and results under the program

Title of your research plan:

INFLECTION POINT QUINTESSENCE MODELS OF THE UNIVERSE AND THE CASE FOR DARK ENERGY

Description of the research activities:

I varied the value of the present day energy density of matter and plotted it on the plane of two of the constants, V_0 and V_1, from the equation of the scalar field potential to compare them.   I then wrote the first draft of the introductory section of our paper.   I embarked on the final step of the project by examining possible methods to perform a chi−squared test with the theoretical and observational Type Ia Supernovae data.

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

I have enjoyed my stay here.   I value the many lessons I have learnt.   I have been treated very well by people connected with the program as well as strangers that I met.   I have experienced the way a premier science institution in Japan functions, as well as how professional relationships are handled.   I have met researchers from Japan and different parts of the world, whom I may seek for advice or collaboration in the future.   Overall, immersion in a contrastingly different culture has been tremendously helpful in broadening my perspective of my profession and life in general.   The ideas I have acquired are useful towards improving the American system and keeping it internationally competitive.

RESEARCH REPORT

1. Name: Alexander Cook	（ID No.: SP12012）

2. Current affiliation: Department of Physics University of Texas at Dallas

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution:　Shimane University, (Osaka University)

5. Host researcher: Prof. Ichiro HIROMISTU, (Prof. Yutaka OHMORI)

6. Description of your current research

My research revolves around fabricating organic semiconducting devices using doped carbon nanotubes (CNT) charge collectors and doped charge transport layers.　At my home institute, this work is focused on organic solar cells (OSC).　My current research uses both solution processed polymers and vacuum sublimed small organic molecules. The general goals are to convert more sunlight into electricity, produce flexible and semi-transparent devices, and to reduce the cost of solar cells by replacing relatively expensive indium tin oxide and metallic electrodes with carbon nanotubes.　Doping the CNT and transport layers improves the conductivity of CNT electrodes and enhances electrical contact between electrodes and photoactive layers. Many of the same techniques developed for OSC can be applied to other organic semiconducting devices such as organic light emitting diodes and field effect transistors.

My research to date has demonstrated methods of fabricating solar cells with carbon nanotube anodes on top and on the bottom of the solar cell stack, p-type doping of carbon nanotubes and p-type doping of hole transport layers in small molecule organic solar cells.

7. Research implementation and results under the program

Title of your research plan:

Connecting Stacked Solar Cells with Carbon Nanotubes

Description of the research activities:

At Shimane University I created organic solar cells with carbon nanotube anodes.   I was successful in producing solar cells in an electrically inverted configuration with CNT top anodes.   Incidentally I noted that these solar cells performed much better than conventional designs in the high humidity of Japan's rainy season.   This suggests that solar cells produced in this method will outlast conventional OSC devices.   Afterwards, I began work with a soluble small molecule which was fabricated at Shimane University.   This material could increase the amount of light harvested in organic solar cells.

My work at Osaka University introduced me many new methods and devices. I produced and characterized organic light emitting diodes (OLED) and organic light emitting field effect transistors (OLEFET) from solution processed polymer and small molecular materials.   While the techniques were similar to those I use to make solar cells, this was the first time I had made these types of devices on my own.   I found that the nanoparticles I use in solar cells performed poorly in OLED devices, but am optimistic about the use of CNT in OLED to improve hole injection and transport.   I found that it was quite easy to produce CNT top-gated OLEFET devices and with the help of Kajii-sensei, I discovered a method of producing micron scale channels in carbon nanotube sheets which opens the door to OLEFET devices with all CNT electrodes.   I also assisted a student produce a flexible OLEFET devices with silver nanowire source-drain and CNT gate electrode.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):   My stay in Japan was truly eye opening.   I laughed when the father of my home-stay family used the same excuses for coming home late as my father does, and had so much fun playing with their two adorable and extremely energetic children.   I found myself wishing I knew more Japanese, but still very comfortable due to the incredible hospitality of the Japanese people.   I even fell in love with the quiet life on the edge of Matsue city and found myself wishing my family lived closer so I could live there. I've gained so much love and respect for the culture and people of Japan.

RESEARCH REPORT

1. Name: Nicholas Day	（ID No.: SP12014）

2. Current affiliation: Portland State University

3. Research fields and specialties: Chemistry

4. Host institution: Osaka University

5. Host researcher: Professor Shunichi Fukuzumi

6. Description of your current research

Future energy demand can best be met by better collection and storage of the ample solar energy reaching Earth. Researchers are turning to materials with the potential to directly produce chemical fuels from the sun's energy. The direct focus of this research is to investigate a novel material with the potential ability to use renewable resources to produce liquid fuel.

In order to turn carbon dioxide into methanol we must transfer six electrons to the carbon atom. Each pair of electrons transferred to the carbon atom will bind one hydrogen atom. When a substance gains electrons we call this a reduction reaction.

Poly-tetrakis-5,10,15,20-(4-aminophenyl)porphyrin (pTAPP) is an organic polymer with nano structure and strong light absorption. pTAPP can be grown onto an electrode, to create a porous network of conductive fibers.[1] Cobalt metallated porphyrins are known to efficiently transfer electrons to CO_2, but have little activity to turn CO_2 completely into methanol. The mechanism involves a sacrificial electron donor, the porphyrin as a light absorber and cobalt as the catalyst.[2] Surface porphyrin units on pTAPP can be metallated with cobalt granting the potential ability to act without an electron donor while still being a light absorber and the catalyst.

Recently, a new method of CO_2 reduction with the ability for multiple reductions resulting in methanol was reported.[3] This method uses a pyridinium catalyst and can be driven solely by light. The rate-limiting step is the first electron transfer to CO_2. We are synthesizing porphyrins with pyridyl and amino substituents in order to attach pyridyl groups to the surface of pTAPP.

Surface modified pTAPP with both metallation and pyridyl substituents, has the

potential to combine the catalytic aspects of these mechanisms and conceivably reduce CO_2 to methanol catalytically with high efficiency using only sunlight.

7. Research implementation and results under the program

Title of your research plan:

Using a Light Absorbing Catalyst to Stimulate the Conversion of Carbon Dioxide to Methanol

Description of the research activities:

The reduction of carbon dioxide was investigated but unfortunately we did not have the proper detection facilities available. This was the main consideration when deciding it investigate other reduction products. We did see an increased rate of electron donor oxidation when in contact with pTAPP and in light.

Co-pTAPP and Fe-pTAPP were investigated for hydrogen evolution in aqueous conditions at neutral and acidic pH. We were unable to detect any hydrogen by gas chromatography. The reduction of oxygen to hydrogen peroxide with Co-pTAPP was also investigated. By increasing pH we will hopefully see catalytic activity and this system should hold promise for the future.

Even though reduction products were not found the porphyrin polymer did show an increase in the degradation of electron donors making many of the experiments a success.

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

During my stay I visited Takarazuka-kita High School and gave a dye sensitized solar cell demonstration. The school specializes in teaching English and Science and appreciated this demonstration greatly. There were 75 students who took part in the demonstration and which lasted approximately four hours. In the demonstration students teamed up in pairs and each one made a dye sensitized solar cell. The school has invited me back if I ever have the opportunity to come to Japan again.

RESEARCH REPORT

1. Name: Nicholas DiRienzo	（ID No.: SP12015）

2. Current affiliation: University of California, Davis

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Hokkaido University

5. Host researcher: Hitoshi Aonuma

6. Description of your current research:

My current research focuses on investigating hormonal mechanism associated with female preference.　In the field cricket, *Gryllus bimaculatus*, males attract females using long-range acoustic calls.　Females prefer calling bouts that are longer and more rapid, as they indicate the size and condition of the male.　Interestingly, female response to calls seems to vary.　Some females tend to be highly responsive, and will rapidly move towards a male call.　On the other hand, despite the call being from a high-quality male, some females will be less responsive and will wander in a zig-zag pattern on the way to a call.　The goal of this study is two-fold. One, to determine what hormones, specifically the biogenic amines octopamine and serotonin, modulate a female's response to a male call.　Second, we will investigate if the strength of a female's preference for a call is related to the strength in hormonal response.

7. Research implementation and results under the program

Title of your research plan:

"Hormonal mechanisms of female preference in the field cricket, *Gryllus bimaculatus*"

Description of the research activities:

The project I initially proposed involved looking at the hormonal mechanisms of animal personalities, which are defined as individual differences in behavior that exist across time and/or context. My first four weeks were spent investigating if personalities were present in the lab population of *G. bimaculatus* here at Hokkaido University.   An analysis of that data revealed that the behaviors were not repeatable and that there was little variation between individuals, and thus, they did not have personalities.   In that time I also learned dissection and high performance liquid chromatography with electrochemical detection (HPLC-ECD) techniques.   As an alternative project, the last several weeks of the program were spent investigating the hormonal mechanisms of female preference.   Females were placed on a treadmill, consisting of a styrofoam ball floating on a cushion of air, which records distance and direction moved.   A male call was played back through a single speaker, and the females response to the call was measured using the treadmill.   After the preference trials the females' brain and prothoracic ganglia were dissected out, and subsequently processed for later analysis via HPLC-ECD. Females were presented with calls for either 5, 30, or 60 minutes.   In order to account for the affect of activity on hormone levels, a separate group of females were placed on the treadmill for the same time intervals, although without a playback playing. One group of unmanipulated females were used to establish baseline hormone levels.   Data was being collected up until my last day in Japan, and thus, has not been analyzed yet.

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

I had a very good experience here in Japan.   My research made is such that I had trouble seeing cities outside of Sapporo, as they would require a plane flight and more time than I had available.   Still, Sapporo was a wonderful city with plenty to see, do, and eat.   Also, my host and the postdoc in the lab took me on several trips around Hokkaido to see some of the popular attractions.   Finally, frequent dinners and barbeques with my lab and associated labs were a great way to see and experience Japanese culture.

RESEARCH REPORT

1. Name: Amalie DONIUS	（ID No.: SP12016）

2. Current affiliation: Drexel University

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Professor Hiroyuki YANO

6. Description of your current research

For biomedical applications, as for many other engineering applications, there is a strong demand for highly porous polymer materials. In the case of biomaterials, porous materials are highly attractive not only because cells can be encouraged to grow into these, but also because porosity greatly increases a material's specific surface area, which plays an important role in tissue regeneration and the efficiency of filters. Porosity further offers the potential to tailor the mechanical properties of a material to the application in question. While for nerve tissue repair, for example, scaffolds with a Young's modulus in the range of 3-10 kPa without reinforcement perform the function well, scaffolds for vascularization would benefit from a fibrous reinforcement, such as achieved with cellulose or chitin nanofibers, to increase the scaffolds strength and toughness during surgery and beyond.

Freeze casting is a novel production technique with which highly porous scaffolds with a large specific surface area and a honeycomb-like structure can be created by directional solidification and subsequent freeze-drying. As water based solutions are used, it is environmentally benign and due to the cold processing, organic materials do not denature.

Using freeze casting, highly porous materials of chitosan, nanofibrillated cellulose, chitin, and combinations of the three were fabricated and investigated for biomedical applications that favor high mechanical performance in one direction.

7. Research implementation and results under the program

    Title of your research plan:

    Modifying Nanofibers for Porous Biomaterials

    Description of the research activities:

       Porous materials are essential for applications ranging from filtration to tissue engineering. Therefore, they intrinsically invoke research interest from vastly different fields and are consequently prepared from a large array of starting materials. Here it is our aim to utilize environmentally benign, renewable,

abundant, and biodegradable components to create and investigate the pore wall material.

The materials for this research were chitin and cellulose due to their abundance as natural resources, as well as their properties and biocompatibility. Cellulose, the most abundant polysaccharide, is widely available, inexpensive, and recyclable. Found in the cell walls of plants, cellulose is made up of β (1→4) linked D-glucan units with the molecular chains orientated in the fiber direction. Cellulose has a microcrystalline structure of alternating crystalline and amorphous regions, which gives it a high toughness. Nanofibrillated cellulose (NFC) is a form of high surface and volume cellulose obtained through a homogenization process, which unravels the cellulose fibers down to fibrils with 4-40 nm diameters. These NFCs have been shown to exhibit high modulus, strength, and toughness in 2D, paper-like structures.
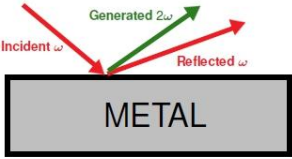
Chitin, is the world's second most abundant polysaccharide and a readily available food waste product. It is an important structural component in the exoskeletons of arthropods and can be separated from waste crab shells, for example, with uniform diameters by fibrillation processes. Chitin's chemical structure, it is a β-(1→4)-2-acetamido-2-deoxy-d-glucose linear polysaccharide offers excellent potential for functionalization. Like cellulose, it exhibits exceptional mechanical properties.

Under the guidance of Professor Yano, I prepared suspensions of NFCs and chitin fibers. Chitin fibers were also modified to create fibers with a chitosan surface. Using these suspensions films were fabricated from chitosan, cellulose nanofibers (NFCs), as well as chitin nanofibers both modified and untreated.   In an effort to understand the properties and performance, the tensile performance and transparency were evaluated for films with and without fiber reinforcement.   This study aimed to support the work of highly porous materials by combining the understanding of film performance with that of porous material from the same constituents.   The combination enables the establishment of structure-performance correlations and aids in a better understanding of the fabrication of high-porosity nanofiber biomaterials.

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

Japan is a country that weaves old traditions in with modern life.   I really enjoyed experiencing this and learning about Japan, its people, and its culture. I had the great fortune to be able to travel to Hiroshima for the Peace Ceremony on August 6th.   This ceremony and the whole atmosphere there was deeply moving. I felt that not only was it a wonderful way to illustrate how far our countries have come since the bombing, but also a great opportunity to push for the hope of world peace.

RESEARCH REPORT

1. Name: Justin Droba	（ID No.: SP12017）

2. Current affiliation: Michigan State University

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: Osaka University, Photon Pioneers Center

5. Host researcher: Hiroshi Ajiki

6. Description of your current research

My research involves modeling and computation for second harmonic generation (SHG) at metal and dielectric interfaces.   In SHG, the simplest nonlinear optical process, incident light at frequency ω is transformed into light at frequency 2ω—for example, a red laser beam becomes green.   At metal surfaces, this generated beam manifests itself as a reflected wave, as opposed to a transmitted one as for dielectrics.

SHG in Dielectrics   SHG at metal/dielectric interface

A model using classical hydrodynamic theory was developed by Bloembergen in 1968. While widely used and surprisingly accurate considering its simplicity, this model makes undesirable physical assumptions and yields an unwieldy mathematical form.   As such, full incorporation of the hydrodynamic model with the Maxwell equations that govern SHG is largely impossible.   To work with this model, one must work must make additional assumptions and simplifications.

Our approach instead uses density functional theory (DFT) to compute the electron density of the metal surface; from the density, the current can be computed and substituted into Maxwell's equations.   In addition to producing a mathematically sound model, the DFT approach is fully quantum mechanical and thus allows us to incorporate effects specific to metals as well as describe the SHG process at the electronic/molecular level.

7. Research implementation and results under the program

    Title of your research plan:

    Improving the Density Functional Approach to SHG at Metal/Dielectric Versions: A
           Non-adiabatic Version

Description of the research activities:

My work up to now relied on a low-frequency (adiabatic) assumption to link ground state DFT to the excited-state case we are studying. Our goals for the summer were thus twofold:

1) Develop a new model that removes the adiabatic ansatz of previous work
2) Develop computational methods for the newly derived model

We accomplished our first goal more than satisfactorily. Our new modeling technique uses linear response theory (LRT) in time-dependent density functional theory (TD-DFT). LRT simplifies time-dependence by treating the external potential (due to the incident electric field) within perturbation theory: we write $V(x,t) = V_0(x) + V_1(x,t)$. This is precisely our situation: because the incident electric field is time-harmonic (has time-dependence $e^{i\omega t}$) the time dependence of V_1 can be removed if we work in frequency (Fourier) domain. This yields two highly desirable results: first, we are no longer constrained to low-frequency signals (fulfilling our first goal); secondly, frequency can be considered directly in the DFT functionals. Past DFT-based models have been "frequency blind."

Our model builds upon previous work by Liebsch some years ago, although he did not apply his results to SHG. We have improved upon his techniques by including contributions from terms he neglected and also established our model with a great deal more rigor than previous authors have used. Furthermore, to compute the ground-state density, we use orbital-free DFT (OF-DFT) instead of Kohn-Sham equations. While resulting in more difficult non-linear equations that must be solved, OF-DFT avoids the need for self-consistent field iteration and thus allows for quick and "exact" computations.

Unfortunately, owing to the high number of intermediate calculations our new model requires, we were unable to finish the computations to the extent we had hoped. However, the foundation has been laid, and what had been intended as a subtle improvement to existing work has resulted in a total overhaul of our DFT-based approach, a much stronger result than anticipated.

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

I am pleased to say I was fully able to experience the wealth of culture and history of the Kansai area. Traveling only on weekends, I was able to visit over 40 UNESCO registered sites, including all 17 monuments registered in Kyoto, and 15 of the 17 non-trail sites comprising the "Sacred Sites and Pilgrimage Routes in the Kii Mountain Range" entry. I was also fortunate enough to be able to attend the Hiroshima Peace Festival on August 6; my first visit to Hiroshima six years ago was a moving and life-changing experience. I will certainly never forget participating in the ceremony in Hiroshima Peace Park, hearing the rallying cry of the Prime Minister and Mayor of Hiroshima for peace and hearing, in their own voices, the harrowing testimonials of survivors of that dreadful day. I hope to attend one day the corresponding ceremony in Nagasaki.

RESEARCH REPORT

1. Name: Michael James DUCHENE	（ID No.: SP12018）

2. Current affiliation: University of Notre Dame

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Prof Takayuki Aoki

6. Description of your current research

We are using the discontinuous Galerkin (DG) finite element method to simulate hurricane storm surge on unstructured meshes of 18+ million elements.　The DG method is computationally expensive relative to continuous methods, however it provides several advantages.　It offers better accuracy and stability, which is important for advection dominated flows and in forecasting applications, especially in areas with high gradient surface water elevation, current, and wave transformation zones.　Also, the localized nature of the DG method provides for more freedom of triangulation for capturing relevant coastal and inland features, and is more efficient for large-scale parallelization. Therefore, it should map well to parallel processors, such as graphics processing units (GPUs).

The primary goal of the research is to port the legacy ADCIRC code (www.adcirc.org) to use multiple GPUs in a message-passing (MPI) environment on the Tsubame 2.0 supercomputer to ultimately reduce the running time of simulations by leveraging large-scale hybrid supercomputers, consisting of both traditional processors and GPUs. To facilitate this, we are developing a C++ framework to automate as much of the porting process as possible, while allowing more time to be spent on the actual parallelization efforts.

We use test cases (by Lynch and Gray) with analytical solutions and up to four different types of bathymetry for verifying convergence and to provide weak- and strong-scaling results.　Actual tidal simulations will provide a better real-world estimate of performance. We will consider the cost per element (or efficiency) associated with running storm surge simulations on hybrid architectures.　In particular, energy consumption, hardware costs, and running time are major factors that determine the cost of the simulation.　As well, we will study accuracy of the final solution, because the DG method is known to produce accurate results on lower resolution meshes.　These results are important for ADCIRC

users (NOAA, FEMA, USACE, etc.) to allow for higher fidelity simulations in both fore-casting (such as for emergency evacuation) and hind-casting (such as for zoning and designing protection systems) applications.

7. Research implementation and results under the program

Title of your research plan:

Discontinuous Galerkin Finite Element Hurricane Storm Surge Simulations on Hybrid Supercomputers with Graphics Processing Units (GPUs)

Description of the research activities:

The primary research activity consisted of porting the ADCIRC code to run on the Tsubame supercomputer at Tokyo Tech and running many simulations with various model sizes and parameters. Additionally, different software libraries were used to determine how best to tune the ADCIRC model to run on Tsubame.

Several simulations were run to help understand the performance aspects of ADCIRC on Tsubame. Strong-scaling tidal simulations were run by varying the number of processors (from 192 to 3,072) for a fixed problem size of 825,284 elements. Weak-scaling simulations were run by varying the problem size from 144 to 147,456 elements for a fixed number of processors; these simulations were repeated on 2, 4, 8, 12, 16, 20, 24, 28, 32, and 36 processors. Additional weak-scaling simulations were done using the latest NVIDIA Kepler GPU, for a varying problem size from 144 elements to 147,456 elements. Many of the simulations were done using the Intel and Portland Group compilers, as well as the OpenMPI and Mvapich2 MPI libraries.

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

I was able to have many cultural experiences during my stay in Japan, including the home stay, Japanese festivals (matsuri) with dancing (odori) and fireworks (hanabi), and visits to the shrines (jinja).

RESEARCH REPORT

1. Name: Robert C. FERRIER, Jr.	（ID No.: SP12019）

2. Current affiliation: University of Pennsylvania

3. Research fields and specialties:

    Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Kohji OHNO

6. Description of your current research

At the University of Pennsylvania, working under Prof. Russell Composto, I mainly work with polymer nanocomposites. Specifically, dispersing gold nanorods in polymer thin films. I created a novel way to covalently connect the ends of the gold nanorods together and subsequently disperse them within a polymer matrix in chains. The distance between the ends can be easily tuned by changing the linker. The optical properties of the ensemble of rods changes depending upon both the distance between the ends and the number of rods in the chain. However, utilizing linker molecules is not the only way to assemble the rods within a polymer matrix. Instead of using linkers, another polymer can be covalently bonding selectively to the end of the rods. This allows us to assemble the rods via entropic interactions between the matrix chains and the brush on the ends and sides of the rods. The end goal is to be able to simultaneously control the spacing between the ends and sides of the rods while in a polymer matrix as well as to orient the rods in a single direction. This would allow us to fully control the optical and electrical properties of the composite material.

7. Research implementation and results under the program

   Title of your research plan:

   Polymer Nanocomposites (PNCs) via Surface-initiated Atom Transfer Radical Polymerization (SI-ATRP) on Janus Gold Nanorods (J-AuNRs)

   Description of the research activities:

   While at Prof. Ohno's lab, I was able to learn many new techniques. I learned how to do two different types of living radical polymerization (RAFT and ATRP) as well as two characterization techniques (GPC and NMR). I was able to polymerize polystyrene (PS), control the molecular weight, and attach a functional group on to the end. I was then able to covalently bond this polymer selectively to the ends of my gold nanorods. I explored this selectivity via UV/Vis spectroscopy. I was able to modify the polymerization procedure for PS in order to synthesize it at a low temperature. This was necessary as my gold nanorods reshape at higher temperatures. Once the polymerization was successful, I tried to polymerize PS directly on the ends of the rods (i.e. instead of polymerizing then attaching to the rods, polymerizing directly from the ends). The polymerization from the rod's surface was successful. However, we are unsure if the polymer is only on the ends or both on the ends and the sides of the rods. Further characterization needs to be done in order to know for sure.

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

  I went to many different temples while in Kyoto. I visited Kobe, Osaka, and Uji while at university. I slept in a capsule hotel in Osaka (very interesting). My lab mates taught me how to play mahjong, which I have gotten pretty good at I think. I saw the fireworks at Uji with my lab mates, and I have been to a few Japanese pubs with my lab mates and the people I met in the program. I like retro video games and so I was able to buy many while I was here. Truly, it has been a great experience, I love Japan!

RESEARCH REPORT

1. Name: Sarah Friedman	（ID No.: SP12020）

2. Current affiliation: Southern Illinois University - Carbondale

3. Research fields and specialties:

   Earth Sciences/Geology

4. Host institution: Kanazawa University

5. Host researcher: Dr. Shoji Arai

6. Description of your current research

My current research at Southern Illinois University involves characterizing the magnetic properties of the Earth's mantle. Samples selected for research are carefully chosen and must meet the following qualifications i) they must be uncontaminated by the host basalt ii) they must be free of secondary alterations, such as serpentinization and oxidation iii) they must be a representative rock type of the upper mantle, usually lherzolites or harzburgites and iv) they must have been previously studied for petrologic characteristics, along with determination of temperature and pressure of equilibration. The magnetic experiments carried out at SIU are used to distinguish the magnetic grain sizes, the magnitude of magnetization and the carrier mineral of magnetic properties in a rock type.

This project has implications for the magnetic satellite and anomaly modeling communities, along with mantle petrologists and mantle modelers. Since the mantle was originally considered to be "non-magnetic" is should not contribute to magnetic anomalies. This project has found mantle materials are able to contribute to magnetization, but we have yet to physically see the magnetic minerals responsible for the magnetization.

We have also found that the tectonic setting may be a controlling factor in the contribution of the mantle to magnetic anomalies. Specifically, subduction zones, where the process of metasomatism produces unique minerals that are not normally present in the Earth's mantle.

7. Research implementation and results under the program

Title of your research plan:

Petrology, pressure and temperature of formation, of the subduction mantle wedge: implications for magnetic anomalies

Description of the research activities:

Research done at Kanazawa University involved by starting from the basics of the project. Previously, samples were obtained with knowledge of the petrology of the rocks, while the time spent here we went back to step 1: sample selection. Samples were obtained from Professor Arai's collection and are representative of unique geologic setting. Then the samples were cut and polished into thin sections (3 weeks). The samples underwent a through petrologic examination. Microscopic analysis was performed and pictures of the samples were obtained.

Electron microprobe analysis was performed on 8 samples, four samples from each locality, to determine the major element composition of the minerals in the major mineral olivine. Two samples underwent a more detailed analysis and also had orthopyroxene, clinopyroxene and spinel content analyzed. All other samples are prepared for further analysis, but due to time constraints could not be analyzed by the end of the fellowship.

While under study of Professor Arai I was able to do some field work in Hokkaido. We studied a peridotite massif near Samani, Hokkaido. Here I was able to glean mantle processes not seen elsewhere, and was able to obtain more samples that can be used for a joint project between Kanazawa University and SIU in the future.

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

I did as much as I could outside of the office. My Japanese colleagues say that I have done more Japanese cultural experiences than they have, such as see a sumo tournament and climb Mt. Fuji. After my experiences here have secured in my mind that I would like to come back and study here for a longer period of time.

9. Advisor's remarks (if any):

I really hope that the Ms. Freedman's study and our future collaborative works as well will bridge between ordinary paleomagnetic and petrological studies of mantle peridotites. I also expect to physically see magnetic minerals within the peridotite if our collaboration proceeds slightly more in the near future.

RESEARCH REPORT

1. Name: Clint D. Frye	（ID No.: SP12021）

2. Current affiliation: Kansas State University

3. Research fields and specialties:

　　Engineering Sciences

4. Host institution: National Institute of Materials Science

5. Host researcher: Takao MORI

6. Description of your current research

　　　Thermoelectric devices are devices that use a temperature gradient to produce a voltage; that is, they can essentially convert heat directly into conventional electricity that can be used in familiar, everyday appliances. In fact, due to thermodynamic inefficiencies in most power producing systems, excess heat is generated and must be dissipated. This heat, which is usually just released to the surroundings, is wasted energy that could be harnessed to generate useable electricity and increase the overall efficiency of systems such as electrical power plants or even car engines.

　　　While many materials produce a voltage when one side is hotter than another, here boron compounds have been studied because of their peculiar properties. First, borides generally have extremely high melting points (many above 2000 °C!) and have been demonstrated to have good thermoelectric performance at temperatures of several hundred degrees Celsius. Second, some borides exhibit near immunity to radiation damage that would destroy the crystalline structure of most semiconductors, making these compounds well suited to high radiation environments such as space. Third, many of these compounds are also resistant to chemical attack.

　　　Icosahedral boron arsenide, $B_{12}As_2$, is a prime example of a boride with a high melting point, extreme radiation resistance, and chemical stability. Single crystals of $B_{12}As_2$ were synthesized at the home institution for thermoelectric characterization at the host institution, the National Institute for Materials Science. Since thermoelectric characterization has not been performed on bulk crystals of this material, these measurements are essential to evaluating the potential performance of the material as a thermoelectric which may be used in harsh environments.

7. Research implementation and results under the program

　　　Title of your research plan:

　　　Developing Materials to Directly Convert Heat into Electricity

Description of the research activities:

The Seebeck coefficient, a measure of the voltage generated due to a given temperature gradient, was measured using a ZEM II thermoelectric measurement system from 100 °C to 400 °C. For thermoelectric materials, higher values of the Seebeck coefficient are desired since a larger voltage is created by a smaller temperature gradient. For two representative $B_{12}As_2$ crystals, the maximum Seebeck coefficients were achieved at 400 °C with high values of 477 and 660 microvolts per Celsius degree of temperature difference (μV/K). The sign of the Seebeck coefficient indicates that the conduction type is *p*-type, consistent with previous reports of the material. A manuscript is being prepared to publish these results.

Although the main research project was thermoelectric characterization of $B_{12}As_2$, several other projects were also investigated. $B_{12}As_2$ epitaxial films were analyzed using a four-cycle X-ray diffractometer. I learned how to create and interpret reciprocal space maps as well has rocking curves and phi-scans to evaluate stresses present in the film and to confirm the epitaxial relationship between the film and substrate. I also observed molecular beam epitaxy, an advanced thin film growth technique. And measurements have been scheduled to measure cathodoluminescence on $B_{12}As_2$ nanowires synthesized at the home institute.

In addition, an academic visit to Tohoku University in Sendai was arranged to meet with Professor Toetsu SHISHIDO at the Institute for Materials Research. Professor Shishido is an expert in transition metal boride crystal growth, and advanced crystal growth equipment was demonstrated.

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

Despite the short time, my experiences in Japan have opened my eyes both scientifically *and* culturally. Often your own culture is invisible until you are immersed into another. Awareness of something so fundamental to the way that you live is not only enriching but also an asset in communication. My relationships with international students at my home institution will be strengthened through my experience.

The land and environment of Japan is beautiful unto itself, but it is the warm and generous people that make Japan so special. Wherever I visited, friends and strangers both were patient, giving, and always lent a helping hand, even when I was too shy to ask. Spending a weekend with a host family was inspiring as I was able to live as the Japanese do in a Japanese home. Even though the stay was only for a couple of days, I felt at home and as a part of the family. I was touched so deeply that I will serve as a host family in the future with hopes to make others feel as welcome as I did in Japan.

RESEARCH REPORT

1. Name: Justine R GARCIA	（ID No.: SP12022）

2. Current affiliation: Emory University

3. Research fields and specialties:

   Biological Sciences

4. Host institution: AIST Hokkaido

5. Host researcher: Dr. Yoshitomo KIKUCHI

6. Description of your current research

   Inter-species mutualisms are ubiquitous in nature and are important in the evolution of many organisms. The term "mutualism" indicates that two species mutually benefit from an interaction. However, most known mutualisms are classified as such because it has been demonstrated that the host benefits with little investigation of the advantages or disadvantages to the symbiont. This is especially problematic when a symbiont is environmentally acquired as it does not require a host to survive and may have higher fitness in a non-host environment. We used an insect-bacteria model of mutualism to test the effect of host association on bacterial fitness. The bacterial symbiont, *Burkholderia* sp., is acquired by axenic juvenile stinkbugs (*Riptortus pedestris*) and resides in a specialized midgut tissue throughout the stinkbugs' life. However, it is unknown whether the *Burkholderia* symbionts can escape from the stinkbug host or if they die when the host dies. In this project, we inoculated juvenile stinkbug with a GFP-labeled *Burkholderia* mutant symbiont and screened for symbiont expulsion to the environment. We tested bug poop throughout development, bug molts (the exoskeleton that is shed when the bug grows and develops), and bug carcasses for the *Burkholderia* mutant symbiont. We also swabbed the mouthparts of the bugs to test whether symbionts could be expelled onto food sources. We expect that symbiont expulsion and increased symbiont fitness through host association has played an important role in the evolution of this mutualistic interaction.

Figure 1: GFP-labeled *Burkholderia* symbiont residing in the midgut crypts of a 3rd instar *Riptortus pedestris*.

7. Research implementation and results under the program

   Title of your research plan:

   The Role of Bacterial Fitness in the Evolution of an Insect-Bacteria Symbiosis

Description of the research activities:

We planned three experiments to test for symbiont expulsion from the bean bug, *Riptortus pedestris*:

1. Screen insect poop and insect molts and swab mouthparts for the expulsion of live symbionts from live insect hosts.
2. Test for symbiont expulsion from insect carcasses.
3. Test for the transfer of viable bacterial symbionts from the insect host to other habitats.

In order to track the movement of *Burkholderia* within and outside the host, I made a GFP-labeled symbiont that can easily be visualized by fluorescent microscopy, even when the bacteria are living within a host. I used a mini-Tn7 transposon system to introduce the GFP gene as well as a kanamycin resistance gene to a typical *Burkholderia* symbiont. I inoculated juvenile bean bugs with the mutant symbiont by feeding, the natural route of infection, and ensured the bugs were infected by dissecting and visualizing the GFP-labeled bacteria within the midgut (see Figure 1). Poop was collected from the 4th and 5th instar juveniles and from adult bugs at multiple time points and screened for the GFP-labeled symbiont by plate culture. No symbionts were detected in juvenile poop. A small number of adult bugs (3/23) had poop positive for the symbiont mutant, but symbiont expulsion did not occur consistently. No symbiont mutants were found on the juvenile-to-adult molts or on the mouthparts of 5th instar juveniles. Bug carcasses were inspected for symbiont expulsion in two ways: 1) by directly placing the carcass on a culture plate for two days and 2) by placing the carcass on potted soil, a more natural environment, and then screening the soil for GFP-labeled symbionts after 3 days. Symbiont mutants were not detected in either the culture media or the soil. These results indicate the insect hosts likely exert tight control over the bacterial symbionts and regulate which tissues infect and when they can enter and exit the host. It is possible that the bacterial symbionts may be able to escape from the host after further decomposition, as the bacteria were still alive in many bug carcasses after three days. However, it is still unclear whether the bacteria gain a net benefit (in terms of population size) from associating with an insect host or how this interaction evolved.

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

I greatly enjoyed this program! I visited many cultural and historical sites, but the best cultural experience was interacting with the Japanese people, especially my lab mates and sensei. I learned a great deal about the Japanese approach to science and life, in general. I was immensely impressed with the lengths my labmates and sensei went to ensure I was comfortable and happy in my new environment. I was invited to many institute functions and informal get-togethers and I was able to meet and speak with many other Japanese people this way. I always felt welcomed and many people made a great effort to speak English with me and to keep me included in the conversation. In addition, I really benefitted from the research aspect of this program. Although two months was a short time, I learned a new technique that I am already planning to use at my home institution and was able to explore a research topic that will now make up a chapter of my dissertation. Thanks for the opportunity!

9. Advisor's remarks (if any):

This program provided both the participant and our laboratory members with a window of opportunity to interact with each other, in terms of science and culture. Although the topic Justine investigated in this program is likely to be difficult to resolve in two month, the results include a novel and valuable findings.

RESEARCH REPORT

1. Name: Elias James Garratt	（ID No.: SP12023）

2. Current affiliation: Western Michigan University

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: Kyushu University

5. Host researcher: Dr. Tsuyoshi YOSHITAKE

6. Description of your current research

This basic research aims to assess how the controlled introduction of chromium, affects the molecular state of carbon in its various forms (sp^3, sp^2, and a-C) within nano-crystalline diamond films prepared by microwave plasma chemical vapor deposition. Chromium has been introduced by ion implantation to a specific depth (between 20 and 60 nm) and dosages (10^{11} and 10^{16}) within each sample. The molecular state of samples will be assessed at the SAGA Light Source and Kyushu University. This study aims to serve as a stepping stone to continued investigations using ion implantation in diamond and other structures, and continued collaboration between research groups at Western Michigan University and Kyushu University.

7. Research implementation and results under the program

Title of your research plan:

Effects of chromium ion implantation on nano-crystalline diamond films.

Description of the research activities:

The primary aims of summer research are to detect chromium within films via x-ray absorption fine structure (XAFS) and assess damage to the nano-crystalline diamond film via transmission electron microscopy (TEM). The ion implantation techniques used to introduce chromium into these films is inherently destructive, however, up to a certain limit the damage can be healed through a heating process. Initial XAFS results detected the presence of chromium within the film but the signal was weak due to the relatively low amount of chromium implanted in the film. Initial results from the highly dosed samples (10^{16}) indicated a complete amorphization of the nano-crystalline diamond matrix. Further studies of the lower dose samples are required to develop a complete picture of structural modification via increasing ion dose.

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

Within the time frame available setbacks that I experienced during sample preparation of TEM analysis precluded me from obtaining more presentable results. If possible, extending the time to perform research in Japan from two months to three months would alleviate some of the pressure to obtain results.

RESEARCH REPORT

1. Name: Natalie GUMATAOTAO	（ID No.: SP12024）

2. Current affiliation: Loyola University Chicago

3. Research fields and specialties:

   Chemistry, Biological Sciences

4. Host institution: Tokyo University of Agriculture and Technology

5. Host researcher: Dr. Masafumi ODAKA

6. Description of your current research

  Nitrile hydratases (NHases) are metalloenzymes that catalyze the hydration of nitriles to their corresponding amides at ambient pressures and temperatures at neutral pH with high specificity. This eco-friendly method replaces traditional industrial methods that consume a great deal of energy and generate toxic waste. NHases are currently used in the large scale industrial production of everyday textiles, animal feedstock, and polymers.

  Despite being used extensively in manufacturing in Asia, questions remain about NHase. It is unclear just how the enzyme catalyzes the reaction. Once this is understood, we can engineer a more efficient, specific, and stable enzyme for broader use in industry.

  Additionally, it is not understood how the enzyme is assembled, or matured. Accessory proteins in NHase are thought to play a large part in the maturation, by bringing the metal ion into the enzyme. By understanding NHase's maturation, we can not only apply the knowledge to NHase understanding and engineering, but also to related enzymes used in wastewater treatment, such as thiocyanate hydrolase (SCNase).

   The goal of my research is to answer these questions. We attempt to capture and study reaction intermediates using kinetic and spectroscopic techniques such as stopped-flow spectroscopy and electron paramagnetic resonance (EPR). NHase maturation is studied with a variety of biophysical methods to probe metal binding and protein-protein interactions.

7. Research implementation and results under the program

   Title of your research plan:

   Maturation of Thiocyanate Hydrolase Facilitated by P15K, a Metallochaperone

   Description of the research activities:

   The first month of research in Japan was largely spent on acquiring protein samples needed for experiments. The genes for the individual components, or subunits, of SCNase were expressed in E. coli. The subunits were purified from other proteins

using hydrophobic interaction chromatography followed by size exclusion chromatography.

The maturation of SCNase was studied by looking for transient interactions between the individual subunits of the metalloenzyme with the accessory protein P15K. The results of a pull-down assay using his-tagged P15K- γ-Co2+ complexes as the bait protein and α-subunit as the prey showed weak interactions between the proteins. Additionally, the results confirmed the hypothesis that binding of the α-subunit does not drive the release of the γ-subunit. In a similar experiment, γ-subunit and α-subunit were also revealed to interact.

Crystal screens of the purified complexes were set up in hopes of getting a diffractable crystal for structure determination. As of one month in 20ºC and 4ºC, no crystals have been identified.

The latter part of the summer was spent on performing in-vitro protein synthesis to observe complex formation. The genes for the subunits and P15K were purified and concentrated to amounts required for the synthesis. Initial results do not show any protein synthesis, suggesting that fine-tuning of the procedure is needed. This may include working with linearized DNA fragments as opposed to plasmid DNA.

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

I thoroughly enjoyed working in the laboratory in Japan. I experienced the famous Japanese work ethic and learned a lot about the Japanese culture that cannot be learned by being an average tourist. I was quite happy to find that most of the lab did not speak English fluently. This forced me to attempt Japanese more often, resulting in a marked improvement in my Japanese speaking and reading. I hope that the students were able to learn more English in exchange. The students in the lab were very friendly and accommodating.

Japan is a beautiful country with fantastic food and a nice balance between modern living and tradition. I was based in a western suburb of Tokyo. During the weekends I would go to the city, or sometimes further. In this short time I was able to experience both modern city living (Tokyo, Yokohama), the more traditional cities (Kanazawa, Kyoto, Kamakura), and the in-between (Hiroshima). It was a privilege to visit these places with so much historical significance.

9. Advisor's remarks (if any):

Ms. Natalie Gumataotao is a very talented researcher as well as a hard worker. I really carried out very good studies on her research subject. Also, she affirmatively communicated with students in our laboratory. It is very good experience both for her and my students. Especially, some students got their visions for future goals during discussion with her.

Finally, I would like to thank Ms. Natalie Gumataotao, her advisor, Prof. Rick Holz, the JSPS and all stuff and institution which have kindly supported this program.

RESEARCH REPORT

1. Name: Colin HAYNES	（ID No.: SP12025）

2. Current affiliation: University of California, San Diego

3. Research fields and specialties: Engineering Sciences

4. Host institution: University of Tokyo 5. Host researcher: Professor Nobuo TAKEDA

6. Description of your current research

I am a PhD student in the Structural Engineering department of the University of California, San Diego, where my research has focused on techniques related to the field of structural health monitoring (SHM).   SHM is the general process of making an assessment, based on analysis of in-situ measured data, about the ability of a structural component or system to perform its intended design function successfully.   The goal of SHM is to reduce the operating cost of structures by enabling optimized maintenance, while simultaneously providing a significant life-safety advantage through catastrophic failure mitigation.

Particularly, my research interests include the application of active-sensing SHM systems to complicated structures, signal processing, data fusion, and uncertainty quantification. Usually, these projects have focused on aerospace structures as the application of interest because the need for SHM in such high-performance, low-margin, and difficult to inspect structures is becoming more and more urgent.   Previously, I have done work to help develop a strain-based, trained-network approach for estimating the reaction forces in aircraft weapon store connectors.   I have also worked to develop rigorous statistical techniques for damage detection using ultrasonic guided wave sensing in geometrically-complex structures.   This work involved experiments on multiple testbeds, including those with bolted connections and those taken from actual, in-service aircraft. I am currently working on developing localization techniques for complex structures as well as optimal selection of data fusion techniques.

7. Research implementation and results under the program

Title of your research plan:

Improving damage prediction capability for composite aerospace structures

Description of the research activities:

This summer, my objective has been to apply ultrasonic guided wave inspection techniques to composite bolted joints.   Composites are gaining increasingly widespread use in the aerospace industry due to their superior performance properties.   Mechanical fasteners such as bolted joints are common in such structures, so I have focused on bolt bearing failure as the damage mechanism of interest.   With my collaborators here, I have done experiments using macro-fiber composite (MFC) sensor-actuators and fiber Bragg grating (FBG) strain sensors to instrument composite laminates.   Specimens were tested destructively in tension to introduce bolt bearing failure, while a variety of inspection strategies have been implemented to monitor the progression of that damage.   I anticipate that the data I have obtained here will be very valuable as I continue my PhD research, as will the collaborative relationships I have established at the University of Tokyo.

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

My experience in Japan has been characterized by the most kind and generous hospitality imaginable.   My homestay family is very kind – I have returned to see them once already, and will later climb Mt. Fuji with one member.   My labmates have been tremendously helpful, taking me to various sightseeing destinations in Tokyo (Asakusa, Ueno, Shibuya, etc.), holding parties after work, and even taking me to a baseball game.   Others I have met have been similarly friendly, resulting in too many cultural experiences to list!

9. Advisor's remarks (if any):

Colin adjusted himself quite well into a two-month stay in my laboratory, and conducted a really fruitful research with his numerous efforts. He already finished a paper submitted to one international workshop based on the results obtained during his stay. I hope his experiences here will help him to understand a different way of life in Japan.

RESEARCH REPORT

1. Name: Vanessa Mary Heckman	（ID No.: SP12026）

2. Current affiliation: California Institute of Technology

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Professor James MORI and Assistant Professor Masumi YAMADA

6. Description of your current research

A method for damage detection in civil structures using seismic interferometry was tested using a numerical model based on a super high-rise steel building located in the Osaka prefecture. The 21-story steel moment-resisting-frame structure is densely instrumented with 13 accelerometers. The continuously-recording seismometers record the acceleration of the building. This data can be used to both understand the behavior of the building during an earthquake and to analyze the state of the building after an earthquake.

7. Research implementation and results under the program

Seismic interferometry was used to study wave propagation in the structure, specifically the propagation of shear waves as a means for damage detection. Deconvolution was used to generate an impulse-response function using experimental data. A numerical test was then conducted whereby structural damage was introduced into the numerical model by reducing the inter-story stiffness. Changes in the impulse response function were used to characterize damage. Damage parameters such as the reflection coefficient, transmission coefficient, and shear wave speed, were used to identify changes in wave propagation. Numerical findings indicate that a significant reduction in single inter-story stiffness of roughly 30% is needed for a 10% change in the amplification and transmission coefficients, and a reduction in inter-story stiffness of roughly 50% is needed for an observable change in the shear wave speed.

    Title of your research plan:

    Damage Detection in Civil Structures Using Seismic Interferometry

Description of the research activities:

Research activities included analyzing experimental data and performing tests using a numerical model. Experimental data was recorded by 13 accelerometers located on a 21-story high-rise building. A numerical model was developed to understand what changes in building behavior would be expected after structural damage was introduced into the model. Numerical testing was conducted to understand what changes in building behavior would be expected after damage was introduced into the structure.

A research visit to the Kyoto University Disaster Prevention Research Institute Kamitakara observatory in Takayama was conducted to study in-field seismometers and data collection systems and discuss the research project with the resident professor at the observatory. A final seminar was given at Kyoto University, Katsura Campus, where the results of the summer project were presented to a professor and students studying the same structure.

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

I took Japanese language classes offered by the Uji International Friendship Club. I enjoyed the cultural exchanges in Japan, and plan to collaborate with my Japanese host professors and keep in touch with my Japanese friends.

RESEARCH REPORT

1. Name: Peter Hundt	（ID No.: SP12027）

2. Current affiliation: University of Minnesota

3. Research fields and specialties: Biological Sciences

4. Host institution: University of Kochi   5. Host researcher: Dr. Kosaku Yamaoka and Dr. Yohei Nakamura

6. Description of your current research

   My research is focused of what organisms eat, how they obtain it, and implications on evolutionary history. Specifically, I study the evolution of feeding structures in the perciform family Blenniidae. Blennies are a group of diminutive near-shore marine fishes, which exhibit the widest array of oral tooth and jaw morphologies in any group of perciform fishes; including teeth that widely vary in shape, number, and mode of attachment and replacement, and a lower jaw that has an extra articulation. For my dissertation, I will examine the evolution of tooth and jaw structures, as related to diet and phylogeny, in blenniid fishes by determining whether changes in jaw and tooth morphologies are correlated with phylogeny and diet and investigating potential interactions with shifts in diversification rate between groups of blennies.

   While in Japan I focused on the diet aspect of my research. The diet of many blennies is poorly known, yet is important for understanding the evolution of trophic specialization. The results of the diet study of blennies (Teleostei: Blenniidae) from two different ecosystems in Japan provide the following: 1) the first description of diet for some blenny species, 2) add to the published data of some previously studied species, and 3) diet data will be used in conjunction with morphological and molecular data to test hypotheses about evolution and correlation of the diet and feeding morphologies of blennies.

7. Research implementation and results under the program

Title of your research plan:

"Assessing diet of a near-shore marine fish (Teleostei: Blenniidae) from two ecosystems in Japan"

Description of the research activities:

I collected blenny specimens for diet study with the use of hand nets, SCUBA, and snorkel in Okinawa (22 species, 23 June – 2 July 2012) and Kochi Prefecture (13 species, 8 July – 4 August 2012). The formalin fixed specimens were dissected and contents of the digestive tract were placed on a 1 X 1 mm grid slide for identification with the aid of binocular microscope. Food items were identified to lowest possible taxon and the volume of each was visually estimated. Volumetric percent composition of each food item was calculated for each individual (volume of food item / total volume of all food items) and as mean volumetric percent composition for each species. A Cluster analysis was used to determine similarity among diet of species and PERMANOVA to investigate the interactions of two factors (climate and habitat zonation) with the diet of blennies. Results: There were six major feeding guilds among blennies of Japan; most are detritivores, some are generalists, and a few species are specialists of coral polyps, fish scale/mucus, pieces of bivalve tissue, or polychaetes. Blennies collected in a subtropical climate (Okinawa) have different diets than those collected in temperate climate (Kochi) and blennies that live in different habit zones (above the spray zone, intertidal, and rocky reef) have different diets. Additionally, there appears to be no interaction between climate and habitat zonation, as the diet of blennies from a specific habitat are the same, regardless of climate (temperate or subtropical).

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

This summer I was able to collect important data, specimens, and tissues for my dissertation, learn techniques for diet study of fish, and conduct a successful study of the diet of blenniid fishes. Beyond research, I met many great people and had an amazing introduction to Japanese culture.

RESEARCH REPORT

1. Name: Lauren Jarocha （ID No.: SP12028）

2. Current affiliation: Department of Chemistry, The University of North Carolina at Chapel Hill

3. Research fields and specialties:

    Chemistry

4. Host institution: The Institute for Multidisciplinary Research for Advanced Materials, Tohoku University

5. Host researcher: Prof. Seigo Yamauchi

6. Description of your current research

This current research project involves the investigation of the paramagnetic states or triplet states of metal coordination compounds by steady-state and time-resolved electron paramagnetic resonance spectroscopy. Three different chemical systems were the primary focus of this research: 1) ruthenium-based single site water oxidation catalysts, 2) the reductive quenching of metal complex excited states by proton-coupled electron transfer, and 3) triplet state properties of platinum and palladium porphyrin compounds. The first two research projects involve proton-coupled electron transfer, a mechanistic step that is very important in many chemical and biological systems. Metal compounds in the third research project undergo photoinduced electron transfer. Both PCET and photoinduced ET are very important tools in designing chemical reactions and devices for applications like artificial photosynthesis. In all cases, understanding how structure and solution conditions affect molecular properties and chemical reactions is important to improving the design and efficiency of these systems.

7. Research implementation and results under the program

    Title of your research plan:

    Proton-Coupled Electron Transfer Reactions: Insights into Mechanism from EPR Spectroscopy

    Description of the research activities: Time-resolved and steady-state X-band EPR spectroscopy was used to examine the physical properties of paramagnetic and triplet states of metal coordination compounds. Ruthenium-based water oxidation catalysts were studied at low temperature using a helium cryostat and

steady-state EPR. A new solvent system was implemented that creates a random distribution of the molecular orientation, which will allow the data to be simulated and useful information on the paramagnetic intermediates of the catalytic cycle to be extracted from the spectrum. Spectrum of radicals produced by the reductive quenching of the excited state of ruthenium based coordination compounds revealed an unusual intensity pattern in the spectrum that differed from the predicted values. Simulation revealed that this intensity pattern is likely caused by the observation of a radical-pair that is an intermediate in the chemical reaction. Additional quantitative simulations will reveal further information about the radical pair in the near future. Data analysis of the triplet state platinum and palladium porphyrins is currently underway. In addition to work related to the proposed project, spectra were collected for a set of dicumyl-ketones. Significant differences are observed in the EPR data for this series of closely related organic molecules that may be related to molecular structure and kinetics. In addition to experimental work, I attended the 7th EPR Summer School, the 2nd International Symposium on Electron Spin Science, and a domestic conference on the photochemistry of inorganic compounds. Recent work on the excited state quenching of ruthenium compounds by PCET was presented in the form of a poster at ISESS and a short oral talk at the photochemistry conference.

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

I am very grateful to the members of the Yamauchi lab for making me feel so at home during my stay in Sendai. They went out of their way to make sure I had everything I needed and experienced everything Japan had to offer. I also appreciate their patience as I adjusted to the lab routines, particularly my initial forgetfulness with lab shoes. In terms of cultural experiences, I can not speak highly enough of the fireworks and Tanabata matsuri in Sendai, the Grand Sumo Tournament in Nagoya, and climbing Mt. Fuji, and would emphatically recommend them to future fellows.

9. Advisor's remarks (if any):

We were very lucky that we could accept her. She is an earnest and always tries to get new things and to have new experiences. I hope that she has learnt many new and interesting things which might be important for the remaining PhD program in USA via giving talks in two conferences and collaborative experiments with me. I also expect that she will come back to Japan as a postdoctoral fellow or a research scientist.

RESEARCH REPORT

1. Name: George E. KACHERGIS	（ID No.: SP12029）

2. Current affiliation: Indiana University

3. Research fields and specialties:

   Social Sciences, Interdisciplinary and Frontier Sciences

4. Host institution: Japan Advanced Institute of Science and Technology

5. Host researcher: Prof. Takashi HASHIMOTO

6. Description of your current research

Learning the first nouns of a new language can be challenging, as there are many possible referents in any situation. But by seeing objects in varied situations, and tracking which words and objects co-occur most frequently, learners can infer words' intended referents. Such cross-situational learning likely plays a role in infant and even adult language acquisition, and involves basic learning, memory, and attention mechanisms. Understanding how these abilities interact to produce learning trajectories requires formal models. I have data from several experiments I previously conducted and published that provide useful constraints for such modeling efforts.

This summer, with the help of Professors Hashimoto and Hidaka, I worked on developing a series of Bayesian models of cross-situational word learning. The models we developed, based on the generalized Bradley-Terry model, are also useful for other problems involving contingency tables (e.g., word alignment for machine translation of natural languages). The first two models matched human data from some conditions well, but does not show trial-order effects that humans show in other data. We formulated a few additional models with varying attention and memory that we hope will allow us to capture these order effects, and we are continuing to work on implementing these models. We have a preliminary write-up describing these several models, as well as our results from our initial tests.

7. Research implementation and results under the program

Title of your research plan:

Mechanisms of Language Learning

Description of the research activities:

We developed an idea for the Bayesian model by reading background papers on the generalized Bradley-Terry (GBT) model and discussing modifications. I implemented a Gibbs sampler algorithm for the GBT and applied it to data from some of my experiments. We went back to the drawing board after seeing how it cannot capture trial-order effects, and worked on the theory of several variants. Professor Hidaka and I met frequently at a whiteboard, and over lunch for long discussions of our work. After writing up some of our models' descriptions, I implemented a second model that allows word-object pairs to be modeled as clusters. I am still working on implementing a model that may help us capture trial-order effects.

RESEARCH REPORT

1. Name: Ravi KAPPIYOOR	（ID No.: SP12030）

2. Current affiliation: Virginia Tech

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Assoc. Prof. Shoji TAKADA

6. Description of your current research

   Almost all eukaryotic organisms have genes that code for actin filaments. Actin, along with two other cytoskeletal polymers (microtubules and intermediate filaments), helps maintain the structural integrity of the cell. In order to generate force, actin monomers undergo subunit addition (polymerizations) and subunit reduction (depolymerization). In doing this, actin is able to play a central role in physiological processes such as chromosome segregation and cell motility. As such, in order to better understand these processes, the polymerization dynamics of actin must be known. Currently, the view of polymerization dynamics is based on a purely chemical kinetics view (postulating that the rates of association and dissociation of polymer subunits are uniquely controlled by the chemical state of the subunit bound nucleotide). However, there has been growing evidence that indicates that structural plasticity of the actin filament (or the change in the structural state of the polymer without a corresponding change of its bound nucleotide) also plays a major role in modulating polymerization dynamics.

7. Research implementation and results under the program

Title of your research plan:

Understanding the Effect of Stress on Actin Filaments

Description of the research activities:

A molecular dynamics (MD) simulation of actin filaments under physiological conditions is proposed for further understanding of the structural changes undertaken by actin during polymerization and depolymerization. The simulation will be able to provide information on when different types of structural changes occur, as well as the types of stresses that each change may put on the filament and how the filament responds to the stress. With this information, it may be possible to more fully understand how and through what process these changes occur, and how they affect polymerization dynamics. Through this process, it will be possible to begin work on developing a model that fully describes the polymerization dynamics of actin filaments.

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

Final decisions on admission into the program were sent out in the end of March/early April. This gives 2 months of time to prepare to come to Japan, and 2 months to work in Japan, for a total of 4 months. This is not enough time for a full research project. I intend to continue working on this project even after leaving Japan, but it would be better if we were informed of the results earlier than April, giving us more time to get significant work done before coming to Japan.

RESEARCH REPORT

1. Name: Tae K. KIM	（ID No.: SP12031）

2. Current affiliation: The University of Alabama in Huntsville

3. Research fields and specialties:

    Mathematical and Physical Sciences

4. Host institution: Nagoya University

5. Host researcher: Munetoshi TOKUMARU

6. Description of your current research

Radio waves from distant, astronomical sources are scattered as they propagate through turbulent medium, such as the solar wind. The resulting random fluctuation in intensity observed is called interplanetary scintillation (IPS), which can be used in determining solar wind parameters, i.e., density and velocity. IPS observations are a powerful, well-established tool for probing the solar wind, which is the predominant source of space weather and creates a bubble-like structure around the Sun called the heliosphere by exerting pressure on the local interstellar medium. Though not as accurate or temporally detailed as *in situ* spacecraft measurements, IPS observations generally provide far better global coverage with reasonably good accuracy and temporal resolution, satisfying the criteria for use as boundary conditions in time-dependent, three-dimensional simulations of the solar wind outflow.

In particular, I derive my boundary conditions from the daily IPS observations made by the Solar-Terrestrial Environment Laboratory (STEL), Nagoya University. Since IPS observations contain a line-of-sight integration effect, they must be deconvolved to generate a more accurate, three-dimensional map of the solar wind parameters. Several tomographic methods have been developed by STEL and University of California, San Diego (UCSD): corotating tomography, time-sequence tomography, MHD-IPS tomography, and time-dependent tomography. Prior to this trip, I have used the MHD-IPS tomography results obtained at the heliocentric distance of 5 astronomical units (AU) as the inner boundary conditions to propagate the solar wind out to the local interstellar medium to investigate the long term variations of the plasma parameters in the global heliosphere and the interactions between plasma and neutral atoms in the outer heliosphere. My PhD dissertation project requires more extensive use of IPS-based boundary values that provide an accurate, realistic view of the solar wind structure in an effort to improve the current model.

7. Research implementation and results under the program

Title of your research plan:

Numerical Modeling of the Heliosphere Using Interplanetary Scintillation Data as Boundary Conditions

Description of the research activities:

In addition to providing a series of lectures on IPS observations and various tomographic methods developed by STEL and UCSD, the host researcher arranged field trips to three of the four IPS facilities operated by STEL. First, we visited the Toyokawa observatory on a routine checkup. Next, we visited the Fuji observatory while an important maintenance work was being performed. Lately, we visited the Kiso observatory for the Open House weekend. The lectures and field trips helped me understand the technical difficulties and complexity associated with IPS observations and the three-dimensional tomographic reconstruction methods. This experience would be valuable in analyzing the IPS-based boundary values and simulation results.

During my stay in Nagoya, I prepared a poster presentation for the Solar Wind 13 conference in Hawaii (my advisor presented it, though, because I couldn't attend the meeting), which showed magnetohydrodynamics (MHD) simulation results for solar wind flow in the inner heliosphere obtained by using UCSD time-dependent tomography data at 0.25 AU as inner boundary conditions. I also wrote and submitted a paper for publication based on a previous MHD simulation with a different set of IPS-derived boundary values. Meanwhile, I began working on a paper detailing the STEL IPS observations and their applications on space weather related research and modeling of the global heliosphere, which would be suitable for an educational journal, such as American Journal of Physics.

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

This was supposed to be a mutually beneficial experience, but honestly, I think I gained a whole lot more from it than my host researcher ever did. The lectures and the field trips he kindly provided (in addition to his barbeque) are the highlights of my stay in Japan and will greatly enhance the quality of my dissertation, which I plan to finish within a year. On a slightly less serious note, I will miss the daily coffee break with his research group.

RESEARCH REPORT

1. Name: Benjamin Krueger	（ID No.: SP12032）

2. Current affiliation: University of Washington, Seattle

3. Research fields and specialties:

   Mathematical and Physical Sciences

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

5. Host researcher: Dr. Toyohiro Chikyow

6. Description of your current research

My research is focused on understanding the physical properties of gallium oxide, a transparent conducting oxide that holds promise for future technological applications. One possible application is a high electron mobility transistor (HEMT), a device formed when electrons become trapped in a quasi-2 dimensional layer between intrinsic and Al-doped Ga_2O_3 due to electric fields arising at the interface. Substitutional aluminum increases the Ga_2O_3 band gap energy above the intrinsic value of 4.9 eV, and the band gap mismatch at the interface with intrinsic gallium oxide leads to strong electron confinement. In addition, Al-O and Ga-O bond lengths are comparable, allowing for an epitaxial interface with low defect density and high electron mobility. Such transistors are conventionally made from aluminum-doped gallium arsenide and aluminum-doped gallium nitride, and used in high power applications including radio frequency and microwave electronics. A HEMT based on gallium oxide promises even better performance due to its wider intrinsic band gap, higher breakdown voltage, and higher peak operating temperature. My summer research is the first step in realizing such a device.

Using combinatorial pulsed laser deposition, I am creating thin films of aluminum-doped gallium oxide, in which the composition varies from 100% Ga_2O_3 to 100% Al_2O_3 as you move from one side to the other. This technique allows us to study physical trends with aluminum concentration on a single sample, such as band gap energy, conductivity and crystal structure. My goals this summer were to determine the limiting Al concentration at which the crystal structure ceases to be **β**-Ga_2O_3, and to measure the energy band gap as a function of Al concentration. In the future I also plan to repeat these experiments by doping with indium instead of aluminum, which will decrease the band gap. This will allow for tuning within a continuous range around 4.9 eV, giving broad flexibility in designing a hetero-interface between doped and intrinsic Ga_2O_3.

7. Research implementation and results under the program

Title of your research plan:

Controlling conduction at the interface of transparent semiconducting thin films

Description of the research activities:

First I conducted experiments to optimize Ga_2O_3 film growth on sapphire and GaN substrates, by varying growth parameters such as the substrate temperature, pulse energy and oxygen partial pressure. In addition, the effect of post annealing on film quality was investigated. For all samples, crystallinity and orientation were assessed using x-ray diffraction, and stoichiometry was measured by x-ray photoemission. Spectroscopic ellipsometry was used to determine film thickness and band gap energy.

Next I began depositing combinatorial films of $(Al_xGa_{1-x})_2O_3$ by alternating laser pulses on Ga_2O_3 and Al_2O_3 targets, using a moving linear shutter. Over the course of the summer several binary films were grown on both GaN and sapphire substrates. For each sample, line scans along the aluminum concentration gradient were taken, and crystal quality and band gap energy were correlated with stoichiometry.

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

Everyone at my host institution was very welcoming and helpful, and it was interesting to see the similarities and differences between life at an American University and a Japanese national lab. I had many opportunities to make new friends using Japanese outside of the lab, and hope to stay in touch with them long after I return to the US. Overall a very successful research experience, and I learned a lot. I am extremely grateful to my host and to JSPS for the opportunity to come here.

RESEARCH REPORT

1. Name: Baek Soo Lee	（ID No.: SP12033）

2. Current affiliation: Oregon State University

3. Research fields and specialties:

    Mathematical and Physical Sciences

4. Host institution: Hokkaido University

5. Host researcher: Dr. Hideaki Shibata

6. Description of your current research

    Changes in land use within watersheds influence stream water and soil quality. My dissertation examines new aspects of various factors, especially land use that affects the nitrogen (N) movement in multiple spatial-scale watersheds in order to manage watersheds sustainably in the future.   For the first time, the feasibility of using the U.S. Geological Survey's (USGS) SPAtially Referenced Regression on Watershed Attributes (SPARROW) model is tested in order to find N sources and to predict its transport in a large watershed within the South Caucasus region.   With this project, effects of current land use management practices to surface water quality are examined.   Secondly, components affecting N flushing during high precipitation are observed at small watersheds having two different historical land use managements in Oregon. Observations on N flushing at this scale are still rare, and long-term clear-cutting effects are closely examined.   Thirdly, the effects of selective-cut forest management practices on surface water quality and the in-soil N cycle were examined in Hokkaido.   The selective-cutting has been conducted at this study site over the last 40 years to maintain the overall biomass and is believed to be a more sustainable forest management practice than clear cutting.   However this assumption has never been verified in the Hokkaido region, and my project attempted to verify it.

7. Research implementation and results under the program

Title of your research plan:

Slope, Vegetation Types, and Historical Land Management Effects on the Nitrogen Cycle in a Selective-Cut Forest Watershed

Description of the research activities:

I conducted two projects while I was in Hokkaido. First, soil and stream water samples were collected to analyze N amounts in catchments of the Nakagawa Experimental Forest, which is located about 250 km north of Sapporo. Half of the soil samples were left in the field to incubate naturally. This provided net nitrogen mineralization and nitrification rates within the soil as the net production of ammonium (NH_4^+) and nitrate (NO_3^-). Those two rates were examined in relation to slope and vegetation in two catchments with different forest management history over the last 40 years. Concentrations of NH_4^+, NO_3^-, and dissolved organic N in surface water were also analyzed to examine the difference of the nitrogen cycle within these catchments.

The second project involved mapping analyses using a Geographic Information System to examine the influence of past forest management practices on overall N and carbon (C) pools in the Nakagawa Experimental Forest. The data used included tree specie type, the height of each tree, diameter at breast height, N of each tree, C of each tree, LiDAR (2m spatial resolution), N of soil, and C of soil.

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

I would like to extend my appreciation to my host researcher, his colleagues, and his students for providing me such wonderful learning experiences. They helped me so much with my research and showed me beautiful Hokkaido throughout my stay in Japan.

RESEARCH REPORT

1. Name: Jia Liu	（ID No.: SP12034）

2. Current affiliation: Columbia University

3. Research fields and specialties: Mathematical and Physical Sciences

4. Host institution: Japan Aerospace Exploration Agency (JAXA)

5. Host researcher: Ken Ebisawa, Masahiro Tsujimoto

6. Description of your current research

40 years after their discovery, the internal structure of neutron stars is still a puzzle. Understanding the equation of state (EOS) of the matters at the core of neutron stars is the key to probe interactions of matters in extremely dense environments, and two key quantities to be measured are the masses and radii of the neutron stars.

Since it is difficult to measure these two quantities directly, we try to find indirect hints by studying the surface phenomenon. In the historical large X-ray burst (a phenomenon seen from accreting neutron stars in binaries) of M15 in 1988, Ginga space telescope found that the spectrum is significantly deviated from the blackbody when the color temperature is less than ~1.5 keV, which has yet to be explained. In my first project, we attempted to use different theoretical models with sophisticated atomic data and simulations (XSTAR warm absorber and X-ray burst atmosphere model by Suleimanov et al. 2011) to fit the spectrum and explain the deviation.

My second project focuses on detecting X-ray absorption lines or edges in neutron star spectra, a more direct way to attack this question. If we can identify the rest wavelengths of detected features, the mass and radius relation can be inferred from the gravitational redshift.

JAXA is under the process of testing Astro-H, the next X-ray space telescope scheduled for launch in 2014. The Soft X-Ray Spectrometer (SXS) on board of Astro-H uses an X-ray calorimeter spectrometer that can measure photon energies with extraordinary precision than previous generation detectors. My task was to test its ability to observe X-ray bursts, where we already have hints for potential absorption features.

7. Research implementation and results under the program

Title of your research plan:

I have worked on two projects:
1) Fit the spectrum of M15 1988 X-ray burst with recently developed X-ray burst atmosphere models
2) Probe the center of neutron stars with Astro-H Soft X-Ray Spectrometer

Description of the research activities:

For the first project, I spend a week to familiarize myself with Ginga space telescope and the tools (Fortran, screen, XSPEC) needed for my data analysis, and another week reducing Ginga data for the 1988 M15 X-ray burst. When the observation data are ready, I turned to prepare for the model fitting by altering an existing Fortran code to write raw model data into a XSPEC readable fits file. For both of the models we used, the fitting results are somewhat disappointing, though slightly better than the previous simple blackbody model. We believe the problem arises from current lack of understanding of chemical compositions during X-ray bursts, which may differ greatly from the cosmic or solar abundances.

I started my second project from week 5. My tasks including learning Astro-H, in particular SXS (physical principles of detection for micro calorimeters, sensor, signal processing, non-linear behavior for bright sources), searching for literatures for currently known X-ray burst sources and select the most promising targets, and simulating the spectrum using PIMMS and XSPEC with various parameters. I delivered the results in form of a poster that will be presented at the third Astro-H summer school. Also, we selected a group of ~ 10 objects out of 100 known X-ray bursters to be the most promising targets and will propose one of them to be observed for 100 kiloseconds during Astro-H's Performance Verification (PV) phase.

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

During the orientation week, I was dreaming myself speaking fluent Japanese by the end of the program. Of course it never happened. However, I ate tons of sushi, learned to put on yukata myself, and grown a lot of love for ramen and Japanese curry. I can't imagine living without them after I leave. Also I must thank my host; he is so thoughtful to arrange my research and life at JAXA that I ended up missing out all the cultural shocks I was waiting for.

RESEARCH REPORT

1. Name: Michael Lopez　　　　　　　　　　　　　　　（ID No.: SP12035）

2. Current affiliation: University of California Los Angeles

3. Research fields and specialties:

   Chemistry

4. Host institution: University of Osaka

5. Host researcher: Professor Hayato TSURUGI

6. Description of your current research

The current work of my group utilizes metal complexes supported by redox-active ligands to undergo novel chemical reactivity. The redox-active ligand is a diamidoferrocene based system which is able to reversibly donate an electron to the metal center thus providing electronic flexibility needed for catalytic transformations. The target metals to be supported by the diamidoferrocene ligands are the group V metals, tantalum and niobium. Initial reactions to synthesize the metal-ligand complex resulted in inseparable mixtures. Upon conducting several control experiments it became clear that an electron transfer from the diamidoferrocene ligand to the group V starting compound occurred before metal-ligand interaction. Using different group V starting compounds, the target metal complex was suspected to be synthesized. Current efforts are to characterize the metal complex.

7. Research implementation and results under the program

Currently industry uses expensive noble metal based catalysts to conduct chemical reactions. While these catalysts are efficient, the global supplies of these metals are decreasing. Unfortunately, many current alternatives utilizing the cheaper more abundant early-transition metals are considered to reactive and thereby difficult to control. Recently, early-transition metals supported by redox-active ligands are seen as a possible alternative. In an effort to synthesize our own catalysts supported we made metal complexes of group V metals supported by a diamidoferrocene ligand.

Title of your research plan:

The Synthesis and Characterization of Group V Metal Complexes Supported by a Diamidoferrocene System.

Description of the research activities:

In the addition of carrying out reactions under various conditions, such as changing reaction temperatures or starting materials, various spectroscopic techniques were used in characterizing the reaction products. Daily spectroscopic measurements include nuclear magnetic resonance spectroscopy, while occasionally electron paramagnetic resonance measurements were also taken.
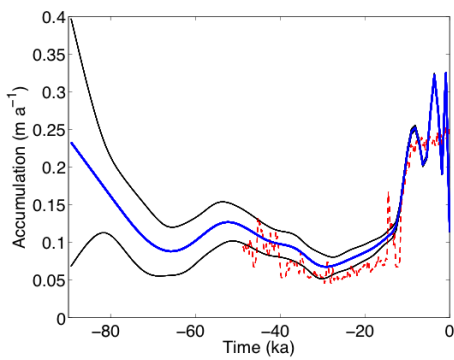
8. Please add your comments, including any cultural experience during your stay in Japan (if any):

In addition to learning about new lab techniques, I also learned a great deal about Japanese culture. During my days off I was fortunate to travel around Japan. I was able to see many famous sights such as the Buddhist temples in Koyansan, fireworks in Kobe, hot springs in Kaga-onsen, Korakuen in Okayama, Atom Dome in Hiroshima, as well as several others. Several lab members would also invite me to many lab activities such as dinner parties, in which I was able to try a large variety of foods.

9. Advisor's remarks (if any):

To continue this research in the US in hope of establishing a collaboration between the two research groups.

RESEARCH REPORT

1. Name: Jessica LUNDIN	（ID No.: SP12036）
2. Current affiliation: University of Washington	
3. Research fields and specialties: Mathematical and Physical Sciences	
4. Host institution: University of Hokkaido, Institute of Low Temperature Science 5. Host researcher: Prof. Ralf GREVE	

6. Description of your current research

Climate reconstructions including temperature and greenhouse gas concentration histories can be determined from the GISP2 ice core, from Summit, Greenland.   The GISP2 chronology, that is the timeline of the climate record, has been found to have significant error between 40-60 ka.   I am currently working to improve the GISP2 chronology to correct this error.

GISP2 Volcanic ash layers have been tied to a more robust GICC05 chronology (Rasmussen, personal communication), creating a sparse data set of 840 dated tie points. With the inverse method developed by Lundin, et al. (*In Prep*), we find a continuous depth-age relationship that fits the sparse depth-age data based on the uncertainty in the data set.   The depth-age data are not fit exactly because the data contain noise.   The physically based method of determining the depth-age allows the inference of the accumulation (precipitation) history (Figure).   The accumulation inferred from the inverse method is shown in blue, with 1-sigma uncertainty in black.   The inferred accumulation does not provide the high frequency variation of previous a previous reconstruction is shown in red (Alley, 1997).

The Lundin, et al. (*In Prep*) method requires the ice-sheet thickness history for GISP2, provided by the 3-d SICOPOLIS model developed by Prof. Ralf Greve (1998, 2005).

Future work includes reducing the smoothness constraint at rapid climate change events, called Dansgaard-Oeschger (DO) events.

7. Research implementation and results under the program

Title of your research plan:

Improving ice-core chronologies

Description of the research activities:

- Poster presentation, Improving ice-core chronologies, JSPS-NSF, 18 June

- Introduction oral presentation: Ice-core physics and paleoclimate, Institute of Low Temperature Science, Sapporo, 6 July

- Research visit National Polar Institute Tokyo (NIPR), 26-27 July

Presentation: Ice-core physics and paleoclimate, NIPR, Tokyo, 26 July

- Applied to the JSPS Short-Term Postdoctoral Program, 3 August

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

I have enjoyed a rich cultural experience living in Japan for 10 weeks. This includes meeting new friends, enjoying Japanese cuisine, and visiting tourist sites. I have great appreciation for Japan and I look forward to returning.

RESEARCH REPORT

1. Name: Xuan Giang Luong	（ID No.: SP12037）

2. Current affiliation: University of California, Berkeley

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Kitasato University

5. Host researcher: Dr. Michihiko Ito

6. Description of your current research

The goal of my graduate studies is to better understand the mechanisms of sex differentiation using the African clawed frog, *Xenopus laevis*. Exogenous estrogens can induce ovarian differentiation in the gonads of genetic males when they are exposed as larvae, but the sensitivity to estrogen varies between individuals and populations. Like larval gonads, the livers of male and female metamorphosed *X. laevis* express estrogen receptors, but respond to exposure with robust increases in vitellogenin expression, an egg-yolk protein precursor. During my time at Kitasato University, I examined whether differential estrogen sensitivity fluctuates across life history stages and across tissue types. To do so, I quantified estrogen receptor and vitellogenin gene expression in the liver of male, juvenile *X. laevis* from two populations characterized by the Hayes Lab.

7. Research implementation and results under the program

Title of your research plan:

Diversity of estrogen sensitivity across populations, life history, and tissue types in the African clawed frog

Description of the research activities:

The focus during my time at Kitasato University was to perform quantitative real-time polymerase chain reaction (qPCR) on treated-liver cDNA samples. However, it was critical that I learn several other processes in order to successfully complete my experiments. During the first several weeks, I learned how to design primers in order to target specific gene isoforms and how to clone my genes of interest in order to obtain pure, highly concentrated levels that would be then used to make probes for *in situ* hybridization (ISH) and standard curves for qPCR. The remainder of the program was dedicated to obtaining quality standard curves and performing qPCR to quantify two genes of interest and their isoforms.

Within the 10-week period, I was able to complete my experiment goals and even had time to train on other techniques that would be useful in the future. In addition, I learned how to dissect out gonads of young, developing tadpoles at several different stages of development and how to localize gene expression with ISH. The techniques and knowledge I gained during my summer at Kitasato University was not only essential for the completion of my experiments for the program, but will be functional for me to complete my graduate studies.

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

In addition to my experiments, I was able to visit several labs at Hiroshima University's Institute for Amphibian Biology, the National Institute for Basic Biology, and Tokai University. During my visits, I had the opportunity to present and discuss my work with experts in my field and gained valuable insight into the future of my research.

I was also able to set aside some time to travel and explore both the Kansai and Kanto areas. My experiences sightseeing, interacting with the Japanese people, and enjoying the rich culture of Japan have only enhanced my time under the JSPS Summer Program.

RESEARCH REPORT

1. Name: Michelle Maier	（ID No.: SP12038）

2. Current affiliation: Oregon Health and Science University

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Toho University

5. Host researcher: Dr. Maiko Kagami

6. Description of your current research

My research focuses on the phytoplankton ecology of the lower Columbia River, U.S.A. I am interested in how the physical environment (river flow, turbidity) influences phytoplankton seasonal dynamics and how changes in phytoplankton species composition contribute to changes in the biogeochemistry and food web processes in the river. During this study, I have used continuous in situ sensors to monitor chlorophyll and nutrient river conditions and adaptively sampled during periods of phytoplankton blooms. During spring blooms prior to increased river discharge events (i.e. storms, snow melt), I have identified an increased abundance of chytrid fungal parasites on diatom species in the river. My goal is to assess the potential impact that these chytrid parasites have in the Columbia River in terms of lethal parasitism and facilitating the transfer of nutrients from 'inedible' host diatoms to higher trophic levels through the mycoloop.

7. Research implementation and results under the program

   Title of your research plan:

   Assessing zooplankton grazing of chytrid fungi in Lake Inba, Japan

   Description of the research activities:

   In order to assess consumption of chytrid zoospores by zooplankton in the field, a culture of chytrid zoospores was first used to verify methods of detection using quantitative PCR and fluorescence in situ hybridization (FISH).   For these experiments, I separated chytrid zoospores from the host diatom population and preformed direct counts, FISH counts, and extracted DNA along with a known DNA

control. The count data was used to standardize the qPCR values and the DNA control was used to determine an extraction efficiency of each sample. Comparable values using these 3 methods of measurement were found when several zoospore concentrations were analyzed. Second, I preformed zooplankton grazer experiments to detect the consumption of chytrid zoospores by two different species of *Daphnia* using the above methods. In addition, in order to determine actual consumption versus random attachment of zoospores, experiments were done to compare the zoospore concentration when the carapace was and was not removed. Results showed that zoospore concentration was higher when the carapace was not removed and therefore analysis of consumption of zoospores in field samples must take into consideration the amount of zoospores randomly attached to the *Daphnia* carapace. The qPCR method was then successfully applied to Lake Inba field samples to analyze free-living and grazed zoospores. These results will help in future studies of zoospore quantification and assessment of zoospore grazing in field conditions.

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

I visited Otsu for one week to present at an international meeting and was able to meet with many Japanese scientists and enjoy an extravagant welcome party of sake and Japanese foods as well as attending traditional music events and tea ceremony. I also attended the Gion matsuri while in Kyoto and sumo tournament in Nagoya, in addition to visiting many temples and shrines. The professors and students at Toho University were extremely welcoming and made my stay in Japan very enjoyable!

9. Advisor's remarks (if any):

Michelle's 2 month staying was extremely fruitful, both in terms of research and cultural exchanges. She worked really hard, and her research results were quite nice, much more than I expected. We are preparing the MS to submit to the international journal. While she was in Japan, 3 of our colleagues visited her home town, Portland, Oregon for the conference. . She could guide them where to visit beforehand. My students were also extremely happy to communicate her in English.

RESEARCH REPORT

1. Name: Kimberlee A. MARCELLUS	（ID No.: SP12039）

2. Current affiliation: Drexel University

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Nagoya University

5. Host researcher: Prof. Hiroki TANIKAWA

6. Description of your current research

My research interests focus on materials management in the built environment using the tools of Industrial Ecology.   My dissertation will focus on tracking an entire network of decision making parameters for urban developers to include recycling waste in construction and demolition (C&D) ventures.   My efforts at Tanikawa lab explore the spatial trends in material stock and magnitude of waste fractions of urban environments that influence the decision making framework.   An innovative approach to tracking waste generation and demolition trends was introduced by Tanikawa and Hashimoto with quantifying materials stock as well as demolition waste utilizing 4D-GIS (Graphical Information Systems) based on 3D-GIS with time series database on an urban scale for two island cities located in Japan and UK (2009).   They conducted a material stock analysis of buildings and substructures combining the quantity of Material Stock (MS) intensity with the layers indicating MS density in an urban land area, a similar concept to population density to estimate stock predict demolition curves.   I have adapted this method to a local US case study and set up a baseline for the Philadelphia region over the past decade. This study has provided useful data for determining material stock in Philadelphia, and another urban-scale case study to compare and contrast results.

7. Research implementation and results under the program

Title of your research plan:

Applying GIS to Predict and Model, Construction and Demolition (C&D) Waste Distribution in Urban Environments

Description of the research activities:

I was introduced to the students at Tanikawa lab at Nagoya University. Each day I would conduct my research and data implementation with ArcGIS. The main activities included: researching historical maps and photos, building study area with all map layers, determining building type and waste profiles, and securing current maps from various open sources available in Philadelphia, PA USA. These data were not readily available and were established from various literature and limited government data sources. This case study set up a city scale map, in University City, utilizing Arc Map and Arc Scene. Land use maps, contour maps, building shape files, and aerial maps were acquired. The building shape layers were compared and digitized against 2012 base map and aerial photos. The material intensity data were adapted from available data for waste profiles within Philadelphia defined land use categories. The 4D-GIS model was compiled from two databases, spatial and statistical. The material intensity data were applied to total floor areas per each land use type and waste fractions were determined in two year time steps from 2004-2012. The stocked materials were calculated per year, land use type, and material types. These data will be evaluated and compared to the UK and Japan case studies. The case study results will be integrated with probabilistic waste predictor model.

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

This has been one of the most life changing events for me. It was difficult at first to get used to the language barrier, but everyone is so polite and helpful, traveling and adjusting is very easy. Climbing Mount Fuji, was the best, most humbling, and rewarding experience, as well as traveling to Hiroshima and Miyajima. The tori and temples in Miyajima are beautiful, and a nice stay at a local ryokan was great! Climbing Mount Fuji San as a novice hiker was scary and exciting. Sunrise was amazing, and finding the strength and resolve to reach the summit has brought peace to my life. I have a new found humility and respect for myself as well as others as a new global researcher.

RESEARCH REPORT

1. Name: Kirstin C. Morton	（ID No.: SP12040)

2. Current affiliation: Indiana University

3. Research fields and specialties:

   Chemistry

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

5. Host researcher: Dr. Hideo TOKUHISA

6. Description of your current research

  My current researches focuses on the fabrication and characterization of carbon electrodes from pyrolyzed parylene C (PPC). Previously, we have shown that PPC is an amorphous carbon that can be used as a thin film, conductive coating for electrodes. Most importantly, PPC can readily be coated on pre-existing, three-dimensional (3D) shapes and structures to batch-fabricate many planar and 3D electrodes simultaneously. Pyrolyzed parylene C films are conformal to precursor structures and the thickness can be accurately controlled from approximately 200 nm to several millimeters. Conductive carbon films from PPC are achieved through the pyrolysis of parylene C, a commercially available, insulative polymer.

We have used PPC as an electrode coating for planar electrodes and for an atomic force microscopy (AFM) probes. Atomic force microscopy is a scanning probe microscopy technique that allows for the imaging and physical investigation of nanoscale features. Most notably, AFM can be hybridized with other instrumentation and techniques, such as electrochemistry, to investigate both topography and another physical phenomena of a sample in liquid, air, or vacuum. Pyrolyzed parylene C AFM probes have been fabricated and extensively characterized. These probes can be used to investigate the electrical conductivity of a conductive substrate and topography at the same time, for example. Currently, efforts are underway to use these probes for a more complex research problem: the free diffusion of dopamine, a neurotransmitter, in situ. To accomplish such a task with AFM, a technique called scanning electrochemical microscopy-atomic force microscopy (SECM-AFM) should be used. In this technique, the AFM probe is used as a working electrode in a three-electrode electrochemical cell, to investigate the electrochemical oxidation or reduction of a chemical species, while topography is probed at the same time. Dopamine, a neurotransmitter known to be involved in Parkinson's disease and addiction, is readily oxidized and can be detected electrochemically. In the future, a PPC SECM-AFM probe can be created if coated with parylene C and a small electrode exposed

using a technique such as focused ion beam milling.

7. Research implementation and results under the program

   Title of your research plan:

   N- and P-doped pyrolyzed parylene C planar and three-dimensional electrodes.

   Description of the research activities:

   Research was carried out to dope conductive carbon electrodes fabricated from pyrolyzed parylene C (PPC). These carbon electrodes were fabricated on planar substrates and quartz nanorods at Indiana University prior to travel to Japan. At AIST, efforts were undertaken to P- and N-dope PPC electrodes through the use of previously established methods. The work functions of fabricated electrodes were characterized using photoelectron spectroscopy and the sheet resistance taken to confirm doping. Other spectroscopic characterization performed at AIST included x-ray photoelectron spectroscopy and Raman spectroscopy mapping. In addition, fabricated PPC electrodes were used to create Schottky diodes and P-N junction diodes. The current-voltage (I-V) characteristics of these diodes were thoroughly documented. Most notably, the I-V curves of planar diodes and three-dimensional diodes were compared using PPC-coated silicon and PPC-coated quartz rods. Finally, diodes were used in a circuit to demonstrate AC half-wave rectification. We hope to continue theoretical comparisons of the planar and 3D diodes at Indiana University from the data obtained at AIST in Japan.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): My time in Japan has been excellent and my decision was one of the best I have made personally and professionally. The experience of international research while immersed in a new culture is invaluable. The best cultural aspects of this program are the home-stay experience during orientation and the flexibility to travel for research. I was fortunate enough to see a few different cities in Japan and travel to Hokkaido University to visit another laboratory.

RESEARCH REPORT

1. Name: Jason NARAD	（ID No.: SP12041）

2. Current affiliation: University of Massachusetts Amherst

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: Nara Institute of Science and Technology

5. Host researcher: Prof. Yuji Matsumoto

6. Description of your current research

There is overwhelming evidence that human language processing is performed by an ensemble of inter-connected layers and that decisions are often not made independently of other layers.   Yet, in the field of natural language processing, models are often constructed to make use of only local information: a part-of-speech tagger, for instance, is traditionally trained using only sequential information, and is rarely explicitly aware of structure within a word (morphology) or non-local information outside of the word (syntax).   This trend goes back many years, generally following the mindset that these individual components would be processed end to end, with tagging preceding parsing, and parsing preceding whatever useful end task is desired (question answering, named entity extraction, etc).   In this scenario each component puts forth its best prediction, but information about the likelihood of other solutions is lost.   When the solution space is a peaked distribution, this is generally acceptable, and the flatter the distribution the more potentially useful information is lost.

In contrast to this trend, my research focuses on so called joint models -- models which encompass more than one independent models within one large, interconnected model. The benefits of this approach is that uncertainty is not lost between each component model as it would be in taking point estimates.   Additionally, we can seamlessly perform different inference methods.   To this end I have begun to explore coupling unsupervised and supervised learning.   Unsupervised learning requires no annotated data, but often suffers from much lower performance than supervised counterparts.   However, while the 1-best solution from an unsupervised model may not be competitive in comparison to state-of-the-art supervised approaches, learning a distribution over all possible unsupervised structures still appears to provide a lot of useful information to a coupled supervised task.   To that end I have been using specialized factors (a component for specifying a belief potential over a clique of variables in a graphical model) and variable configurations to represent structure that is often useful to NLP tasks -- namely syntax -- and using it to improve the performance of a coupled task (semantic role-labeling, relation extraction, part-of-speech tagging)

7. Research implementation and results under the program

Title of your research plan:

Improving Relation Extraction through Marginalization of Hidden Syntactic Structure

Description of the research activities:

Results from the suggested research idea were good: we saw modest improvement gains of roughly 10% when coupling relation extraction to a latent constituency syntax representation. However, the same configuration with dependency syntax, perhaps the more natural syntactic representation for the problem, performed only marginally better. In the process of performing error analysis to determine why this was, and simultaneously with a few other factors (learning Japanese, new results from BioNLP researchers, observing how dependency parsing differs in the Japanese community), we began to see the larger problem to both relation extraction (for BioNLP and many domains in English) and dependency parsing as the same: coordinate structure. NAIST has a history of performing research in coordinate structure because it is an important problem in automatic Japanese syntactic analysis, but have yet to solve it with a joint approach to the problem, so we have started an effort to model this within my joint infrastructure. Because this is a project that was unplanned and simply sprung from being here in the right circumstances, we've only just begun actual implementation and it will carry through past the end of the EAPSI program.

I also managed to spend a good amount of time developing a joint part-of-speech and syntax model based on the research interests of a student in the NAIST lab, who had developed an interesting data set for this problem. However, our short-term results seem to indicate that the data is more inconsistent than other similarly-themed data sets, and may need some refinement before machine learning models are able to provide significant performance gains.

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

As a language researcher my primary intention in pursuing the EAPSI program in Japan was to learn the characteristics of another language and to make a solid effort to become a competent speaker, so that I may develop new research ideas. While I haven't learned as much of the language as I would have liked (this is my first time attempting it), I already have a couple promising research ideas based on the contrastive characteristics of English and Japanese. Of course, taiko drum concerts, festivals, temple visits, and simply meals with friends of another culture were all exceptionally fun and enlightening experiences. From the quiet calm of NAIST/Nara to the bustling urban nature of a place like Osaka, I've been as happy with my personal time here as I have with my research time, and I hope I'll be able to return in both capacities sometime in the years to come.

RESEARCH REPORT

1. Name: Christine E. OFFERMAN	（ID No.: SP12042）

2. Current affiliation: Tufts University

3. Research fields and specialties:

    Mathematical and Physical Sciences

4. Host institution: Okayama University

5. Host researcher: Prof. Tomoyuki KAKEHI

6. Description of your current research

I am currently continuing my study of a generalization to symmetric spaces of the initial value problem for the wave equation called the Cauchy problem. The wave equation in this case becomes a system of differential equations with multiple "time variables." After deriving solutions to this multi-temporal   system using the Fourier and Radon transforms on the tangent space to a symmetric space of noncompact type this summer, I am continuing to study the various properties of these solutions including their uniqueness and propagation speed. I am also working on deriving a solution using the mean value operator as well as studying the energy functional for the tangent space case. I am also continuing my work on generalizing Ásgiersson's Mean Value Theorem after my discussions with Prof. Kakehi this summer.

7. Research implementation and results under the program

Title of your research plan:

Ásgeirsson-Helgason Mean Value Theorem for Homogeneous Spaces

Description of the research activities:

I gave two talks about the background on Mean Value Operators and Ásgiersson's Mean Value Theorem for symmetric spaces of rank one at Okayama University, which fostered useful discussion with Prof. Kakehi and others on how to generalize this theorem to higher rank symmetric spaces. I was able to attend some talks at a conference on partial differential equations at RIMS as well as visit Kyushu University where I attend a research talk and met Prof. Nomura. I also spent time studying a generalization to symmetric spaces of the initial value problem for the wave equation called the Cauchy problem. The wave equation in this case becomes a system of differential equations with multiple "time variables." I derived solutions to this multi-temporal system on the tangent space to a symmetric space of noncompact type using the Fourier and Radon transforms.

RESEARCH REPORT

1. Name: Haley OHMS	（ID No.: SP12043）

2. Current affiliation: Oregon State University

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Hokkaido University

5. Host researcher: Dr. Itsuro KOIZUMI and Dr. Seigo HIGASHI

6. Description of your current research

For ectothermal species, such as fish, climate change poses a major challenge for population persistence. Climate change is predicted to cause changes in water temperatures, which will likely have strong effects on age, size, and timing of maturation in fishes. The size and timing at which organisms reach sexual maturity is one of the most important life history traits affecting fitness and has direct consequences for population resilience. The relationship between water temperature and growth is well established for fishes, however the consequences of this temperature-growth relationship on maturation is not well understood. My project will focus temperature and maturation relationships between thirty populations of Dolly Varden charr that live in the Sorachi River located on Hokkaido Japan. The Sorachi River contains tributaries with distinct thermal regimes and provides a unique opportunity to investigate temperature influences on size and timing of maturity in distinct, but closely related populations. This project will lend insight into current phenotypic variation in maturation among fish in different thermal regimes and how climate may influence population dynamics through effects on maturation.

7. Research implementation and results under the program

Title of your research plan:

Temperature Effects on Body Size and Maturation Timing in a Freshwater Fish

Description of the research activities:

We sampled 30 streams in the Sorachi River basin in June to assess relative population size and structure of Dolly Varden in each tributary. We then sampled these same streams in August to assess maturity status and to compare maturation timing between tributary types. In addition, we measured habitat variables, such as substrate size and stream size, in each tributary which also have possible influences on maturation timing.

In addition to these field surveys, I also participated in other ecological field research with the Japanese graduate students in my lab. This included snorkeling to observe behavior and species composition of fish in rural and urban streams. I was able to observe masu salmon, dolly varden, introduced brown trout, and white-spotted charr- all of which are species I have been very interested in.

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

I really enjoyed my time in Japan and am very thankful to the Koizumi lab for such a warm welcome.

RESEARCH REPORT

1. Name: Christopher C. Paget	（ID No.: SP12044）

2. Current affiliation: University of South Carolina

3. Research fields and specialties:

   Biological Sciences, Environmental Health Sciences

4. Host institution: University of Tokushima

5. Host researcher: Dr. Hiroshi Yamamoto

6. Description of your current research

My current research explores alternative methods for removing aquatic pharmaceutical contaminants, as they are incompletely removed by treatment plants. Once released as pseudo-persistent compounds, they have harmful effects on aquatic organisms on a chronic or sub-lethal level, and on human health, particularly in the long-term. As a single treatment method has not been successful in eliminating all compounds, supplemental methods are required. This project investigates removal efficiencies of phytoremediation, using the common wetland plant duckweed (Lemna minor), and bioremediation, using a microbial biofilm grown in the lab. These processes are currently used in constructed treatment wetlands to remove agricultural and industrial pollutants. This project examined four pharmaceuticals from different classes and with differing persistence, biodegradability, aquatic behavior, and hydrophobicity: carbamazepine (anticonvulsant), ampicillin (antibiotic), triclocarban (antiseptic), and ibuprofen (anti-inflammatory). These processes were investigated separately and in combination in flask-scale systems, which included controls to account for other environmental sources of degradation and removal by sorption to the substrate in the biofilm flasks. The project's goal is to contribute to understanding how these processes can be utilized to further remove aquatic PhACs and supplement current wastewater treatment technologies.

7. Research implementation and results under the program

   Title of your research plan:

   Use of a microbial biofilm and duckweed (Lemna minor) in the removal of aquatic pharmaceutical contaminants

Description of the research activities:

An initial experiment was conducted to confirm methods and to attain preliminary results for a conference presentation. During the project that followed, my daily lab time consisted of (1) sampling each of the flasks in timed increments, (2) analyzing samples using high-performance liquid chromatography (HPLC), ensuring that recovery was conducive to data collection, and (3) maintaining duckweed or biofilm growth environments. After stock solutions were created and pharmaceutical concentrations determined in each, the HPLC was calibrated using environmentally relevant concentrations, with a standard concentration of 0.1 mg/L. On each Monday, stock solutions were added to nutrient medium and distributed among 300 mL flasks. Initial/0 hour concentrations were recorded using HPLC, and duckweed or biofilm (or both) were then added to the flasks to begin. 1.5 mL filtered samples were placed in vials at 1 and 6 hours. This process continued at 24-hour intervals to 96 hours. pH, temperature, and dissolved oxygen were recorded at the beginning and end. Although final results are pending, preliminary results indicate that biofilm achieved greater removal in a shorter period of time (48 hours) than duckweed (comparable removal at 96 hours); ibuprofen was removed most completely by both processes (consistent with its chemical characteristics); removal of carbamazepine was lower than the other compounds (given its very low biodegradability); and sorption onto substrate played a significant role for triclocarban, which is very hydrophobic. This could indicate that use of sediment alone in a constructed wetland may be most appropriate for removal of some hydrophobic compounds.

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

I am very fortunate to have worked in Dr. Hiroshi Yamamoto's lab. There was a real sense of welcoming and teamwork. I learned how to use lab equipment and techniques specific to pharmaceutical contaminants research, including understanding the subtle differences in chemical properties between compounds and how to adapt an experiment to those properties. Homestays (including one with a labmate's family), weekend travel to historic sites, group meals, and attending special annual events were very memorable. I hope to work in Japan again.

9. Advisor's remarks (if any):

Chris has done a great job both in research and after-school cultural activities with my students and his friends. Some of my students, his labmates, cannot speak English very well and he had a hard time to learn the experimental works but it took only a few days for him to get used to the circumstances to complete a certain amount of works by the Society of Environmental Chemistry Meeting at Matsuyama in mid-July, where he made an oral presentation. He continued his lab works afterword to accomplish almost all the experiments we planned at the beginning. He is also active toward the weekend and made a few trips to outside of the town with his friends and my students even though he has worked very hard on weekdays. I really appreciate and satisfied with what he has done here in Tokushima. I expect that these experiences will help him sometime in the future.

RESEARCH REPORT

1. Name: Joon Hyuk Park	（ID No.: SP12045）

2. Current affiliation: The John B. Pierce Laboratory

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Osaka University

5. Host researcher: Tetsuya Yagi

6. Description of your current research

My research is to develop novel tools to optically measure neuronal activity in awake and freely moving animals using fluorescent voltage sensors. Such tools allow us to examine neuronal function during natural behavior without the stress and suppression of activity inherent in the use of anesthetics and physical restraints. Currently, the only method to record neuronal activity in awake, unrestrained, and mobile animals at high speed requires electrode-based systems. While these systems have provided profound insights into neurophysiological events related to sensory activation, motor tasks, sensory motor integration and cognitive processes, these methods can only monitor a few dozen randomly chosen neurons simultaneously in an awake, behaving animal.

Currently, no off-the-shelf components meet the strict requirements on speed, power, and weight for this application, so everything must be custom-designed. The measurement system is composed of three components. The first component is an image sensor fabricated in a 0.35μm process that can operate at high frame rates with high signal-to-noise ratio while consuming very little power. The second is a small microscope that can be attached to the head of an animal with a specially designed head-mount. It must be light enough to allow the animal to move around freely. The third is a light source to illuminate the surface of the cortex. It uses a high-power LED with active cooling to reduce the temperature around the brain, and can be powered off a small battery.

7. Research implementation and results under the program

   Title of your research plan:

   Studying the visual cortex in active animals using optical probes

Description of the research activities:

The work this summer was the first time actually attempting to head-mount my system onto a live animal and record brain activity. As soon as I arrived at the lab, I consulted with Dr. Tanaka to implement my measurement system onto a rat and perform simple experiments to verify and improve my imaging system. The small size of the skull posed many challenges in reliably securing the microscope to the head. We came up with an effective method to head-mount the system with the help of Professor Sawai from the medical school. I also learned how to achieve better results from the voltage probes from Professor Sawai by watching him conduct experiments on animals.

The next challenge was to minimize the imaging system even further, as the current system turned out to be suboptimal for awake and behaving animal experiments. This required an overhaul of my imaging board design. I redesigned the image acquisition board and had it fabricated by a Japanese company. Then, I ordered a smaller chip package from a company in California. We sent my imaging chip to a company in Kansai to have it placed onto the package we ordered from California.

Also, I was able to reduce the size of the imaging system further by using a special connector only available from a company in Minnesota. But due to connector being on backorder, it took about a month to receive the connectors. Due to having to redesign my imaging system, I was unable to obtain experimental data. However, this summer was a big step in realizing a head-mountable measurement system due to the various improvements made on the design.

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

I have visited Japan a few times previously, but this trip had the most impact in my understanding of Japan and its culture. It was a completely different experience having locals show and explain various aspects of this country in person. I got a chance to visit and interact with people in Yokosuka, Okinawa, Tokyo, Kyoto, and Okayama. I met people with a wide range of interests that I had never experienced before in Japan. The best part was how they all made me feel like one of their own and shared everything so freely. I now have a much greater appreciation for this country and would love to have another chance to return here in the near future.

RESEARCH REPORT

1. Name: Kathryn R. Riley	（ID No.: SP12046）

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

My research at Wake Forest University focuses on development of a rapid screening technology to aid in molecular discovery. Our goal is to select ligands in small molecule libraries against clinically relevant targets such as tyrosine kinase proteins. The proposed molecular discovery technology will couple capillary electrophoresis (CE) pre-screening with a final "lab-on-bead" selection method. Specifically, CE preselection will involve selection of drug molecules against the Src tyrosine kinase, which is known to be present in elevated levels at progressive stages in tumor development. Subsequent lab-on-bead selection requires the production of nanobeads functionalized with multiple copies of pre-selected, DNA-encoded small molecule ligands via a process called BEAMing (Beads Emulsion Amplification Magnetics). So, in addition to developing CE selection strategies, another goal of this research is the characterization of functionalized polymer beads by CE.

The goal of my research at Saitama University was to extend methodologies developed for small molecule selection for use with microbial targets. In particular, methods relating to polymer bead characterization by CE were to be applied for use with microbes. Rapid and facile handling methods for the separation and sensitive detection of microbes and cells are of growing importance in the field of bioanalytical chemistry as microbe determination is increasingly important in food safety, biothreat detection and homeland security, and environmental and human health assessment. While CE is a potential candidate for the separation and detection of microbial systems, potential problems with this type of analysis have been reported, such as the difficulty in obtaining a single peak for a particular species due to the likelihood of microbe aggregation and dispersion in aqueous solution. Another limitation is the ability to achieve high resolution among multiple microbial species. Work at Saitama University aimed to address these problems by examining the utility of functionalized gold nanoparticles for their affinity towards microbes and their contribution towards improved electrophoretic conditions.
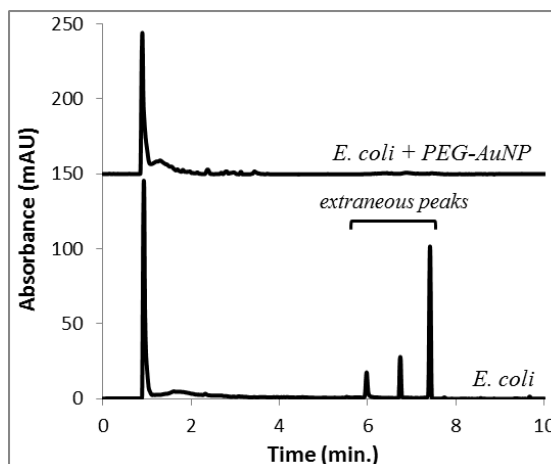
7. Research implementation and results under the program

Title of your research plan:

Separation of Microbes Using Nanoparticles

Description of the research activities:

Upon arrival in Dr. Saito's laboratory I was given an introduction to the specific instrumentation I would use and instruction in the preparation and sample handling of AuNPs and microbes. In an initial experiment, the concentration of PEO- and amine-modified AuNPs was determined using UV-Vis Absorption Spectroscopy based on a method reported in the literature. Much of my work throughout the summer involved optimization of buffer composition and of electrophoretic conditions for microbe detection by capillary electrophoresis with absorbance detection. Efficient methods were developed for AuNP- facilitated electrophoretic detection of saccharomyces cerevisiae (baker's yeast) and Escherichia coli. Future work will involve the application of these methods to additional bacteria and to mixtures of bacteria.

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

I had the opportunity to do a lot of sight-seeing during my stay in Japan. With my host family I went to Tokyo Tower and to Kamakura. With JSPS fellows I traveled to Nagoya for a day of the Sumo tournament, to Tsujido beach for a day of surfing, enjoyed a festival at Yoyogi Park and climbed Mt. Fuji. With my labmates I enjoyed playing in a softball game and relaxing afterward at a barbecue. We also had a 4th of July celebration where I cooked American foods for them and they cooked Japanese foods for me.

RESEARCH REPORT

1. Name: Richard E. Ruiz	（ ID No.: SP12047）

2. Current affiliation: University of Wisconsin – Madison

3. Research fields and specialties:

　　Mathematical and Physical Sciences

4. Host institution: Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU), Todai Institutes for Advanced Study, University of Tokyo
東京大学 国際高等研究所 カブリ数物連携宇宙研究機構

5. Host researcher: Professor Hitoshi Murayama, Director Kavli IPMU

6. Description of your current research

The Standard Model of Particle Physics (SM) is a triumph of the scientific method. To unparalleled precision, it explains the structure of the atom, the origin of electromagnetism, and, if recent experimental discoveries are indeed true, even the origin of mass for all known matter in the Universe. However, the SM has its faults. Aside from failing to explain the excess mass observed in galaxies (the dark matter problem), it does not explain why some particles have twice as much spin (intrinsic angular momentum) as others, nor does it explain how gravity functions at sub-microscopic distances.

Unexpectedly, the questions of spin and dark matter are summarily remedied by Supersymmetry (SUSY), a stipulation that there exists a deep-seeded relationship between particles of one spin with particles of a different spin. To explain why SUSY is no longer observed in the Universe, we consider the Scherk-Schwarz mechanism (SS), which postulates the existence of a new, compact spatial dimension. Consequently, at distances smaller than the size of this new spatial dimension, nature is manifestly supersymmetric. Just beyond this new dimension, the presently known particles remain massless while their supersymmetric partners obtain (soft) masses. Radiative processes amplify this small asymmetry, and initiate the spontaneous breakdown of symmetries in the SM.

The principle research goal is to investigate a breakdown of a particular supersymmetric extension the Standard Model of Particle Physics (NMSSM), its viability in the face of current experimental constraints, and devise new techniques to test the model.

7. Research implementation and results under the program

Title of your research plan:

New Techniques to Measure Dark Matter at the Large Hadron Collider

Description of the research activities:

Research activities during fellowship tenure involved (a) extensive literature review; (b) analytical calculations; (c) numerical simulation & extrapolation; and (d) fruitful collaborative discussions.

A comprehensive review of letters, journals, and texts enabled an expedited and thorough introduction to both the SS mechanism and the NMSSSM, with emphasis placed on the defining features that separate them from similar theories. This was greatly facilitated by the vast resources provided by IPMU. Replication of analytical calculations reported in select references followed. To reproduce said results, new mathematical techniques were learned (Supersymmetric Kaluza-Klein Expansion). New results are pending the completion of several calculations.

In anticipation of new results, a software suite capable of computing physical observables from the NMSSSM (NMSSMTools) was installed and successfully validated. Once new, analytical results are completed, the software suite will automatically calculate the masses of newly predicted particles, and thereby allow the development of firm predictions that are immediately testable at the Large Hadron Collider experiments.

The extensive progress over the past few months is due to the rich and beneficial discussions with visiting researchers, permanent researchers, and JSPS fellows at IPMU, including post-doctoral fellows and other Summer Program fellows.

8. Please add your comments, including any cultural experience during your stay in Japan: The incredible hospitality and kindness received while in Japan extended well beyond the walls of my host institution. As a less-than-proficient Japanese speaker, the patience given was deeply appreciated, especially while engaging in activities, including attending a major sumo wrestling tournament, summer festivals, Kabuki theater performances, and a summit of Mt. Fuji. I certainly look forward to applying for a JSPS Post-Doctoral Fellowship in the coming years.

RESEARCH REPORT

1. Name: Erin M. SANEHIRA	（ID No.: SP12048）

2. Current affiliation: University of Washington

3. Research fields and specialties:

　　Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Motoichi OHTSU

6. Description of your current research

　At the University of Washington Electrical Engineering Department Photonics Laboratory, under the direction of Professor Lih Y. Lin, I study quantum dot based photonic devices. Quantum dots (QD) are an ideal candidate for photonic devices because of their higher quantum efficiency compared to the same material in bulk form, as well as their tunable bandgap energy. Furthermore, colloidal QDs in solution can be deposited using low-cost, high-volume methods such as spin-coating or drop-casting.

　Previously, I have researched colloidal synthesis of germanium nanoparticles, which has been chosen for its non-toxicity. However, colloidal synthesis of germanium nanoparticles is particularly challenging. At the University of Tokyo in Professor Ohtsu's laboratory, I have learned how to synthesize ZnS-AgInS$_2$ (ZAIS) nanoparticles, which still reap the benefits of non-toxicity and solution-processability, but with a simpler synthesis method.

7. Research implementation and results under the program

　　Title of your research plan:

　　Using Self-assembly to Fabricate a Novel Photonic Signal Transmission Device

　　Description of the research activities:

　　　The purpose of this research project is to develop a nano-scale photonic transmission device from semiconductor nanoparticles. Compared to conventional dielectric waveguides, like fiber optic cables, the size of the semiconductor nanoparticle transmission device is not limited by the diffraction limit of light. Thus, this device can be almost two orders of magnitude smaller by using nanoparticles. Compared to the nanophotonic signal transmission device previously fabricated by Professor Ohtsu's laboratory, my summer project utilizes a different type of

nanoparticle, which can emit light in a wider range of colors in the visible spectrum.

The two major parts of my research were (1) synthesis of ZAIS nanoparticles, and (2) alignment of the nanoparticles to DNA. Since the chemical synthesis of ZAIS nanoparticles had been previously reported, my first task was to reproduce these results. Within the first couple of weeks, I was able to synthesize and characterize a variety of ZAIS nanoparticles ranging from green to red in color. After having successfully synthesized ZAIS nanoparticles, the nanoparticles must be coated with a silane coupling agent to align with DNA. Compared to the prior work, this was a challenge due to the surface chemistry of ZAIS nanoparticles. To overcome this roadblock, I proposed a novel technique to modify the surface chemistry of the nanoparticle. In pursuing this new line of research, I was able to show a change in surface chemistry by demonstrating a change in solubility with respect to various organic solvents. While I did not complete the device, I did succeed in introducing a new research idea that I can continue to pursue once I return to the University of Washington.

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

I have learned a lot about the laboratory culture in Japan. In particularly, I was impressed by the cooperation and mentorship between the older, more experienced students and the younger students. I hope to bring some of these values and practices back with me to my home institution. Additionally, I enjoyed making new Japanese friends and learning about their perspective. I look forward to returning to Japan to reconnect with all of the friends that I have made.
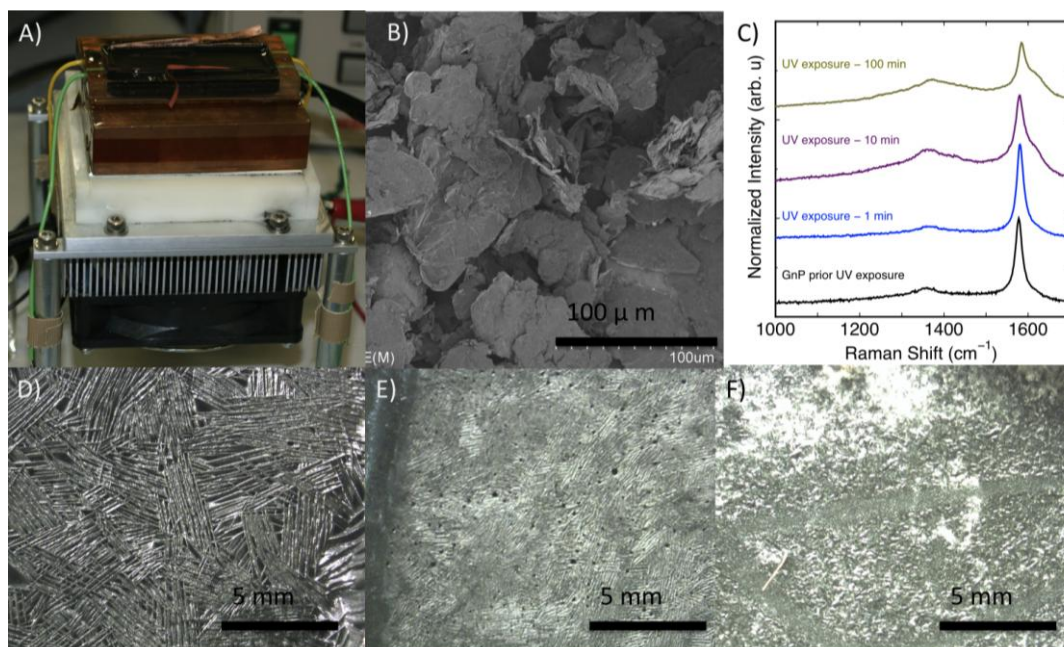
9. Advisor's remarks (if any):

I am very happy to accept Erin's stay. She was an active and excellent student. She worked so hard every day on ZAIS nanoparticle synthesis. It was good that with a few advices she has carried out a lot of things, more than I expected. My students were stimulated very much by her. Surprisingly, she found new research topics during her very short stay, which are academically very significant. I wish she could continue this work and get more successful results.

RESEARCH REPORT

1. Name: Scott N. SCHIFFRES	（ID No.: SP12049）

2. Current affiliation: Carnegie Mellon University - Ph.D. student in Mechanical Engineering.   Advisor: Prof. Jonathan A. MALEN

3. Research fields and specialties:

Engineering Sciences

4. Host institution: The University of Tokyo – Mechanical Engineering

5. Host researcher: Professor Shigeo MARUYAMA and Professor Junichiro SHIOMI
Host Ph.D. Student: Sivasankaran HARISH

6. Description of your current research

Thermal conductivity measurements of nanofluids (fluids with suspended nanoparticles) reflect dramatic, yet controversial, improvements in thermal conductivity. We hypothesize that the degree of agglomeration/percolation and the thermal resistance between contacting nanoparticles are significant factors affecting the nanofluid thermal conductivity, especially at high nanoparticle volume fractions.   We seek to control the pressure applied to the nanoparticle-nanoparticle junctions in the nanofluid and to measure the resulting thermal conductivity and electrical conductivity.   To apply pressure to the nanoparticle junctions, we control the base fluid crystal size through careful control of the cooling during base fluid freezing.   Energy saving applications of nanofluid phase change, such as passive solar heating, benefit from improved thermal conductivity by increasing the thermal energy storage and withdrawal rates per unit surface area.

7. Research implementation and results under the program

Title of your research plan:
Investigating How Nano-sized Particles Enhance Heat Transfer in the Melting-Freezing Process

Description of the research activities:

To test our hypothesis that frozen nanofluid properties depend on the cooling rate, nanofluid samples are frozen in a test cell with measurement probes for thermal conductivity and electrical conductivity (Fig. A).   A Peltier cooler is powered with a variable current source for slow-to-moderate cooling rates (~20 min to 5 hours for a ~1 cm deep pool).   For more rapid cooling (~2 min for a ~1 cm deep pool), liquid nitrogen coolant is used.   The thermal conductivity is measured with the transient hot wire technique, in which a metal wire acts simultaneously as a heater that emits a thermal impulse and as a thermometer that measures the temperature response of the wire.   The thermal conductivity was determined by fitting the temperature response of the hot wire to an analytical model.   The electrical conductivity is measured between two copper film strips that are integrated into the thermal conductivity test apparatus.

The nanofluid preparation starts with purchased exfoliated graphite flakes that are about 10 nm thick (~30 graphene layers) with a surface diagonal length of ~20 μm (Fig. B).   As purchased, the exfoliated graphite flakes will not form stable suspensions in hexadecane.   To improve the dispersibility and stability of the

nanoparticles in hexadecane, we expose the exfoliated flakes to ultraviolet light, creating defects that improve the flakes wettability in hexadecane. Raman spectroscopy confirms that ultraviolet exposure generates defects in the flakes, as characterized by a tripling of the Raman defect band intensity relative to the graphite band intensity (Fig. C). Finally, the flakes are dispersed in hexadecane with a horn sonicator.

Our results indicate that the thermal conductivity and frozen structure of the nanofluid depends on the cooling conditions. Our tests were with freezing times of ~5 hours, ~20 minutes, and ~2 minutes for a 10 mm sample. Microscopy images of the frozen 1% graphite-hexadecane nanofluid are in Fig. D-F, respectively, with the slower cooling rates forming longer range laminar sheet patterns. The frozen nanofluid thermal conductivities decrease with quicker freezing. For the 1% graphite-hexadecane, the thermal conductivities of the slower to faster freezings are 0.62, 0.56, and 0.47 W/m-K, which is an enhancement over solid hexadecane of 68%, 51%, and 27%. We measured the thermal conductivity of this nanofluid to be 0.28 W/m-K, a 65% enhancement in thermal conductivity, as compared to pure liquid hexadecane.

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

In addition to the research, my visit with the Maruyama-Shiomi Laboratory has given me a window into Japanese research and academic setting and an opportunity to network with Japanese researchers in the field. I visited Kyoto University's Profs. Mitsuhiro MATSUMOTO and Toshiro MAKINO, Kanazawa University's Prof. Yukio TADA, and Tokyo Institute of Technology's Professor Hideyuki TSUKAGOSHI. I have also enjoyed passing my leisure time with my labmates, from climbing to the top of Mt. Fuji to our everyday lunch and dinners.

9. Advisor's remarks (if any):

We look forward to continuing this collaboration after Scott returns to Carnegie Mellon University.

RESEARCH REPORT

1. Name: Brian P. Setzler	（ID No.: SP12050）

2. Current affiliation: Georgia Institute of Technology

3. Research fields and specialties: Engineering Sciences

4. Host institution: Shizuoka University   5. Host researcher: Professor Masao SUDOH

6. Description of your current research

Proton exchange membrane fuel cells (PEMFCs) have many benefits, but are currently limited by cost and durability. In particular, the expensive platinum catalyst in the cathode degrades with time, decreasing performance and limiting lifetime (driving costs higher). A major cause of catalyst degradation is platinum dissolution; platinum is slightly soluble under the high potentials and acidic conditions at the cathode. A solid mechanistic understanding of platinum dissolution has been elusive because platinum dissolution occurs over the same potential range in which an oxide layer is formed on the platinum surface. This oxide layer partially protects the surface from dissolution, but repeated cycles of oxide formation and destruction actually accelerate dissolution.

This goal of this project was to detect platinum dissolution by use of a rotating ring-disk electrode (RRDE), and to determine what factors influence the rate of dissolution under potential cycling conditions. The effects of upper potential limit, lower potential limit, sweep rate, and potential holds were investigated.

With an upper potential limit of 1.2 V (vs RHE) or higher, Pt^{2+} ions could be detected upon oxide reduction. This is in agreement with the literature, but the proposed mechanism in the literature is questionable. The simplest platinum dissolution reaction is oxidation of the metal – Pt(0) to Pt^{2+}; however, this reaction should occur on the anodic sweep, not the cathodic sweep. Others have proposed the reduction of Pt(IV) oxide to Pt^{2+}, which would produce dissolution on the cathodic sweep. However, we measured the Pt surface oxidation charge and found a value of approximately 1.4 e^- per surface Pt atom for an upper potential limit of 1.2 V. Therefore, we conclude that it is unlikely that any Pt(IV) oxide is present until much higher potentials. Instead, the necessary condition for cathodic platinum dissolution appears to be place exchange of Pt(II) oxide, which occurs at around 1 e^- per surface Pt atom. Although chemical dissolution of Pt(II) oxide should be independent of potential, it is possible that there is an interaction with oxide reduction which accelerates the chemical reaction.

Concerning the other factors, it was found that higher sweep rates produce less dissolution per cycle due to faster reduction of the oxide, only partially offset by faster dissolution. Potential holds at the upper potential limit were found to increase dissolution upon oxide reduction, consistent with the increased coverage of oxides. The lower potential limit did not have a significant effect on platinum dissolution per cycle.

7. Research implementation and results under the program

Title of your research plan:

An RRDE Investigation of Platinum Dissolution and Its Effect on Hydrogen Peroxide Formation in PEMFCs

Description of the research activities:

At Shizuoka University, I was introduced to RRDE experimental methods. I spent about one third of the time on experimental work, and two thirds of the time on analysis. The experimental work consisted of casting thin catalyst films on the RRDE surface, and conducting cyclic voltammetry experiments in a standard RRDE four electrode cell.

Data analysis was performed using the Python programming language with the SciPy, Pylab, and Numpy modules. Custom programming allowed batch processing of data files and extra signal processing to remove known sources of crosstalk between the disk and ring electrodes. The programs also remove a bit of subjectivity from the data analysis and provide better repeatability. The resulting programs analyze every cycle of the cyclic voltammetry experiments and calculate electrochemically active surface area, platinum oxide coverage, and total amount of Pt^{2+} detected at the ring. The programs and data will be very useful as I expand on this summer's work in the future and begin modeling.

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

I had a wonderful experience in Japan thanks to the incredible hospitality of Prof. Sudoh and his group. Our lab group climbed Fuji-san together, which was great fun (and hard work). I also took the opportunity to travel most weekends, visiting Kyoto (twice), Nagoya, Kanazawa, and Hiroshima, and climbing the 1st, 2nd, and 4th tallest mountains in Japan in one weekend. This was my first time outside of North America (it's about time!), so I'm very grateful for the opportunity.

RESEARCH REPORT

1. Name: Mary Southern	（ID No.: SP12051）

2. Current affiliation: University of Minnesota

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Meijo University

5. Host researcher: Tomoichi Takahashi

6. Description of your current research

Disasters are an unfortunate part of our lives which cost communities much in both material damage and human life. These costs have long caused much effort to be put into preventing or mitigating the devastation that occurs. Even in recent years we have seen the great extent to which these events can alter lives, from the attacks on the World Trade Center, Hurricane Katrina, and the Great East Japan Earthquake and Tsunami, among many others. One tool which can be used to assist in understanding and preparing for these types of events in simulation. Because these large-scale disasters do not happen often, it is hard to check if our response plans are adequate without costly drills. Even then we can only prepare for unexpected problems or events to a very limited extent. Using simulation we can avoid much of the costs associated with studying disaster behaviors. From these tools we hope to provide a better understanding of what may occur when disaster hits, as well as better training for the emergency responders.

Communication between those involved in an event is one important aspect which must be considered. Those who are involved in a disaster are often found "milling", attempting to gather information about the situation and what others are doing before acting. This community-centric action is important to consider when modeling civilian behaviors in disaster situations. The time taken to talk with others and deliberate may cause a delay in evacuation initiation, but it can also be an important tool for quickly spreading information about both the environment and authority instructions.

I have developed parent and child agents which utilize communication as part of their evacuation of a building. Agents can share information about their own person as well as observed information about the environment and information heard from other agents. My work uses a simulator developed by a student of Professor Takahashi to look at how the addition of agent communication effects the behaviors of agents during an evacuation.

7. Research implementation and results under the program

Title of your research plan:

Information sharing among family agents and their behaviors in
Agent-based Evacuation Simulation

Description of the research activities:

At first I spent much time reading articles, papers, and other documents to understand current work being done on large-scale disasters. One important document is the NIST report on what occurred during the terrorist attacks on the world trade center. This document clearly reported the different activities which occupants engaged both before and during their evacuation from the building. From the readings I determined that communication plays an important role in evacuations and so designed agents which would implement a more robust communication than previously.

Most days were then spend programing and debugging the new agent implementations. Three new types of civilian agent were developed, adult, young child, and teen child, all using a Belief-Desire-Intention model. This type of model determines the agent's actions by using beliefs about the world to determine the desires of the agent which are in turn used to chose an intention to perform some action. The young child agents have very limited communication capabilities, while teen child agents are able to easily communicate and understand the environment.

After implementation I designed different scenarios to run simulations on and collect data. The scenarios used differing ratios of the two types of child agents as well as differing evacuation instructions. I then used this data to determine how these two variables effect the evacuation of agents.

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

The most important cultural experiences I had while in Japan were the multiple dinners I shared with the other students working in the lab. I feel that from these simple gatherings I learned more about daily life in japan then I did from watching a sumo tournament or climbing Mt. Fuji, though both of these were also important cultural and learning experiences. For these dinners, the students would prepare and eat different Japanese dishes, including hand-rolled sushi, curry ramen, and sukiyaki. These meals not only let me start to understand the bonds formed between students, but I also was able to learn a bit about Japanese culture through the new foods I tried.

RESEARCH REPORT

1. Name: Deborah Ann Sunter	（ID No.: SP12052）

2. Current affiliation: University of California, Berkeley

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: University of Kitakyushu

5. Host researcher: Professor Weijun Gao

 6. Description of your current research

My current research efforts at the University of California, Berkeley are in designing a solar absorber tube for combined heat and power distributed energy generation. Currently, the absorber tube used in solar thermal applications is a simple round tube. The outer wall becomes quite hot, resulting in significant thermal losses. With my adviser, Professor Van Carey, I have developed a multi-chamber absorber tube that mitigates the thermal losses, improving the overall efficiency of the system. Solar thermal is a promising renewable energy. Being able to provide both electricity and heat locally has made solar thermal less expensive than its popular counterpart, photovoltaics, which can only produce electricity. It is hoped that improvements, such as the multi-chamber   absorber tube, will make solar thermal increasingly cost effective and, ultimately, promote green energy on a global level.

 7. Research implementation and results under the program

     Title of your research plan:

     Economic and Environmental Comparison of Micro CHP Systems for Use in Residential Sector in Japan

     Description of the research activities:

     Professor Gao had previously studied the economic and environmental potentials of both gas engine and fuel cell micro combined heat and power (CHP) residential systems. He found that the introduction of both micro CHP systems resulted in significant economic merit. However, the environmental potential measured by GHG emissions for both micro CHP systems was found to be disappointingly low. The study suggests further research of micro CHP systems for residential use in Japan that would use renewable energy sources to more dramatically reduce GHG emissions. The

objective of the proposed research was to achieve this goal by expanding Professor Gao's analysis to include solar thermal.

Upon arriving in Japan, I learned that Professor Gao's laboratory was currently working towards an energy proposal for the University of Kitakyushu. Due to the limited rooftop space on residential homes in Japan, it was agreed that the solar thermal analysis would most appropriately be done for small commercial/ university scale projects. Working with a local graduate student, Shi Xingzhi, Professor Gao's analytical models were modified to compare a 200 kW gas engine CHP system to an equally sized solar thermal system. This would account for 20% of the energy portfolio for the University of Kitakyushu. Using commercially available solar thermal systems from Sopogy Inc. for the analysis, it was found that the solar thermal system was both more cost effective and environmentally friendly than the gas engine. The levelized cost of electricity was 5.7% less and the CO_2 emissions were 5.2% less. The results were so promising that we presented them to City Hall.

In addition, I had several other research opportunities. I presented at the Pacific Rim Energy and Sustainability Congress. I was able to assist a fellow graduate student in sizing a combined heat and power system for convenient stores in Thailand. I gave a lecture on current and historic energy portfolios for the world, America, and California. I toured several environmental systems: University of Kitakyushu distributed energy center and water treatment plant, the Kitakyushu Eco-Town and Smart Community, and an environmentally-recovered harbor near Moji-ku.

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

The entire summer was an incredible cultural experience. I attended the Hiroshima Peace Ceremony, and the Gion and Awa Odori festivals. I experienced sunrise from the summit of Mt. Fuji. I watched a sumo wrestling tournament and Noh performance. I visited many historical sites: Matsumoto Castle, Kyoto, Nara, and Miyajima to list just a few. I have tried many new foods and even learned how to cook some of them. I have met many welcoming and lovely people.

RESEARCH REPORT

1. Name: Rachael Tomasino	（ID No.: SP12053）

2. Current affiliation: University of Denver

3. Research fields and specialties:

　　Mathematical and Physical Sciences

4. Host institution: Japanese Aerospace Exploration Agency (JAXA)

5. Host researcher: Dr. Yamamura Issei

6. Description of your current research

The AKARI MLHES (excavating Mass Loss History in Extended dust shells of Evolved Stars) data set is the largest collection of the most sensitive far-infrared images of the cold extended circumstellar dust shells of evolved stars and it is the key to understanding the dusty mass loss phase of stellar evolution. This data will be processed with a new imaging tool kit FAST (FIS-AKARI Slow-scan Tools). This program allows for an interactive assessment of the data quality and on-the-fly corrections to the time-series data on pixel-by-pixel bases in order to manually correct glitches that would have been missed in the automated process. These corrections include: eliminate bad on-sky calibration sequences, flag out cosmic-rays and their after-effect affected time-series readings from the data stream and remove real sources from local sky-flat frames, among other options. These extra processes result in better-calibrated noise reduced images and would be by far the best detection limit among all existing far-infrared data of extended evolved star dust-shells. The main goals of this project are to completely process the entire AKARI MLHES data set and to give feed back to help the future development of FAST.

7. Research implementation and results under the program

Title of your research plan:

Removing Anomalies from Extended Emission Objects

Description of the research activities:

Working at the JAXA Sagamihara campus allowed me to collaborate face-to-face with both experts in the field of astrophysics and of the inner workings of the complex FAST program. With such a large data set, 144 sources, there was an opportunity to test FAST in ways that it hadn't been tested before and then immediately relay my findings to the experts.

I was able to give first hand accounts of how well the program's interface worked and gave suggestions on what could be done to make it both more user friendly and allow for data reprocessing to become more easily reproducible. While my suggestions were not implemented during my time in Japan, since the interface code is very complex, they are planned for subsequent updates.

Another aspect of my research was to classify different types of structures in the data on both an individual and systematic basis. For the systematic structures, I found that the long wavelength CCD chip has many pixels that exhibit unique structures that are found in most of the sources and they haven't been recorded yet. As a result of this research, I will be compiling a list of problem pixels that will go into an update of the users manual. An example of an individual basis would be the result of a charged particle striking the detector and affecting a pixel and this problem doesn't happen across sources. My findings will help in the future automation of this code that will help make FAST data reduction more scientifically robust.

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

The JSPS program has given me the opportunity to not only work at JAXA and do valuable research but also the time and money to travel and enjoy the sites of Japan. Such as: DisneySea, sumo in Nagoya, boat ride through Tokyo, climbing Mt. Fuji and staying at the Okayama Astronomical Observatory to talk with the director, Dr. Hideyuki Izumura. I am very glad that I came to Japan and had this wonderful experience.

RESEARCH REPORT

1. Name: Joshua P Townsend	（ID No.: SP12054）

2. Current affiliation: Northwestern University, USA

3. Research fields and specialties:

    Mathematical and Physical Sciences

4. Host institution: Ehime University Geodynamics Research Center, Matsuyama Japan

5. Host researcher: Dr. Jun Tsuchiya

6. Description of your current research

My current research concerns the potential of minerals in the deep earth to contain small amounts of hydrogen incorporated into their crystal structures (hereafter referred to as 'water'). My work at Northwestern University has been focused on synthesizing these materials under high pressure and temperature conditions, as found in planetary interiors. In particular, I have been working on synthesizing a material called "postperovskite" (ppv) under hydrous conditions because this material is believed to exist at the boundary between the rocky mantle and iron core of the Earth. The reason I am interested in the water storage capacity of this material is because many materials in the interior of the Earth can incorporate significant amounts of hydrogen in their crystal structures, and such materials have drastically different properties than their hydrogen free counterparts. In order to understand the interior of our planet, we must understand the properties of its constituent materials.

    However, only very limited information about these materials can be measured through experiments. To completely describe the physical and chemical characteristics of these materials I wanted to investigate the properties of hydrous ppv using computer simulations of crystals at the quantum mechanical level. The reason I submitted an NSF EAPSI/JSPS Summer Program proposal was to travel to Japan and work with Dr. Jun Tsuchiya, to carry out those calculations and learn how to model earth materials under extreme pressures and temperatures.

7. Research implementation and results under the program

Title of your research plan:

Water Storage Capacity of Planetary Interiors

Description of the research activities:

Weeks 1-2: Found likely hydrogen defects for ppv model. Tested computational parameters for computational speed and experimental reproducibility.

Weeks 3-4: Calculated the elastic constants from 0 to core-mantle boundary pressures. Calculated the equation of state, the basic experimentally determined quantity. This step was very important because it will allow me to compare my calculations to experimental data.

Weeks 5-6: Calculated vibrational properties of hydrous ppv, specifically the IR active modes, which can be experimentally determined. Also began high temperature and high-pressure molecular dynamics (MD) calculations to determine hydrogen stability within the ppv structure at core-mantle boundary conditions.

Weeks 7-9: Continuing MD calculations as well as vibrational mode calculations. Calculate seismic wave velocities to compare with seismic observations.

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

I would like to thank the NSF and the JSPS for selecting me for the NSF EAPSI/JSPS Summer Program. My time in Japan was unforgettable and I feel like it has changed my life, both professionally and personally, for the better. I developed many new skills while working with my host researcher over the summer, and forged many friendships that I feel will last a long time.

I enjoyed many cultural experiences during my stay in Japan. The most memorable for me was attending my host researchers annual 'summer school' in the mountains of Shikoku, away from the summer heat and humidity. While this was technically billed as a research event, for me it was an inside look at real Japanese culture. We stayed in a small village in the mountains and enjoyed lectures and seminars and research presentations from members of my host's research group. We enjoyed many meals together and had great conversations in the evenings. I had an incredible experience, and I will remember it fondly for a long time.

RESEARCH REPORT

1. Name: Lok-kun Tsui	（ID No.: SP12055）

2. Current affiliation: University of Virginia

3. Research fields and specialties:

   Engineering Sciences

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

5. Host researcher: Professor Takayuki Homma

6. Description of your current research

Although solar energy is one of the few renewable energy resources that can meet the world's energy demands, a major challenge for solar energy is the problem that photovoltaics can only generate electricity when the sun is shining. We are developing photoelectrochemical solar cells that us sunlight to drive the splitting of water into oxygen and hydrogen. Photoelectrochemical solar cells produce hydrogen, which is a storable energy resource and can be used to generate electricity on demand without concern for whether sunlight is available. The devices we are investigating are titania (TiO_2) nanotubes that are modified by cuprous oxide (Cu_2O) and hematite (α-Fe_2O_3). TiO_2 nanotubes are formed from the anodization of Ti foils in fluoride containing electrolytes, exhibiting beneficial features such as high surface area, 1D charge transport, and stability in solution and under irradiation. However, because of TiO_2's relatively wide bandgap, it only absorbs the small UV portion of the sunlight. Sensitization with narrow bandgap semiconductors Cu_2O and Fe_2O_3 enable extension of absorption into visible light. Cu_2O and Fe_2O_3 can be deposited using inexpensive, scalable electrodeposition techniques, and furthermore, they are abundant and environmentally benign materials. We have demonstrated fourfold enhancements in the integrated efficiency of the devices when Cu_2O and Fe_2O_3 are added, yielding an increase from 0.5% to 2%. Continuing efforts target tuning the electrodeposition technique to promote the filling of the TiO_2 nanotubes and characterization of the electronic and electrochemical structure using a number of spectroscopy techniques.

7. Research implementation and results under the program

Title of your research plan:

Storing Sunlight with Nanotube Solar Cells

Description of the research activities:

We have observed that TiO_2 nanotubes formed by anodizing in electrolytes containing varying ratios of water to ethylene glycol in the solvent produce devices of varying efficiency, but with an unclear cause. Raman spectroscopy is a technique that uses a laser to excite the vibrations in the chemical bonds of materials and can be used to for purposes such as phase identification, determination of crystallinity, and detection of defects. By using Raman spectroscopy and x-ray diffraction we determined that the efficiency is determined in-part by a variation in the crystallinity of the nanotube samples. The Raman spectroscopy instrument at Waseda can be used to examine the surfaces of electrodes in an electrochemical cell. In-situ Raman spectroscopy probed the surface of TiO_2 nanotubes and TiO_2 with Cu_2O while using the laser as a light source for a photoelectrochemical reaction. We were able to study the formation of new bonds in solution and the stability of our sensitizers in solution. In collaboration with Prof. Yoshihara's lab at Utsunomiya University, we have used the nanotubes for photocatalysis and characterized the semiconductor properties using electrochemical impedance spectroscopy, determining the flatband potential and doping of the nanotubes. The research was presented at the Materials Tailoring Workshop in Karuizawa at the beginning of August.

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

My two months in Japan have been one of the most amazing adventures of my life. There was plenty around Tokyo to see including the Skytree, the Tokyo Tower, Asakusa, and Akihabara. I went to a Vocaloid Market event and saw firsthand the enthusiasm and creativity of the doujin music scene. I also went to Nagoya, Utsunomiya, Nikko, and Gifu, but I enjoyed my visit to Kyoto the most. Visiting all the historic shrines and temples was a wonderful experience and seeing the thousands of red Torii gates at Fushimi Inari Taisha was one of my favorite moments of my entire stay here. I was also able to meet several friends in Japan that I only knew previously through online interactions.

RESEARCH REPORT

1. Name: Keiko M. Tuttle	（ID No.: SP12056）

2. Current affiliation: Washington State University, Pullman, WA

3. Research fields and specialties:

Biological Sciences, Agricultural Sciences

4. Host institution: RIKEN Plant Science Center, Yokohama

5. Host researcher: Dr. Mitsunori Seo

6. Description of your current research

The "Hormone Balance Theory" states that the balance between antagonistic phytohormones, is what enables a seed to undergo germination or maintain its dormancy. Dormant seeds fail to germinate under favorable conditions, and seed dormancy is lost by a period of dry storage termed after-ripening.   Selection for rapid seedling emergence has led to loss of seed dormancy in wheat, resulting in susceptibility to preharvest sprouting (PHS), germination on the mother plant when it rains before harvest. To strike an appropriate balance between good emergence and PHS tolerance, it is essential to understand the balance between the plant hormone ABA that stimulates seed dormancy, and GA that breaks dormancy and stimulates seed germination.   In model systems like Arabidopsis, ABA is known to accumulate at higher levels whereas GA levels increase with dormancy-breaking treatments like after-ripening and cold stratification.   It is clear that ABA plays a similar role in cereals like wheat, but the role of GA in breaking dormancy is controversial.   To address whether the ratio between ABA and GA hormones control the dormancy status of wheat I measured hormone levels in embryos/scutellum and in aleurone/endosperm from imbibing seeds.   I also measured these hormones in imbibing seeds that have undergone cold stratification, to determine if we see the same pattern as in Arabidopsis. Lastly, other acidic hormones were profiled to determine whether hormones other than GA and ABA may contribute to dormancy breaking treatments.

7. Research implementation and results under the program

Title of your research plan:

"Investigating the control of wheat seed dormancy and germination by plant hormones"

Description of the research activities:

Upon my arrival at RIKEN Plant Science Center (PSC), I first had meetings with my host advisor, Dr. Seo, and hormone specialist, Dr. Jikumaru, to discuss strategy and the best way to prioritize my time. I then inventoried all the samples I had prepped and sent in the previous weeks to Dr. Seo's laboratory. My daily research activities consisted of discussions with Ms. Takebayashi, the resident ESI-LC-MS/MS technician, measuring sample masses, creating internal standard mixtures with heavy isotope hormone conjugates, and performing extractions on dried wheat seed material. This extraction protocol isolated and collected acidic hormones, first via an HLB reverse-phase column, followed by a second day extraction with a mixed-mode WAX column which isolated for stronger acids. This last eluate was prepped for ESI-LC-MS/MS analysis. RIKEN PSC's Dormancy and Adaptation Unit has optimized their ESI-LC-MS/MS to analyze the following hormones from the above extraction: ABA, IAA, JA, JA-Ile, GA1, and GA4. The chromatogram raw data output from the MS/MS was analyzed with the MassHunter Analyzer Software. My results indicated that there was a decrease in ABA content with increasing after-ripening time. ABA content also decreased substantially in samples that were cold stratified. GA1 and GA4 increased with cold stratification, but were not detectable in other samples.

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

While living in Yokohama, I was able to visit the biggest China Town in Japan. I was excited to see the density of international people living in the greater Tokyo area. I very much enjoyed visiting many temples and shrines where I was able to acquire stamps for my temple booklet. To experience the beauty of the Japanese culture by visiting these extraordinary buildings and gardens was absolutely amazing. I was also very fortunate to meet up with Japanese friends I had made at a previous internship and attend a retirement party for a Japanese professor from Kyushu University. I found the ceremony and location to be very elegant. Although my research was conducted at RIKEN and not an educational institution, I felt that I have a much better understanding of the scientific and research-related infrastructure of Japanese researchers. The best part of this JSPS internship, was being able to create strong social connections and professional contacts with world-renown scientists in my field. It was a humbling and memorable experience.

9. Advisor's remarks (if any):

I would like to thank the JSPS summer program for providing us with a good opportunity to work with Ms Keiko Tuttle. She worked very hard and she finished all the experiments as she planned. All the members in our laboratory liked her, and I hope we could have a next opportunity to work together in near future.

RESEARCH REPORT

1. Name: Alan Twomey	（ID No.: SP12057）

2. Current affiliation: University of Minnesota

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: Kyushu University

5. Host researcher: Prof. Hiroshi Takamatsu

6. Description of your current research

Freezing and freeze-drying are common techniques used to stabilize macromolecules for long-term storage in the pharmaceutical industry. During freezing in aqueous solutions, complex interactions occur between the growing ice phase and the remaining solution, which becomes increasingly concentrated as the solutes are rejected from the ice phase.

The research this summer at Kyushu University focused on the freezing of model macromolecule and cryoprotectant solutions under both equilibrium and non-equilibrium freezing conditions. Previous Fourier transform infrared spectroscopy (FTIR) data of solutions of bovine serum albumin and dimethyl sulfoxide (DMSO) indicated that protein accumulates at the ice interface during near-equilibrium freezing. This is of interest, because interactions with ice during freezing can cause structural damage to proteins, diminishing product yield and efficacy in the pharmaceutical industry.

The initial goal was to confirm the occurrence of protein accumulation at the ice interface during equilibrium freezing using confocal Raman microscopy (CRM). The subsequent aim was to identify non-equilibrium freezing conditions that would minimize harmful protein-ice interactions. This was to be done by freezing solutions along a temperature gradient, encompassing a large spectrum of freezing conditions, and then mapping the distribution of solutes along the temperature gradient.

7. Research implementation and results under the program

   Title of your research plan:

   Quantifying Protein Distribution in Frozen Solutions with Confocal Raman Microscopy

Description of the research activities:

To evaluate protein accumulation at the ice interface in solutions of bovine serum albumin and DMSO, solutions of 30 w/w DMSO with 5.8 w/w albumin were cooled quickly until frozen, then warmed slowly until a small amount of ice remained at length at -17.5° C. The freeze concentrated liquid was then scanned using CRM. In subsequent experiments, the ratio of albumin to DMSO was held constant, while the overall concentration was decreased. With complete rejection of DMSO and albumin from the ice phase and no other interactions, the freeze concentrated liquid of all the solutions at -17.5° C would be identical and there simply would be more ice present in the lower concentration solutions. To freeze the lower concentration solutions under near-equilibrium conditions, the solutions were rapidly cooled until frozen, warmed slowly until little ice remained, then finally cooled slowly at 0.5° C/min.

Calibration experiments were performed at -17.5° C with solutions of 30 w/w DMSO and varying protein concentration in order to quantify protein concentration. Preliminary analysis showed a decrease in protein concentration of between 14% and 23% for solutions of 25, 20, and 15 w/w DMSO. Since ice normally excludes large molecules, the observed decrease in protein accumulation in the freeze concentrated liquid was attributed to accumulation at the ice interface.

The remainder of the summer was spent freezing solutions of albumin in the cryoprotectant trehalose. A microchannel of the solution was placed between a warm (16°C) and a cool (-20°C) stage, separated by a 4mm gap. Ice was nucleated at the cold end, after which CRM was used to scan along the channel. Data have been collected and will be analyzed after the end of the summer.

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

I have had an excellent experience in Japan, both in and outside the laboratory. My hosts and fellow lab members have been very welcoming and supportive. They included me on laboratory excursions to the countryside, the Hakata Gion Yamakasa festival at 5am, as well as a welcome dinner upon arrival. I made one trip outside the Fukuoka area to attend the Hiroshima Peace Memorial ceremony on August 6th, which was quite moving.

9. Advisor's remarks (if any):

I'm sure that he has had a nice experience in research as well as feeling different cultures in Japan. He worked hard and obtained excellent results. We are planning to publish several papers after returning to Minnesota. I feel so happy to have had a chance to work with a student like him, and hoping to see him again.

RESEARCH REPORT

1. Name: Benjamin Walker	（ID No.: SP12058）

2. Current affiliation: University of Missouri – Kansas City

3. Research fields and specialties:

    Mathematical and Physical Sciences

4. Host institution: Kwansei Gakuin University

5. Host researcher: Professor Kazuyoshi Ogasawara

6. Description of your current research

The area of condensed matter physics we study is calculation of the electronic structure of solid materials.　The electronic structure of a material determines many of that material's properties, so having an accurate way to calculate this is an important goal in materials science.　The goal of my research is to perform the mathematical calculations necessary to develop a more accurate software package with which to calculate electronic structure.

Specifically, I'm working on solving interaction integrals that will be used to more accurately predict multiplet and defect states of solid state systems.　This is necessary in order to understand how a given material will behave when its atoms have undergone excitation.　Once this goal is completed, our software package (OLCAO) will be merged with that of our collaborators (DVME) at Kwansei Gakuin University in Japan.　This merged software package will then more accurately predict the electronic structure of large and complex solid state systems, including giving an accurate picture of multiplet and defect states of an excited system.

7. Research implementation and results under the program

Title of your research plan:

Developing a New Method for Calculating the Excited State Electronic Structure of Solids

Description of the research activities:

I performed the literature searches necessary to establish the mathematical formalism which is being used to solve the atomic interaction integrals. After trying several methods that lead to conflicting or incorrect results, I found a paper which likely contains the proper formalism which has yielded the proper results. At approximately the same time, some code was developed to put this formalism to practice, and the results are promising. I attended the DV-Xα conference in Fukuoka August 6-8, and made a small presentation there. On August 17 I gave a 50-minute colloquium to the chemistry department of Kwansei Gakuin University's Sanda campus. On August 20 visited the University of Tokyo to visit Prof. Teruyasu Mizoguchi's computational lab, and gave a presentation to his students.

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

Having prior language training really helped me function here. Japan's rail system is very impressive, and helped me go places quickly and efficiently. I'm slowly learning Kanji by using the rail system too!

9. Advisor's remarks (if any): Mr. Benjamin Walker brought an international atmosphere to our laboratory and inspired our students to turn their attention to the world. He also seems to have enjoyed exchange with Japanese students. I believe that his visit was beneficial to both of us and contributed
to establish a solid foundation for further collaboration between UMKC and KGU. I am really glad to have had the opportunity to work with him and appreciate the support from the summer program.

RESEARCH REPORT

1. Name: Laura Aiko Michelle Walsh　　　　　　　　　　（ID No.: SP12059）
2. Current affiliation: University of California, San Francisco, and University of California, Berkeley
3. Research fields and specialties: Engineering Sciences
4. Host institution: Tokyo Women's Medical University   5. Host researcher: Dr. Teruo OKANO
6. Description of your current research In Dr. Tejal Desai's lab in the Joint Graduate Group in Bioengineering at the Universities of California, San Francisco and Berkeley, I am interested in investigating the interactions between cells and materials. More specifically, my research investigates the interactions between epithelial cells or fibroblasts and surfaces with or without nanotopographies. Preliminary results have shown nanostructures can affect the tight junctions of epithelial tissues, which has implications for drug delivery, and nanostructures affect growth and profibrotic gene expression in fibroblasts. Our lab is also interested in tissue engineering, so I was very intrigued with the work done by Dr. Teruo Okano's laboratory at Tokyo Women's Medical University making cell sheets for tissue engineering applications. The use of poly- (N-isopropylacrylamide) and how cells interact with the polymer were of particular interest as well, considering my current research. PNIPAAm is a thermoresponsive polymer that changes from a hydrophobic and cell-adhesive to a hydrophilic and cell non-adhesive confirmation when the temperature is lowered below 32°C, releasing a cell sheet – a confluent layer of cells along with the extracellular matrix that supports and holds the cells together as a sheet. The mechanism of the thermoresponsive nature of PNIPAAm has been investigated. However, the requirements for cell adhesion and detachment have yet to be determined by our literature searches. Cell adhesion and detachment behavior determine which cell sheets can be synthesized and therefore determine the possible applications of cell sheets as a therapeutic method. Furthermore, cell adhesion and detachment behavior are important for quality control of cell sheet harvesting. Therefore, with funding from JSPS and the NSF, we proposed to investigate adsorbed proteins on the PNIPAAm before and after cell sheet harvesting and cell adhesion protein expression in multiple cell types to correlate with successful detachment behavior and cell adhesion.

7. Research implementation and results under the program

Title of your research plan:

Elucidation of ECM and Cytoskeletal Elements Controlling Attachment and Detachment of Cell Sheets on Thermally-Responsive Polymer Surface

Description of the research activities:

During my time in Japan, I was able to investigate elements controlling cell attachment and detachment to a thermo-responsive polymer by both physical and biological methods, thereby acquiring experience with new techniques. To investigate adsorbed proteins, we used Atomic Force Microscopy to examine the surface topography of the polymer surface before and after cell adhesion and detachment, as well as the effect of different proteins in the media used with the cells. To study the composition of proteins on the surface, we used X-ray Photoelectron Spectroscopy. Both techniques were new to me. To investigate the cell surface receptors for extra cellular matrix proteins that adsorbed to the surface of the polymer, I used qPCR to quantify mRNA expression levels. These techniques were used for multiple cells types with differing ease of cell sheet harvesting, therefore by the end of our investigation we hope to discover a correlation between the ability to fabricate cell sheets and the expression of cellular receptors and/or the proteins adsorbed to the surface. We hope to use these results to improve and expand cell sheet fabrication.

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

Walking from Nippori station to Ueno station, I happened upon a beautiful, old Japanese house. Inquiring whether I could take pictures of it, I was subsequently invited inside. The house is used as a café usually, but on Mondays (it was Uminohi) it is a shakuhachi workshop and place where people gather to play shakuhachi. I decided to make my own shakuhachi, learned how to make a noise, and stayed to drink late into the night. I ended up coming back every Monday until the end of the program. It was a unique opportunity to participate in Japanese Zen culture, as well as to discuss current Japanese and American cultures, and to drink (a very important hobby in Japan I have learned). Also, going to hanabi with labmates was a highlight of my summer (the crowded trains before and after, not so much). However, the best day of my summer was getting a text from a friend in lab inviting me to go shopping and have dinner. We had so much fun talking about how hot it is, the differences in culture, differences in opportunities for women in science, and future plans. I learned we have much in common, maybe slight differences in attitudes, and she has a much better eye for clothes for me than I do.

RESEARCH REPORT

1. Name: Travis Walter	（ID No.: SP12060）

2. Current affiliation: University of California, Berkeley

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: University of Kitakyushu

5. Host researcher: Professor Weijun Gao

6. Description of your current research

I am currently a graduate student researcher working toward my doctoral degree.   My research is on statistical methods for estimating energy use in buildings.   I am working to develop methods for both predicting energy use by buildings, and for quantify the uncertainty associated with the energy predictions.   Specifically, I use time- and temperature-dependent linear regression models built with historical electric load data to predict electric load.   I use a cross-validation method to sample several instances of model fits and model predictions in order to construct a probabilistic distribution describing the error between the model predictions and the measured data.   The energy predictions and the associated uncertainty can be used by building owners and public utilities for programs that offer financial incentives for implementing energy conservation measures. Characterization of the prediction error allows building owners to quantify the risk associated with investing in energy conservation measures so that funds used for energy efficiency can be fully utilized.

7. Research implementation and results under the program

Title of your research plan:

Forecasting Building Energy Use for Optimal Distribution

Description of the research activities:

While at the University of Kitakyushu, I learned about combined heat and power (CHP) energy systems, specifically the system installed at the Kitakyushu Science and Research Park (KSRP). I took tours of the KSRP distributed energy system and water treatment plant, the Kitakyushu Smart Community and Eco-Town, and an environmentally-recovered harbor near Moji-ku. I analyzed measured data of electricity and heat use by the KSRP distributed energy system, and applied my previously developed energy prediction techniques to the data. I collaborated with my professor and other students in the lab to investigate applications of these energy predictions into the optimal design and operation of CHP systems. My research focused both on future upgrades to CHP systems, such as at KSRP, and also on newly installed CHP systems. As well as analyzing the KSRP data set, I worked with another student in lab to apply my energy prediction methods to energy use data from a convenience store. While the energy prediction methods have previously only been applied to large commercial buildings, this project illustrated the capability of the energy prediction methods for small scale applications. In addition to academic research, I presented my previous research to my host professor and other students in lab, I gave a presentation on energy conservation measures in the USA to my host professor's university class, and I gave an oral presentation during the PRESCO 2012 conference in Hiroshima on August 8th.

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

During my time in Japan, I visited many different places, ate many delicious foods, and met many interesting people. I visited temples and shrines in Kyoto, Nara and Miyajima, as well as many other places. I explored the beauty of the Japanese alps at Kamikochi, I watched a sumo tournament in Nagoya, and I climbed Mount Fuji and watched the sunrise from the summit. I ate okinomiyaki in Hiroshima, ate fresh sashimi for breakfast at the Tsukiji Fish Market in Tokyo, and ate raw horse in Kitakyushu. I watched a traditional Noh performance in Fujiyoshida, attended the Gion Festival in Kyoto, and watched the dancers in the Awa Odori festival in Tokushima. I learned about Japanese daily life when I stayed with Japanese people in Matsumoto and on Yakushima Island. Overall, I had a fantastic time experiencing the history, culture, arts, food and natural beauty of Japan.

RESEARCH REPORT

1. Name: Carol WANG	（ID No.: SP12061）

2. Current affiliation: Carnegie Mellon University

3. Research fields and specialties:

    Mathematical and Physical Sciences

4. Host institution: Kyoto University

5. Host researcher: Professors Kazuo IWAMA and Suguru TAMAKI

6. Description of your current research

I am interested in verifying solutions to computational problems. For example, consider the traveling salesman problem. In this problem, we are given a list of cities and want to find the shortest tour visiting all of the cities. We believe this problem cannot be solved efficiently; however, there is one sense in which we can be efficient. If we are *given* a tour and asked if it is shorter than, say, five hundred miles, this is easy to check. We think of such a tour as a "proof" that short tours exist.

In this framework, we have to read the whole proof (tour) in order to check its validity. However, it is natural to ask if we can give a proof that only needs to be spot-checked. That is, we would like to only have to read a constant number of proof symbols in order to be reasonably sure the proof is valid. This is the idea behind *probabilistically checkable proofs*.

A somewhat surprising result is such proofs exist, and we can check them with only a constant probability of error. An important line of research is on optimizing the tradeoffs between various parameters, most notably between the number of symbols read and the probability of error. In general, the definition allows us to occasionally reject proofs which are correct. Our project focuses on the special case when this is not allowed and we want to always accept valid proofs.

7. Research implementation and results under the program

Title of your research plan:

New probabilistically checkable proofs.

Description of the research activities:

Our goal was to construct a probabilistically checkable proof system building on previous work by Tamaki and Yoshida. Very roughly, standard PCP constructions combine an outer verifier and an inner verifier. In this case, we wanted to use the so-called long code test of Tamaki and Yoshida as the inner verifier while preserving the property that correct proofs are always accepted.

Some related work had successfully extended their inner verifier by using a conjecture called the d-to-1 Conjecture. We hoped that a similar approach would work with our chosen inner verifier. However, many of the crucial ingredients from the previous work were missing in our case, and our attempts were unsuccessful.

Instead, we have chosen to focus on constructions based on other conjectures, rather than the more standard d-to-1 Conjecture. Doing so has given us more flexibility, and we hope that we will be able to find support for one or more of these conjectures.

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

I really enjoyed the chance to live in Kyoto. In addition to the sheer number of historical landmarks, events like the Gion matsuri were a great experience.

RESEARCH REPORT

1. Name: Marcus H. WELKER	（ID No.: SP12062）

2. Current affiliation: Dartmouth College

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Hokkaido University

5. Host researcher: Prof. Hiroshi UEDA

6. Description of your current research

The overarching objective of my research is to restore Atlantic salmon populations in Lake Champlain. In the 1850's the fish were extirpated, or killed off, from the lake. For the last 32 years, the United States Fish and Wildlife Service, has been coordinating efforts to restore this economically, environmentally, and socially important fish to the lake. Their efforts have successfully created a lake fishery, but failed to establish river-runs of spawning adults and the associated self-sustaining populations. My research seeks to understand the mechanisms and functions of Atlantic salmon migration processes to improve hatchery water-management, rearing, and outplanting strategies.   My work here in Japan, studying the presence and concentrations of amino acids in river, hatchery, and lake waters, is just one aspect of this multidisciplinary sustainability science project. Amino acids are suspected to be the naturally occurring chemical that both Pacific (*Oncorhynchus spp.*) and Atlantic (*Salmo salar*) salmon smell as juveniles in their home-streams and create powerful memories of (imprint) and then use these memories as adults to find their way to the same place they were born on their adult spawning migration (homing). In Japan, using a High Performance Liquid Chromatograph, I have analyzed samples from one homing period (Fall 2011) and one imprinting period (Spring 2012). Initial results from the Fall 2011 samples suggest there are no differences between the four types of waters analyzed (hatcheries, rivers, lake, and groundwater); however within the water types (hatcheries and rivers), both exhibit univariate differences. These results provide insight into why the land-locked Atlantic salmon of Lake Champlain may not be homing properly – if all the waters smell the same it may be impossible for fish to distinguish their home-stream from other streams or locations.

7. Research implementation and results under the program

Title of your research plan:

Restoration of Lake Champlain Atlantic salmon: A study of river, hatchery, lake, and groundwater amino acids

Description of the research activities:

This summer I had two main research objectives (1) to analyze 200 water samples and (2) to design a two-choice Y-maze modeled off of my host lab's and learn their techniques for testing adult salmon migration and homing behaviors. During the early stages of my research in Japan, I focused on the Y-maze because time was of the essence in order to get a similar maze built in the US in order to use in the fall of 2012. Once I had visited the field station where the Y-maze is located twice with the Post-doc in the lab, I began my ongoing struggles with the HPLC to analyze amino acids. The Post-doc, whom was responsible for operating the machine, left just 3 weeks after my arrival, so I have had the opportunity how to run the machine on my own. Furthermore, the reproducibility of the machine has constantly been changing and so I have spent a lot of time troubleshooting. I have successfully analyzed 106 of 180 samples, so in the last week I am hoping to rapidly finish my analyses.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): While in Japan I had the opportunity to present my research plan and some of the initial results 3 times – once to my lab, once to the Salmon research center in Sapporo, and once at Hokkaido University's School of Fisheries in Hakodate – these opportunities were invaluable in making connections, practicing my presentation skills, making me think critically about my dissertation, and my methods of delivery of these complicated ideas to a broad range of audiences.

9. Advisor's remarks (if any):
I am very pleased to become the host researcher of Marcus H. Welker who has high ambition to research the mechanisms of olfactory imprinting and homing to the natal stream in salmon. He had two research objectives in my laboratory, and both were quite successfully carried out. He also presented his research plan for 3 times at different 3 laboratories, and experienced very important opportunities. 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: Benjamin Wright	（ID No.: SP12063）

2. Current affiliation: New Mexico State University

3. Research fields and specialties:

　　Mathematical and Physical Sciences– Computer Science

4. Host institution: Wakayama University

5. Host researcher: Prof. Chiaki Sakama

6. Description of your current research

　My current research entails modeling multi-agent systems and groups of agents using logical foundations.　This includes looking into beliefs held as a group and individually. In addition, the *actions* taken by a group or an individual are of key interest.

　By focusing on the actions, my research is investigating ways to use action theory, or action languages, to describe multi-agent systems.　Using the ideas of action theories along with the logical foundation of the system, models are tested by implementing them in a logic program – generally *answer set programming*.

　Through these models of groups, we can begin to look at questions of group actions versus individual actions.　Such as saying, "Someone from the group will answer the door", compared to specifying an individual to always answer the door.　This is important as in many situations it does not matter whom answers the door, just that the door is answered.　However, one also has to ensure that not everyone answers the door.

　Along with answer set programming, a lot of implementation cues are being taken from the 'planning' community.　In this sense, most of the models are structured in a way as to answer a query or objective – such as answering a door.　This is achievable when the group, group's actions, and the surrounding environment are known.

7. Research implementation and results under the program

　　Title of your research plan:

　　Lying to Succeed: Developing Formal Models of Dishonest Negotiation

　　Description of the research activities:

　　My first week was spent visiting a research laboratory in Tokyo at the National Institute of Informatics.　There I began organizing my thoughts and some papers I brought to begin looking into possible avenues of execution.

Upon arriving at my host university, I began first looking into recreating one working implementation of negotiation without lying that was mentioned in one of the publications I was reading. This proved difficult and my host suggested to work on representing an example of lying with negotiation instead.

The example used was blocks world which models two robots negotiating and rearranging blocks on a table based on two separate desired arrangements of blocks. Through this example a problematic area was discovered. This area was defining when a lie would be beneficial. The publications took a very probabilistic and game theory approach to this question, however my approach was using logic statements.

Melding the two together easily proved to be a tough concept to crack. A few weeks were spent contemplating this issue, however all ideas were as complicated and computationally expensive as the original problem itself – if not higher or intractable.

Thus, this avenue was abandoned due to the time constraints of the summer program and no feasible solutions available. Instead, I started to pursue an idea I had from the beginning, which used a logical approach to false communication, instead of game theory. This was to modify an implementation of announcements so that false announcements could be made. After showing that this would be possible in the semantics, I began to look into a working implementation of the system that contained announcement actions. This is where the research currently stands.

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

My overall experience in Japan has been really positive. I greatly enjoyed the trips I was able to make on the weekends. Meeting up with other JSPS fellows on these trips was also a nice respite from research and allowed for a simple way to evaluate my current progress in relation to others. I have already started making a mental list of places I need to visit when I get a chance to return to Japan. Being the only fellow in Wakayama though made the weekdays a little long as the lab I was working with was mostly undergraduates and master's students. The language barrier was a little high causing both sides to not converse often.

9. Advisor's remarks (if any):

A formal model of dishonest negotiation is important because people often behave dishonestly in negotiation. In spite of this fact, little attention has been paid for developing a formal model for dishonest negotiation. The fellow pursues this challenging topic and is on the way of developing a formal model of dishonest communication.

As the fellow states, there are few students who can communicate well in English, especially in their research topics. This is the reality of most students in Japan.

RESEARCH REPORT

1. Name: Michael Makoto YOSHIZAWA	（ID No.: SP12064）

2. Current affiliation: University of California, Santa Barbara

3. Research fields and specialties:

 Mathematical and Physical Sciences

4. Host institution: Nara Women's University

5. Host researcher: Professor Tsuyoshi KOBAYASHI

6. Description of your current research

My area of mathematical research is in the topology of 3-manifolds, in particular Heegaard splittings and the notion of distance. A Heegaard splitting of a closed 3-manifold is a decomposition of the manifold along a surface into two simpler pieces known as handlebodies (a solid ball with g solid handles attached). It is a classical result that every 3-manifold admits a Heegaard splitting and this fact has played a fundamental role in the field, e.g. the definition of Heegaard-Floer homology, a recent subject responsible for remarkable progress in mathematics. In 2002, John Hempel introduced the concept of the distance of a Heegaard splitting, which has been studied by many mathematicians and is now known to give a good representation of the topology of the ambient 3-manifold. Roughly speaking, the distance of a Heegaard splitting is the minimum distance (in what is called the curve complex) between any pair of curves such that one bounds a disk in one handlebody, and the other bounds a disk in the other. It is shown by Hempel that for any large n, there exists a Heegaard splitting whose distance > n. However, the more delicate behavior of distance is still relatively mysterious.

Any Heegaard splitting can be described via a surface automorphism (i.e. the gluing) of the splitting surface. This idea was adopted by many authors to show the existence of Heegaard splittings of arbitrarily high distance. In particular, they used pseudo-Anosov automorphisms (a type of particularly complicated automorphism). However, the construction using psuedo-Anosov automorphisms does not give an exact distance of the resulting splitting nor provides concrete examples.

My research focus has been on determining the relationship between distance and a different type of surface automorphism known as Dehn twists. Unlike a pseudo-Anosov, Dehn twists are the simplest type of surface automorphism and can be visualized as "twisting" around an annular neighborhood of a curve on the surface. I am currently working to understand how distance is affected by Dehn twisting about various curves on the splitting surface.

7. Research implementation and results under the program

Title of your research plan:

Developing a Criterion for Distance 3 Heegaard Splittings

Description of the research activities:

I participated in a weekly seminar with my host researcher and two others, a graduate student and a post doc, as we were all conducting research in a similar area. I was asked by my host researcher if I could replace pseudo-Anosov maps used in his on-going research with explicitly constructed Dehn twists. I have recently presented the outline of a proof that such Dehn twists can be obtained and I am hoping to continue this work after I return to the United States.

On the other hand, my host researcher was interested in my current research and I gave a series of presentations on my work during our weekly seminars. While my interest was originally focused on distance 3 Heegaard splittings, it became clear that these ideas could be applied to higher distance splittings. My host's helpful comments allowed me to construct examples of Heegaard splittings using solely Dehn twists that have distance equal to any even integer. I am currently writing up this result and hope to submit for publication this fall.

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

Due to the efforts of my host researcher and other colleagues, I was also able to give seminar talks at Tokyo, Osaka City, and Hiroshima Universities. These opportunities allowed me to network with many faculty and graduate students in Japan, which I hope will foster future collaboration. I am thankful to my host researcher and the rest of the math department of Nara Women's University for their gracious hospitality.

9. Advisor's remarks (if any):

The research fellow, Mr. Yoshizawa, has made big mathematical achievements that are far more than expected in the research plan (that are concretely described in section 7 above). He also gave a series of talks on his research and actively attended the seminars in our department, which helped and encouraged my colleagues and students very much. For example, he together with a JSPS research fellow and a Ph.D. student of mine started a new research project while he was in Nara.

He stayed in the university's international house and shared an office with graduate students. This gave him a good chance to feel daily life in Japan. He also visited various places in Japan to see many aspects of Japanese culture. I believe that these experiences furnished him a deeper understanding of the country Japan.

I and our department are very happy to say that his visit was very helpful for us and very glad to have had a chance to host him.

RESEARCH REPORT

1. Name: Amanda Beatrice Young	（ID No.: SP12065）

2. Current affiliation: Pennsylvania State University

3. Research fields and specialties:

  Biological Sciences

4. Host institution: Shinshu University

5. Host researcher: Dr. Koichi Takahashi

6. Description of your current research

My research explores the differences between angiosperm and gymnosperm forests along an elevational gradient in the Japanese Alps.   Most high elevation forest research is conducted on gymnosperms, specifically conifers.   This is partly because conifers are more likely to occur on dry, nutrient poor soils in cool environments (Bond 1989), and partly because of their prevalence in the northern hemisphere.   However, there are high elevation angiosperm forests.   In the Japanese Alps   there are three main forest tree species, Fir (*Abies mariesii*), Birch (*Betula ermanii*) and creeping pine (*Pinus pumilla*). The forest up the mountains is composed of bands dominated by one species or another. The lowest forest is the subalpine forest dominated by fir, above that is the birch forest, and at the top is the creeping pine forest.   The focus of my research is what are the structural and compositional differences between these different forest types over the elevational gradient.   This research is a preliminary portion of my dissertation research, which, funding dependent will continue in Japan.

7. Research implementation and results under the program

  Title of your research plan (I worked on two projects):

  1. The plasticity of angiosperm vs. gymnosperm canopy structure at timberline and the subalpine forest
  2. Composition, Structure and Age analysis along an elevational gradient on Mt. Norikura

Description of the research activities:

1. Dimensions of 40 trees of Birch (*Betula ermanii*) and Fir (*Abies mariesii*) tree canopy's were taken at the timberline (uppermost location of upright trees) and in the continuous forest below.   Dimensions measured were: tree height, height to lowest living branches, crown width, diameter of tree stem at base.   Additionally, a tree core was taken from each tree to establish the age and wood density of each species at the two locations.   Differences between the two species at the two locations is being analyzed using an ANCOVA analysis.   All the 160 trees were measured and cored for this research question, core analysis and statistics are in progress.

2. Analysis of canopy composition, structure and age was conducted at 125 previously established forest plots on Mt. Norikura.   Point-center-quarter methods were used to collect tree age, forest composition and tree structure data across an altitudinal gradient.   Point-center-quarter methods break each plot into 4 quarters, in each quarter the nearest tree to the center point is measured (measurements are the same as from question 1) and cored.   Thus 500 trees were examined during this field campaign.   Additionally, at each plot two hemispherical photographs were taken.   One taken at 35cm or as close to ground as possible and one at 170 cm above ground level.   These photographs will be analyzed to assess the amount of light penetration through the forest canopy (1.5m) and through the shrub layer (10 cm).
Tree-ring analysis of the cores and hemispherical photographs will be conducted upon returning to the United States as will the statistical.

Completion of the fieldwork was a main goal of this summer research, and it has all been successfully completed.   As well as making preparations for future research and analysis in Japan.

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

I really enjoyed my time and experiences in Japan.   Much of my time on Mt. Norikura, conducting fieldwork.   During that time I stayed at a mountain cottage, the people at the cottage were amazing and though I was a guest I was also treated as part of the family.   I was able to practice my Japanese and learn much about Japanese hiking, biking and mountain culture from my stay in the mountains.

When not in the mountains I spent most of my time in Matsumoto and the surrounding areas.   I visited the famous Matsumoto Castle, drank from the many fresh springs and ate much soba while in Matsumoto.   I was also able to attend the Matsumoto Bon Bon which was an interesting experience, one song, one dance, 5 hours long.

I really appreciate all the support and advice that Dr. Takahashi was able to give me during my stay at Shinshu University and look forward to further collaboration with him.

RESEARCH REPORT

1. Name: Laura Cotton	（ID No.: SP12101）

2. Current affiliation: Cardiff University

3. Research fields and specialties: Biological sciences (palaeontology)

4. Host institution: AORI, University of Tokyo   5. Host researcher: Prof Hodaka Kawahata

6. Description of your current research

My current research is on the mass extinction of larger benthic foraminifera (LBF) at the Eocene/Oligocene boundary. The Eocene Oligocene transition (EOT) was a time of profound climatic and oceanographic change associated with the first major glaciation of Antarctica (~33.5 and 34 Ma). During this interval a number of long-ranging, widespread and abundant LBF became extinct. However, the timing of this extinction was uncertain. Previously it was suggested that the sea level fall associated with increased continental ice caused a decrease in shelf space and therefore the extinction (Adams et al. 1986). However, we have found this is not the case. The Kilwa District of Tanzania contains an apparently complete succession through the EOT, which has been recovered in three boreholes drilled by the Tanzania Drilling Project. These cores contain a detailed record of larger benthic foraminiferal stratigraphy tied to planktonic foraminifera, nannofossil and stable isotope data which allow them to be correlated with plankton stratigraphy and the global isotope curve. The records show extinction of the majority of larger benthic foraminifera occurs at the Eocene/Oligocene boundary. This precedes the major sea level fall by 200,000 years, indicating it cannot be the cause of the extinction.

Although the extinction occurs in the plateau of the $\delta18O$ shifts and not with the largest temperature drop, the EOT is a period of rapid global cooling and the distribution of larger benthic foraminifera is known to be related to temperature. Therefore it appears likely that the temperature decrease has some effect on the foraminifera living at the time. However, it remains uncertain as to how detrimental this effect would be or whether it is able to cause a rapid co-ordinated extinction.

7. Research implementation and results under the program

Title of your research plan:

Effects of temperature on larger benthic foraminifera

Description of the research activities:

Amphistegina specimens had been collected prior to my arrival in Japan, additionally juvenile clonal specimens of *Calcarina*, *Sorites* (2 groups) and *Heterostegina* were mailed to me from collaborators at the Sesoko Island research station in Okinawa. The larger foraminifera were then cultured at six different temperatures between 16 ^{o}C and 32°C. Each genus was divided between twelve jars of sea water, to allow for a repeat experiment at each temperature. The jars were placed into water baths with heaters, pump to circulate water and thermostat, under lighting with a 12hr on/off cycle. Additionally, several specimens were kept as individuals in small jars to allow a daily count of chamber formation. Photographs and measurements of a random sample from each jar were taken twice weekly to monitor test growth. These measurements and photos along with the empty tests will be taken back to the UK to analyse whether there are significant differences in the growth between different temperatures. Bleaching was also observed in both the lowest and highest temperature experiments. The tests may also be used in future stable isotope work.

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

I really enjoyed my stay in Japan. Everyone in my office/lab has been really friendly and helpful and I have learnt so much from working with the live versions of my fossils. I visited a number of places around Tokyo and also travelled to Kyoto. I especially enjoyed visiting Owakudani and eating black eggs. I also attended a workshop on culturing living foraminifera in Okinawa, where we collected specimens – snorkeling on the reef was definitely one of the highlights of this trip!

RESEARCH REPORT

1. Name: Benjamin J. DRYER	（ID No.: SP12102）

2. Current affiliation: The Open University

3. Research fields and specialties:

    Mathematical and Physical Sciences, Engineering

4. Host institution: Institute of Space and Astronautical Sciences, Japan Aerospace Exploration Agency

5. Host researcher: Prof. Taro SAKAO

6. Description of your current research

I am interested in characterizing the effects of the space radiation environment on CMOS-APSs. CMOS APSs (Complementary Metal-Oxide-Semiconductor Active Pixel Sensors) are a silicon imaging technology that until recently have not been able to outperform CCDs (Charge Coupled Devices) in scientific work. The ongoing improvement in semiconductor device manufacture by virtue of ever increasing demands of performance for computing devices such as processors has allowed CMOS APSs to approach the imaging quality realized by CCDs. One of the often touted advantages of CMOS APS technology is reduced susceptibility to radiation damage.

In space science applications, radiation damage is a concern for most aspects of a mission. All components of a space craft will degrade while in the space environment due to radiation emitted from galactic, solar, and magnetically trapped sources. This damage limits the effective lifetime of a mission, as the instruments will degrade to the point that the accuracy of measurements is no longer sufficient to meet the aims of the instrument.

My current research involves a series of radiation campaigns, characterizing the damage to CMOS APSs due to incident protons, gamma-rays or heavy ions, and comparing the amount of damage to similar CCD studies.

During my research, my expertise in operating and characterizing these devices has enabled me to work with groups looking to propose or study instruments for upcoming space missions being launched by NASA, ESA and JAXA. One example being performing characterization of the spectroscopic x-ray performance of CMOS APSs for the proposed X-ray Imaging Spectroscopic Telescope on board Solar-C, a JAXA mission.

7. Research implementation and results under the program

Title of your research plan:

Study of the x-ray spectroscopic abilities of e2v technologies' 'Ruby' CMOS APS for use on board the X-ray Imaging Spectroscopic Telescope for Solar-C

Description of the research activities:

Some preliminary characterization had been performed before my arrival in Japan, but with a limited implementation of the camera system. During my stay a full implementation of the system was implemented, leading to full realization of the camera's capabilities. After this the system was analyzed with respect to performance characteristics and the x-ray performance of the device was measured and compared to previously studied devices.

Alongside this work, a study was performed to optimize the 'event processing' that is carried out in post-processing to regain performance that is lost due to the spreading of charge within the device. This involved the simulation of images from a device with known input parameters, allowing the comparison of the input to the 'event processed' output. This allowed investigation of how event processing parameters affect the measured spectrum, and also results from the study can allow estimation of correct event processing parameters without simulation or measurement.

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

Of great interest to me was a visit to the Ueno science museum. As someone who values and participates in public engagement with science, familiarity with the way that science is portrayed and presented in a different culture such as Japan was enlightening. Similarly, extent I was interested in observing the JAXA open day for similar reasons. Beyond this, I was able to experience Japanese nightlife, and visit places such as Kamakura and Shimoda to experience Japanese beach and spiritual culture.

9. Advisor's remarks (if any):

Visit of Dr. Ben Dryer greatly benefited our group in X-ray evaluation of e2v CMOS devices. Also, his study on optimizing event processing has been showing interesting and important progresses. His visit certainly promoted collaborative relationship between U.K. and Japan in the field of CMOS detector development and I very much hope this relationship will even be strengthened towards the future.

RESEARCH REPORT

1. Name: Melissa Gammons	（ID No.: SP12103）

2. Current affiliation: University of Bristol

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

4. Host institution: University of Kyoto

5. Host researcher: Professor Masatoshi Hagiwara

6. Description of your current research My current research has been based on the identification of novel therapeutics for the treatment of exudative age-related macular degeneration (AMD). Choroidal neovascularization (CNV) is the primary cause of vision loss in patients with exudative AMD, current anti-VEGF-A therapies have proven both safe and effective in randomized clinical trials, however, such treatments rely on intraocular injections as often as every month. We have successfully identified SRPK1 as a target in controlling the splicing of VEGF in retinal pigmented epithelial cells, in addition we have demonstrated that small molecule inhibitors of the SRPK family of kinases are capable of inhibiting choroidal neovascularization in both mouse and rat models of AMD following intraocular injection. Furthermore, we have recently shown that SRPIN340, an inhibitor of SRPK1 and SRPK2, is effective at suppressing CNV dose dependently when given topically as eye drops.

7. Research implementation and results under the program
 	
   Title of your research plan:
 	
   SRPK1 as a novel target in regulating alternative splicing of VEGF mediated by SRSF1 phosphorylation
 	
   Description of the research activities:
 	
   During the summer of 2012 I was fortunate enough to take up a JSPS fellowship position in Prof. Masatoshi Hagiwara's laboratory in the graduate school of developmental biology and anatomy at the University of Kyoto. Throughout this time I was able to build on research I had carried out at the University of Bristol, making use of the expertise and equipment available in Professor Hagiwara's laboratory. At Kyoto University, I have identified novel inhibitors of SRPK1 and another member of the SRPK family, functionally related SRPK2, using their in vitro kinase assay. Such inhibitors differentially affect the kinases and make useful tools in elucidating

downstream targets and alternative splicing events involving the SRPK family of kinases.
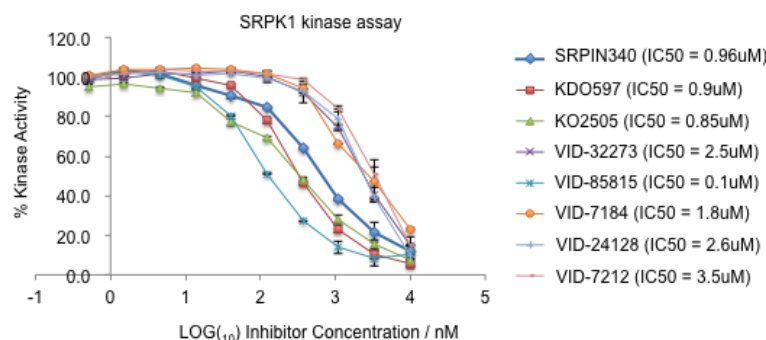

Figure 1. Novel inhibitors dose-dependently reduce SRPK1 kinase activity similar to that of previously identified inhibitor SRPIN340. Compounds show varying potency in vitro as determined by their IC50 values.

Furthermore, I have shown that these inhibitors prevent SRPK1 kinase activity without altering the expression of the kinase even after 6 days of repeated daily treatments at 10uM, a concentration high enough to almost entirely inhibit kinase activity based on the in vitro kinase assay data. Surprisingly SRPK1 inhibition reduced the expression of its substrate, SRSF1, suggesting phosphorylation of an SR protein may be necessary for its intra-cellular stability and expression. This effect has not been previously identified but if reproducible identifies novel ways of targeting SR protein expression in vivo.

Figure 2. Treatment of ARPE-19 cells with various SRPK1 and SRPK2 selective inhibitors reduced the expression of SRSF1 protein relative to internal control tubulin, as determined by western blot. KO2507 failed to inhibit either SRPK1 or SRPK2 in the in vitro kinase assay and here fails to reduce SRSF1 expression.

I hope to further this work back in England to confirm this effect in other cell lines and determine whether the reduced expression is nuclear, cytoplasmic or both.

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

Whilst having the opportunity to further my academic knowledge and learn new skills, I was also delighted to experience Japanese culture and cuisine. Japan is an amazing country with beautiful shrines and temples at every corner. Being located in Kyoto I also had the pleasure of enjoying the spectacular mountainous background. A short trek up the Diamonji mountain provides views of the whole of Kyoto stretching as far as Osaka, and a cable car to the top of mount Hiei allows spectacular views of Lake Biwa. The restaurants and izakaya lining the Gion-Shoji encapsulate the heart of the city, and the Kamo river makes for a great evening cycle. I hope future fellows enjoy their time in Japan as much as I have. Arigato gozaimasu!

RESEARCH REPORT

1. Name: Mohsan Hussain	（ID No.: SP12104）

2. Current affiliation: Aston University, Birmingham, UK

3. Research fields and specialties: 　Engineering, Management, Technology Management

4. Host institution: Auto ID Lab Japan, Keio University (Shonan Fujisawa Campus)   5. Host researcher: Professor Jin Mitsugi

6. Description of your current research
The focus of the present research is RFID (Radio Frequency Identification) adoption in the English NHS.. This research is an investigation into the problems faced in the National Health Service (NHS) for RFID adoption and why the full benefits of RFID may not be leveraged in the current situation of limited adoption in voluntary isolated projects. The outcomes of this research are to develop guidance for NHS managers and its commercial partners and to contribute to academic knowledge by: applying scenario planning to RFID studies; applying IT/IS systems knowledge to the English healthcare setting through RFID as an IT/IS application.

7. Research implementation and results under the program
Title of your research plan: Foreign Body Retention and the Need for AIDC Technology Description of the research activities: Foreign body retention (FBR) although not a frequent event, still remains clinically significant. Technologies for error prevention in the operating room (OR) setting are emerging but manual, error prone, processes still exist. Through the use of Automatic Identification and Data Capture (AIDC) technologies, positive effects for patient safety but also reducing the costly secondary events caused by FBR are a possibility. The aim of this study is to present a review of the previous work in the area, Open Information System's relevance to the topic, a path toward sharing the costs of AIDC technology adoption between hospitals and suppliers, an account of AIDC adoption in Japanese healthcare to date to synthesise a summary from personal communications with steralisation teams, standards agencies and manufacturers.

AIDC technologies for the OR are emerging. The issues of cost, reliability, regulatory restrictions and the reluctance of diverting from established processes require greater evidence that AIDC technology can help and not hinder in making FBR a truly 'never event'. Implications for practitioners, manufactures, policy makers and regulatory bodies include adjusting current practices in order for AIDC technologies to be adopted with greater ease. Implications for researchers are to provide further evidence of the reliability, viability, contribution to efficiency and the increase to patient safety from adopting AIDC technology.

Future Studies:

To date, the following aims are yet incomplete but can be conducted at a later date:

- A path toward sharing the costs of AIDC technology adoption between hospitals and suppliers

Personal communications with steralisation teams, standards agencies and manufacturers. The personal communications conducted were of value in setting the scene, making contacts and obtaining background information. However, in order to gain maximum leverage, a questionnaire based study would have to be developed.

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

I have listed my favourites:

Shimoda: Surfing, eating local vegetables, enjoying the seafood with my Lab mates:

Keio University: I trained with the University Football team three times a week. This allowed me to meet everyday students and lots of fellow footballers!

Visits to Japanese Hospitals, Japanese tool manufactures and Japanese Branches of Standards agencies as part of my research.

I will miss the amazing food!

9. Advisor's remarks (if any):

Mr. Hussain has been actively pursued his research on tracking surgical tools with automatic identification technology during his stay.

He establishes good relationships with hospitals and suppliers who practice the technology. He has also participated a lot of social activities to get familiarized himself to Japanese society.

His such activities motivate Japanese students in my laboratory. I believe his stay has been beneficial both to himself and my laboratory.

RESEARCH REPORT

1. Name: Iona McIntosh	（ID No.: SP12105）

2. Current affiliation: Durham University

3. Research fields and specialties: Mathematical and Physical Sciences

4. Host institution: Japan Agency for Marine-Earth Science and Technology (JAMSTEC)   5. Host researcher: Dr Alex Nichols

6. Description of your current research

My PhD research concerns the growth of gas bubbles in magma. Gas bubbles form when volatiles exsolve from the magma, typically as a result of pressure decrease as magma rises through the crust. The rate and extent of bubble nucleation and growth are key factors controlling the explosivity of a volcanic eruption, since they control the efficiency of magma degassing.

Bubbles grow through two main mechanisms: the diffusion of excess volatiles (chiefly H_2O) from the magma into the bubble, and decompressive expansion during magma ascent. Both melt viscosity and H_2O diffusivity are dependent on dissolved H_2O concentration, which makes bubble growth models highly sensitive to spatial and temporal variations in H_2O concentration. Crucially, these coupled processes are recorded in the H_2O concentration profiles surrounding the bubbles.

My research to date has used a combination of backscatter scanning electron microscope (BSEM) images and secondary ion mass spectroscopy (SIMS) to measure H_2O concentration profiles in both synthetic (decompression experiments) and natural (erupted) bubbly volcanic glasses. An unexpected finding is that all samples show evidence of bubble resorption as well as growth (even in experimental samples designed to induce only bubble growth).

It is hypothesized that this bubble resorption occurs during the quench to glass, as decreasing temperature causes H_2O solubility to increase, resulting in diffusion of H_2O back into the magma/glass. This has important implications. Experimental studies of magma degassing currently assume no change occurs to bubble sizes during the quench process; however there is evidence that quench resorption could result in significant reductions in bubble size. For natural eruptions where eruptive conditions are unknown, there is potential for concentration profiles altered during quench to be misinterpreted as evidence for changes in e.g. pressure prior to eruption.

7. Research implementation and results under the program

Title of your research plan:

H_2O speciation in concentration profiles surrounding bubbles in volcanic glass: constraining bubble growth and bubble resorption

Description of the research activities:

Water exists in silicate melts and glasses as two species: molecular water ($H2O_m$) and hydroxyl water (OH). Speciation varies with total H_2O concentration, temperature, pressure, and above and below the glass transition. At JAMSTEC I have used Fourier-transform infrared spectroscopy (FTIR) to distinguish between H_2O_m and OH in the H_2O concentration profiles surrounding bubbles. These data will provide insights into the mechanisms that create and modify H_2O concentration profiles around bubbles, which in turn will enable better interpretation of naturally erupted samples.

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

The data I have obtained during the Summer Program are invaluable to my PhD research and I am grateful for being given the opportunity to work at JAMSTEC. I would like to thank my host researcher and the other researchers and staff at JAMSTEC for their warm welcome and help with various aspects of research and daily life. During my time here I was able to join a research cruise to the Izu Bonin arc to study submarine volcanoes, which was a fantastic experience, and also a field trip to Hakone and the Izu Peninsula. I'm happy to have made such good friends and have many entertaining memories from dinners out, firework displays and, of course, karaoke.

9. Advisor's remarks (if any):

It has been an enjoyable two months having Iona working in the FTIR laboratory. I hope she will benefit from experiencing the trials and tribulations involved in getting data from the FTIR, and that the data she has collected will be useful in understanding the mechanisms of bubble growth in magmas. It is a shame that the time is so short, but I hope this just marks the beginning of long and fruitful collaborations between Iona and JAMSTEC.

RESEARCH REPORT

1. Name: Charles Renney	（ID No.: SP12106）

2. Current affiliation: University of Bristol

3. Research fields and specialties: Chemistry

4. Host institution: Osaka University   5. Host researcher: Professor Y Inoue

6. Description of your current research

The binding and recognition of carbohydrates by synthetic systems remains a challenging feat, due not only to the complexity in structure of carbohydrates, but also to the subtlety in structure between many of them; often just the stereochemistry of a single hydroxyl group. Coupled with this, the biological medium for carbohydrates predominately comprises of water; a medium to which carbohydrates strongly resemble through their array of hydroxyl groups, providing an extra challenge in binding carbohydrates.

Despite these difficulties much interest is concentrated around carbohydrate recognition due to the potential it has in helping treat diseases such as diabetes as well as providing a better understanding of many biological recognition processes.

Recently our group has developed a system capable of selective glucose recognition over an array of other carbohydrates in a water medium. The system comprises a macrocyclic molecule with a cavity of specific size for glucose and complimentary polar and apolar binding interactions between the receptor and the glucose molecule. The use of fluorescence moieties within our system allows both remote and low concentration detection of glucose, something that has given the system potential for use in continuous glucose monitors for diabetes management. Much of the current research in the group is focused upon making further modifications to the system in order to maximize its effectiveness in this field.

7. Research implementation and results under the program

Title of your research plan:

Further investigations into reported carbohydrate recognition by porphyrin-based systems.

Description of the research activities:

During my time spent in the Professor Inoue laboratory I was able to carry out investigations into the change in optical properties of the commercially available porphyrin molecule meso-tetrakis(p-sulfonatophenyl)porphyrin (TSPP) upon addition of glucose. Previous literature had reported these changes in optical properties to be associated with a specific binding interaction between the porphyrin molecule and the carbohydrate. Such carbohydrate binding is a difficult feat especially in a water medium, as is the case for this system, and thus investigations into the nature of this binding were carried out.

By using techniques such as UV-vis spectroscopy, fluorescence spectroscopy, circular dichroism, NMR and dynamic light scattering (DLS) I was able to show that these changes in optical properties are more likely associated with porphyrin aggregation, and that binding does not appear to occur under the examined conditions. The data I acquired for porphyrin aggregation matches very strongly with previous literature on both porphyrin and TSPP aggregation in particular. It appears that glucose, as well as other examined alcohols, incur changes in optical properties as a result of dispersing porphyrin aggregates.

Further investigations are still needed in order to further support the lack of carbohydrate binding and also to probe into the effect glucose and other alcohols have on the dispersion of porphyrin aggregates. It is hoped that this further research will help continue collaborations between the Inoue laboratory and my laboratory back in Bristol.

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

I have had an amazing time here in Japan, and have thoroughly enjoyed immersing myself in different cultural events. Throughout my stay I have met many people and travelled around various parts of the country, both rural and urban areas. The time spent here has only fuelled my love for the Japanese people, food and culture; although the hot weather is something I will probably not miss! Overall my time in Japan has been a fantastic experience and I would very much like to come back here in the future.

RESEARCH REPORT

1. Name: Paul M. RICHARDS	（ID No.: SP12107）

2. Current affiliation: PhD Student, University of Nottingham

3. Research fields and specialties:

Biological Sciences

4. Host institution: Tohoku University

5. Host researcher: Prof. Satoshi CHIBA

6. Description of your current research

Evolutionary genetics seeks to link evolutionary and ecological processes with underlying genetics, to understand how variation arises populations, and how new species evolve. Over the past decade this field has undergone a revolution, as a result of the development of next-generation DNA sequencing technologies. My PhD utilises these new approaches to investigate the genetics and evolutionary processes responsible for morphological variation in both shell colour and coiling direction in European and Japanese land snails.

Evolution of variation for left-right asymmetry in Japanese land snails:

Left-right asymmetry is a fundamental aspect of animal development, which has received great interest in terms of understanding the underlying genetics and why most animals are invariant of left-right asymmetry. Snails are unique because some taxa are variable for left-right asymmetry, comprising of both dextral (right) and sinistral (left) coiling species. Thus they may present a rare opportunity to indentify the gene for left-right asymmetry, investigate how and when selection favours variation for left-right asymmetry, and investigate whether such variation can lead to speciation. I have been exploring the latter two of these questions in the Japanese snail genus *Euhadra*, which exhibits both dextral and sinistral species. Previous research, that used mitochondrial DNA (mtDNA) sequences sampled from snail populations throughout Honshu, indicated that switches in chirality may have resulted in recent or ongoing speciation between two closely related species. However, a better understanding can only come from the high resolution genetic relationships that can be inferred from next-generation sequencing data, as well as focusing on contact zones where the species coexist close together, which may be the focus of recent chiral evolution events. Using a new next-generation sequencing method (RADSeq), in addition to further mtDNA-based sequencing from new populations, I have been trying to further develop or understanding of chiral evolution in *Euhadra*.

7. Research implementation and results under the program

Title of your research plan:

Fine-scale genetic mapping of populations of two closely-related species of Japanese *Euhadra* land snail that exhibit dimorphism for left-right asymmetry.

Description of the research activities:

In collaboration with members of my host lab, whose help was invaluable, a number of trips were made to Yamagata and Iwate to sample snail populations, to finer map contact zones between the dextral and sinistrals species. These trips were highly successful and we were able to sample numerous new populations of interest. I also aided other lab members with their own sampling. Laboratory work was also very productive and I was able to extract DNA and sequence mtDNA from the majority of the samples that I had collected. A further benefit was being able exchange new techniques with members of my host lab. Good progress was also made with the bioinformatic analysis of RADseq data I generated in Nottingham. As results continue to arise from both this analysis, and analysis of the sequence data I have generated in Japan, I will continue to discuss these with my host, with the ultimate aim of collaboratively publishing a research paper. Finally, a talk that I gave about my research resulted in a discussion with one of the students, who is now keen to use RADseq, and may end up visiting Nottingham to do this work.

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

My two months working in Japan have been productive and have yielded collaborations that I hope to continue in the future, both in the UK and perhaps through further future visits to Japan. The cultural experience has been fantastic, from the food, visits to beautiful temples, attending the famous Sendai Tanabata festival, through to my personal highlight of hiking in the stunning mountains surrounding Sendai with new found friends.

9. Advisor's remarks (if any):

Paul found a number of new populations of both sinistral and dextral species and obtained DNA sequences data that exhibited interesting patterns. On the basis of these datasets, he estimated how sinistral and dextral species have evolved. His research in Sendai has definitely been successful, promising further progress.

RESEARCH REPORT

1. Name: Anna Seabourne	（ID No.: SP12108）

2. Current affiliation: Department of East Asian Studies, University of Manchester, United Kingdom

3. Research fields and specialties:

    Cultural and Social Sciences

4. Host institution: Sociology Department, Kyoto University, Japan

5. Host researcher: Professor Kimio Ito

6. Description of your current research

The term *koryû bujutsu* literally translates as 'old stream martial arts' and refers to classical traditions founded before 1868. Literature on martial arts includes popular manuals; studies of samurai writings; historical studies; modern writings on techniques and philosophy; catalogues of extant *koryû*; and ethnographies of modern arts; but not of *koryû*. My research explores how the *koryû* contribute to discourses on selfhood, identity and masculinity through investigating participants' motivations for entering a *koryû*; how they view their practice; and how membership relates to their identity outside training. The study takes an ethnographic approach, gathering data through participant observation, interviews and examining practitioners' writings.

7. Research implementation and results under the program

    Title of your research plan:

    Forging the spirit: How training in a *koryû bujutsu* affects practitioners' lives

    Description of the research activities:

    The first key objective was obtaining formal consent for the research from the head of the Takeuchi-ryu Bitchuden. This has been achieved and I have also been able to discuss the research and gain the cooperation of senior teachers in the tradition. I have carried out initial data collection through participating in regular training sessions at the main dojo and at two branch dojo in Tokyo. I have taken part in two major events in the dojo calendar: Enmamôde at the Byakugô-ji temple in Nara and the Ryusosai, which this year commemorates 480 years of Takeuchi-ryu. In addition I was unexpectedly able to join the main Takeuchi-ryu commemorative event in

Okayama, a rare privilege which has given me a greater awareness of the wider Takeuchi-ryu tradition and will provide a useful reference point for comparison.

A further objective I have achieved is to gain access to an electronic copy of　習い方の五ヶ条、(*Narai kata no gokka jyô)* and　教え方の七条　(*Oshie kata no nanaka jyô)* and begun work on translation. These are two articles written by the head instructor on the principles of learning and teaching.

I have identified and made some initial approaches to possible candidates for interviews and have also been able to access online discussions where members of *ryuha* exchange ideas about training and their experiences.

In addition to meeting and discussing my research with my host researcher, Professor Kimio Ito, I was also introduced to Professor Shun Inoue and Associate Professor Akira Kurashima whose comments have helped me to develop my ideas and both of whom are useful contacts for future collaboration.

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

Although I have spent most of my time in the field, the support of the academics and support staff at Kyoto University has been invaluable for which I offer my sincere thanks.

As a former resident of Japan, I was already familiar with various aspects of Japanese culture. However, this time I have added a few additional skills: I now know how to don a suit of armour and how to correctly tie an *obi* to hold a *yukata* (summer kimono) in place. The highlight of the summer had to be taking the part of the Yamabushi in a reenactment of the founding myth performed to members of the Takeuchi-ryu Bitchuden as part of the 480th anniversary celebrations.

RESEARCH REPORT

1. Name: Ross S. WINTER	（ ID No.: SP12109）

2. Current affiliation: University of Glasgow

3. Research fields and specialties: 　Chemistry

4. Host institution: University of Tsukuba

5. Host researcher: Prof. Hiroki OSHIO

6. Description of your current research

Polyoxometalates (POMs) are a diverse array of molecular metal oxides typically composed of W, Mo or V. Many other elements can be contained within their complex architectures which can convey a wide array of physical properties such as electric, magnetic and catalytic properties and POMs can be functionalized with organic moieties to make new materials. Despite the vast number of POMs that are synthesised each year, there is still little known about the exact nature of POM assembly mechanisms, which makes design and prediction of structures a challenge.

The POM starting material I work with is $\{\gamma\text{-SiW}_{10}\}$, as it is used to make many transition metal substituted POMs (TMSPs) and readily reorganises in solution to give numerous different POM fragments of different nuclearity and geometry. Several reaction parameters have been screened such as pH, temperature, ionic strength and concentration/ratio of reactants to determine if the rearrangement process can be better understood and hence controlled. First row transition metals Mn, Fe and Co were used as they have the potential to infer magnetic/electrical properties and potentially water oxidation capabilities to the final products.

Many POM architectures with unique transition metal cores have been synthesized, but there is limited ability to reproduce the same architectures using different transition metals under similar reaction conditions implying that the metals themselves are heavily influencing the assembly process. I have been able to make one particular structure using either Mn, Fe, or Co with some ability to control and vary the positions of the transition metals within the structure. If these POMs could be sandwiched together with other transition metals to give larger clusters, multiple homo- and hetero-metallic cored architectures could be synthesized with positional control of the metal centres (something not yet fully attainable in POM chemistry). This would open up a large array of new complexes with potentially interesting and programmable physical properties.

7. Research implementation and results under the program

Title of your research plan:

Magnetic analysis and synthetic understanding of Polyoxometalates. Controlling the positions occupied by Transition Metals within the final architectures.

Description of the research activities:

With regards the magnetism studies, it was believed that several of my POMs could be single molecular magnets (SMMs). In Tsukuba I had access to a SQUID (Superconducting QUantum Interference Device) which allows for the study of molecular magnetic properties at variable temperature and external magnetic field. All my samples were tested accordingly, however the SMM properties expected were not initially apparent, however ongoing analysis and tests are being conducted to ascertain the exact magnetic exchanges occurring within the systems.

Initially the reproducibility of my clusters needed to be determined in a new environment. The reactions were successful but crystallization was occurring faster than before, which meant crystal quality was slightly diminished and it was difficult get accurate structure solutions. With adapted conditions, previous and new POMs were made, allowing for greater control over the positions of metals within the POMs. Work was begun to try and sandwich the POMs together and a few crystals were grown that showed changes in morphology and colour compared to their parents, however the crystals were not of suitable diffraction quality and fully solved structures could not be obtained. With careful alterations, diffraction quality crystals should be achieved.

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

My time in Japan has definitely been well spent. The different approach to work is something I will carry back home with me and I will miss my host group and the analytical equipment in Tsukuba very much. Culturally, Japan is all I hoped it would be. From the numerous vending machines, to the questionable shops in Akihabara, the fashion of the Harajuku girls, learning to enjoy karaoke, wearing a yukata and participating in a parade, the Sumida Hanabi display (complete with Pikachu fireworks), to climbing Mt Fuji and best of all visiting the Ghibli Museum, not to forget the food (I will miss takoyaki), it has been amazing and I hope I can return soon.

RESEARCH REPORT

1. Name: | Rebekah Yu	（ID No.: SP12110）

2. Current affiliation: University College London, UK

3. Research fields and specialties:

   Medical, Dental and Pharmaceutical Sciences

4. Host institution: Department of Molecular Therapy, National Institute of Neuroscience, National Center of Neurology and Psychiatry (NCNP), Tokyo

5. Host researcher: Professor Shin'ichi Takeda

6. Description of your current research

Peripheral Arterial Disease (PAD) is a systemic manifestation of cardiovascular disease. It affects over 27 million people in the Western World, and is composed of a spectrum of disease states ranging from patients who are asymptomatic, to those who will suffer from pain in arm and leg muscles during exercise, to the most severe form of disease, critical limb ischaemia (CLI), which involves gangrene and tissue loss.   30% of patients with CLI will face major amputation within 1 year.   Inflammation, cell damage and cell death are some of the responsible factors in CLI.   Medical and surgical interventions have limited functional or quality of life success, and therefore the remit of my project was to identify novel adjunctive therapies which maybe effective in the treatment of CLI.   We decided to investigate the effects of erythropoietin and erythropoietin derivatives in protecting skeletal muscle from ischaemic damage, as a consequence of peripheral arterial disease.

I have analysed the cytoprotective effects of erythropoietin and the derivative (ARA-290), as well as the signalling pathways utilised, and also the release of inflammatory cytokines, all of which propagate the secondary inflammatory biological response to cell-injury in an established murine model of skeletal muscle ischaemia.   This preliminary work has now progressed, and after optimisation of myoblast isolation, I am conducting this work in human isolated myotubes (obtained from patients who have provided informed consent, allowing us to take gastrocnemius muscle biopsies), to link the work more closely to the clinical scenario we are tackling.   So far, I have managed to show a decrease in apoptosis in those cells treated with both erythropoietin and ARA-290, and a decrease in inflammatory cytokine release, suggesting that these agents are able to mediate some degree of tissue-protection.   Analysis of signalling pathways utilised has suggested an important role of the PI3k/Akt pathway.   I will go on to look at other upstream and downstream signalling molecules, which may also play an important role in mediating cytoprotection, and also try to identify the suitability of this new *in vitro* model of skeletal muscle, which uses human myotubes

7. Research implementation and results under the program

Title of your research plan:

Characterisation and profiling of the differences between true myogenic satellite cells and artificially induced progenitor stem cells.

Description of the research activities:

The Department of Molecular Therapy at NCNP focuses on treatment of Duchenne Muscluar Dystrophy (DMD). Cell therapy using muscle progenitor cells (satellite cells) is a promising approach to ameliorate the muscle wasting that occurs in DMD.

During my stay in Prof. Takeda's lab, I focused on finding novel biomarkers that would allow the identification of satellite cells, which would propagate their use in the future in any disease where muscle wasting occurs. Various techniques were utilised, including immunohistochemical staining of novel markers of mouse satellite cells (Stem Cells 25:2448-59, 2007) (calcitonin and Odz4 receptor), both of which provided positive results in human muscle samples. A second technique (FACS analysis) allowed us to screen 250 cell surface antigens on human skin fibroblasts and skeletal myoblasts. After two rounds of screening I have obtained promising targets, which are supposed to have important roles in channeling progenitor cells into the muscle lineage. I would like to investigate their functions further, in collaboration with Prof. Takeda

We also investigated inducible pluripotent stem cells (iPS cells) once they were transfected with muscle specific genes (MyoD) to force them into the muscle lineage, to investigate the similarities and differences in the resultant muscle. This work then progressed to use iPS cells from DMD carriers, to identify the muscle fibres generated.

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

Besides being welcomed so warmly by my colleagues at work, I was also fortunate enough to spend time with them outside as they helped guide me through a wonderful tour of Japanese culture, festivals, traditions and especially food. Our Sensei often ensured we were exposed to the magnificent arts culture Tokyo has to offer by guiding us with great knowledge and expertise around some of Tokyo's finest museums. He also greatly encouraged me to explore other areas of Japan, and even suggested things for me to see. I was lucky enough therefore to be able to climb Mount Fuji, as well as visit other cities including Kyoto and Nara, all of which I enjoyed immensely.

9. Advisor's remarks (if any):

Miss Yu is a very talented and hardworking student. I hope that her experiences in my lab and in Japan would help her be a good scientist or medical doctor. (Shin'ichi Takeda)

RESEARCH REPORT

1. Name: Queenie CHAN	(ID No.: SP12111)

2. Current affiliation: Imperial College London

3. Research fields and specialties:

    Interdisciplinary and Frontier Sciences

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

5. Host researcher: Prof. Naohiko OHKOUCHI

6. Description of your current research

My current research spans the areas of geobiochemistry and astrobiology, involving analysis of the amino acid contents of Martian soil analogues and extraterrestrial bodies. My research targets to enhance the detection of life in future space missions, and also aims to validate the fundamental theories of the origin of life. My work involves the detection of biomarkers using forefront analytical techniques, which includes fluorescence spectroscopy, gas chromatography–mass spectrometry (GC-MS), GC-nitrogen phosphorous detector (GC-NPD), and GC combustion isotope ratio mass spectrometry (GC/C/IRMS).

My work has resulted in several main findings. Fluorescence maxima of amino acids were identified using a spectrofluorometer, and the quenching effects were also evaluated. These results greatly enhance the chances of amino acids detection in laboratory and future space missions My most recent research investigates the amino acid contents of ordinary and carbonaceous meteorites. The enantiomeric (D/L) ratios of amino acids were obtained to distinguish materials produced biotically or abiotically as life on Earth is dominated by L-asymmetry. Despite the D/L ratios indicating a certain level of terrestrial contamination, the presence of non-protein amino acid suggests the presence of indigenous materials in the meteorites. These results were developed into refereed journal articles, and were also reported at international conferences.

7. Research implementation and results under the program

    Title of your research plan:

    Nitrogen-stable isotope analysis of amino acids in carbonaceous chondrites

    Description of the research activities:

    The relative abundances of heavy stable isotopes (D, 13C and 15N) are indicative to the origins of compounds present in meteorites. Organic compounds in meteorites are enriched in heavy stable isotopes relative to the light counterparts. This has provided an alternative mean for determining the synthetic origin of amino acids in

meteorites.

Amino acid nitrogen isotope analysis requires precise measurements of 15N/14N ratios. GC column Chirasil-Val, which is capable of separating amino acid enantiomers, has been employed extensively in recent studies for resolving amino acid contents of meteorites. However, GC columns that contain nitrogen compounds in their stationary phase, like Chirasil-Val, may contribute additional nitrogen through column bleeding. Such contribution of nitrogen results in ambiguous signal that hampers the detection of subtle variations in isotopic values in meteorites.

A way to obviate such problem is to derivatize amino acids with optically active reagents to yield diastereomeric derivatives (N-pivaloyl-2-butyl esters). The NP/2Bu esters can be separated on a GC column without the need of using a chiral stationary phase. Amino acids were analysed by GC-MS with a DB-23 column, and were identified through comparison of the retention time and mass fragmentation pattern with known amino acid standard mixtures. The nitrogen contents of the samples were then quantified using GC-NPD, and the nitrogen isotopic ratios were obtained by GC/C/IRMS.

A modified amino acid extraction and preparation protocol was established. Results including comparison between the efficiency of direct (liquid-) and indirect (vapor-phase) hydrolysis of amino acid standards and soil sample, determination of the fragmentation patterns of NP/2Bu esters of common terrestrial and extraterrestrial amino acids and their retention time on non-chiral GC column. After the protocol has been tested and evaluated, meteorite samples (CO3 ALH77003 and CI1 Y980115), which were obtained from the National Institute of Polar Research (NIPR) collection, were analysed under the new protocol. Amino acid contents, enantiomeric ratios, and nitrogen isotopic ratios were obtained for these meteorites.

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

The only thing that I still cannot get hold of is when to stop saying arigatou. When someone served me in a restaurant, I thanked them, and he bowed back, then I thanked again, so on and so forth. I figure that Japanese are simply too nice. It is the people that have made this wonderful culture.

9. Advisor's remarks (if any):

During her stay in my laboratory, Queenie Chan worked very hard and her performance of conducting scientific project has been very efficient. So far, she has achieved several scientific progresses. It includes evaluation of the protocol for nitrogen isotopic analysis of individual amino acids. She is currently in the final stage of analyzing nitrogen isotopic composition of amino acids from meteorite samples. We plan to discuss the results through email even after finishing her stay in Japan.

RESEARCH REPORT

1. Name: Niall Kent	（ID No.: SP12112）

2. Current affiliation: Barts and The London School of Medicine and Dentistry

3. Research fields and specialties:

    Medical, Dental and Pharmaceutical Sciences

4. Host institution: Kyushu University

5. Host researcher: Professor Ishikawa

6. Description of your current research

My current research has been focused on the develop of a novel calcium phosphate cement which I have accomplished, developing a novel route for producing these cements and a number of different formulations which will increase applications and offer new treatment options for patients in orthopedics and dentistry. Calcium phosphate cements are biomaterials formed through the reaction of various calcium phosphate salts that dissolve releasing Ca^{2+} and PO_4^{3-} ions which react to form apatite ($Ca_{10}(PO_4)_6(OH)_2$), a mineral that makes up bone and enamel. The material that has been developed has high potential for patient treatment. Current research has focused on optimizing composition of these cements to achieve ideal properties for use, including setting time, compressive strength and porosity.

7. Research implementation and results under the program

    Title of your research plan: Characterization of Novel Calcium Phosphate Cements Using X-ray Diffraction (XRD) and Scanning Electron Microscopy (SEM).

Description of the research activities: During my time in Japan I have performed a real-time study using X-ray diffraction on the setting reaction of the Apatite $(Ca_{10}(PO_4)_6(OH)_2$ and Fluorapatite cement formulations $(Ca_{10}(PO_4)_6F_2)$. The results showed the setting mechanism of the materials produced. Cement specimens were also immersed in solution to asses how they changed over time. SEM was performed on the specimens after 1 hr, 1 day, 7 Days, and 28 days immersed in solution.
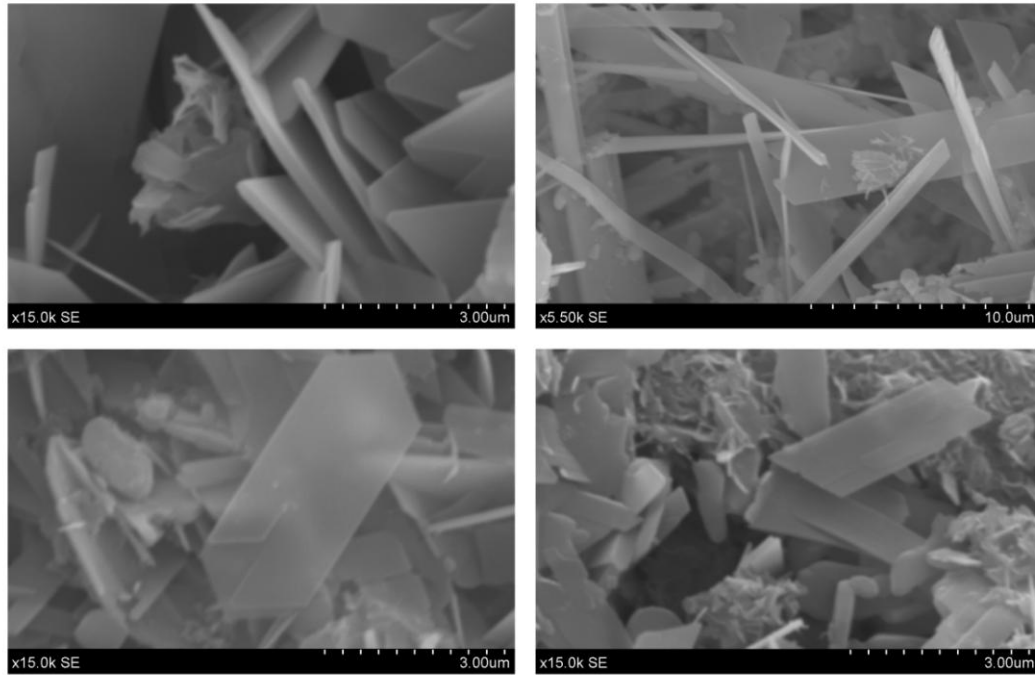

Figure 1 SEM Images of Apatite Forming Calcium Phosphate Cement

8. Please add your comments, including any cultural experience during your stay in Japan (if any): During my time in Japan I have been fortunate enough to see a lot of Japanese culture. During my home stay experience when I first arrived in Japan I visited Yokohama and went to a tea ceremony there. I also spent a day in Kamakura where I visited a number of temples and also saw the giant daibutsu, which was enjoyable. Whilst in Fukuoka I have visited a number of small islands off the coast, Nokonoshima was especially great. The food in Fukuoka has also been very nice, the city is famous for ramen noodles and yatai (small food stalls). I was able to climb Mt. Fuji at night to see the sunrise near the end of my stay and I would recommend this to anyone coming to Japan. Overall my stay has been both worthwhile for my study and for the culture of Japan I have experienced.

RESEARCH REPORT

1. Name: Julien BEAUDAUX	（ID No.: SP12201）

2. Current affiliation: University of Strasbourg

3. Research fields and specialties:

    Mathematical and Physical Sciences

    Interdisciplinary and Frontier Sciences

4. Host institution: Internet Initiative Japan Innovation Institute

5. Host researcher: Jean LORCHAT and Keiichi SHIMA

6. Description of your current research

Over the last decade, a multitude of medical sensing devices emerged, with a wide range of application (e.g. blood pressure, oxygenation, glucose). When deployed into a network, these sensors make possible to perform remote reliable monitoring of patients in hospital units and at home. Meanwhile, more and more patient felt the need to be able to access their medical records (e.g. monitoring readings, physician notes) easily, as well as managing it.

Consequently, adapted storage systems were designed, to fit both with medical requirments (privacy, security, resilience) and emerging needs (patients authentication, data access share and revoke, good performances to fith with telemedical applications).

Tamias is a data storage system currently developed at IIJ Innovation Institute. All data stored within Tamias is encrypted, and the system ensures that information cannot be mined without its owners' authorization. Erasure-coding also guarantees preservation of the stored data. On top of that, Tamias users can share and revoke access to all or part of their data at any time

Satisfying all mentioned constraints and needs, Tamias is an ideal solution for health record storage. However, its performances remained unknown. To ensure that the constraints imposed by telemedical applications were met, a thorough evaluation of the Tamias system performances remained to be done.

7. Research implementation and results under the program

Title of your research plan:

TAMIAS: a thorough experimental study.

Description of the research activities:

We performed a thorough evaluation of the Tamias storage system, in order to get a clear view of its performances. Precisely, we developed two monitoring systems, one external relying on remote periodical requests, able to evaluate performances as perceived by Tamias users, and one internal, built within the Tamias system, able to precisely detail the repercussions of each action performed by the user.

This evaluation was performed on a testbed composed of 18 Tamias nodes, deployed at the Internet Initiative Japan Innovation Institute.

At the light of the results, we improved several aspects of Tamias (e.g. leases management, API commands), in order to get a fully operational release. Several nodes based on this release will soon be shipped to several institutions around the world. This will provide us a real-use case configuration, allowing us to perform an even more realistic evaluation.

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

Professionally speaking, this summer program was a marvelous experience. Indeed, I had the opportunity to learn new working methods, as well as a new research theme (data-storage and privacy). Also, while this 2 month period seemed short at first, I am very satisfied by the results obtained, and by the facts that all goals were met.

This experience in Japan was also exceptional on a personal point of view, allowing me to improve my Japanese language level.

9. Advisor's remarks (if any):

As advisors, we are very pleased with the summer program, and especially regarding the work that could be achieved within such a short-term stay. This is the first time we have hosted a JSPS summer intern, and for us this was a very succesful stay. We are looking forward to many future collaborations with Julien, and with other potential summer interns.

RESEARCH REPORT

1. Name: Alexis BOROWIAK	（ID No.: SP12202）

2. Current affiliation: University of Lyon

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Osaka University

5. Host researcher: Prof. Hidekazu TANAKA

6. Description of your current research

The project has concerned the epitaxy and nanostructuration of multiferroic film. Multiferroics are materials which present both ferroelectric and ferromagnetic properties.

I have realized the epitaxy of multiferroic BFO ($BiFeO_3$) film by Pulsed Laser Deposition and I have determined the optimal deposition parameters.

In a second step, I have used a nanostructuration process previously optimized by Prof. Tanaka. He already reported on nanofabrication beyond the limitation of the original top downnano-process using a size-reducible high aspect ratio (AR) hollow molybdenum (Mo) (SHHM) nanomask and demonstrated the fabrication of epitaxial 3D ferromagnetic FMO ($Fe_{2.5}Mn_{0.5}O_4$) nanostructures with high controllability in their size and location (Nanotechnology 22, 185306, 2011). The same process has been used to fabricate the multiferroic BFO nanostructure and the electrical and ferromagnetic properties at the nanoscale on the same nanostructure have been studied.

I will continue the study of the multiferroic nanostructures realized in Osaka when I'll come back at INL, France. In order to complete the ferromagnetic study in Osaka, the ferroelectric nanoscale characterizations will be performed using PFM, the technique I am using at INL during my thesis.

7. Research implementation and results under the program

Title of your research plan:

Ferromagnetic and ferroelectric characterizations of BFO/FZO nanostructures

Description of the research activities:

My weeks were divided in 3 main parts. First I have prepared the samples using a physical vapor deposition method: Pulsed Laser Deposition (PLD).

During this program, I have prepared 2 kinds of samples: First for the main project, I have prepared some nanostructures of BFO/FZO ($Fe_{2.5}Zn_{0.5}O_4$). And in parallel some thin films. Second, I have controlled the composition of my nanostructures and thin films by XRD (X-Ray Diffraction). Third, I have characterized the samples by AFM (Atomic Force Microscopy) and their modes. AFM is a technique which allows the scanning of the surface of a sample at the atomic scale. I also have characterized the electrical properties of the nanostructures by C-AFM (Conductive Atomic Force Microscopy). C-AFM is a mode of AFM, and it differs from AFM by using a conductive tip.

And finally, I have characterized the magnetic properties of my samples using another mode of AFM which is called MFM (Magnetic Force Microscopy), MFM differs from AFM by using a magnetic tip.

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

I will speak about my experience in Osaka. During the program I have lived in the Toyonaka campus of the University of Osaka. It was a quite good place to live. It allows me to meet a lot of Japanese and international students.

The city of Osaka is well positioned. If you are interested by the shrine, Kyoto and Nara is only at 40 km.

In the point of view of sightseeing, Osaka has perhaps not a lot of monuments, but it has a lot of interesting places, and I have always discovered a lot of new things in each of these places (Umeda, Dotonbori, Namba, Shinsekei, Kaiyukan…). I will present 3 places where I really enjoyed spending some times.

The first one is Umeda. Umeda is the biggest shopping area in the west of Japan. You can find anything you need in this place: clothes, entertainments (cinema, bowling...), restaurants... A good place to eat is the Hankyu building. You have 3 levels of restaurants at the 30 floors of this building and a beautiful view of Osaka, especially by night. Another interesting place in Umeda, which surprise me, is the underground market of Hanshin. It's a maze of food shops (fish, meat, fruit, sweet…).

The second place where I have also spent some time is Dotonbori. It's the perfect place for going out, a big street of shopping, restaurants, bars…
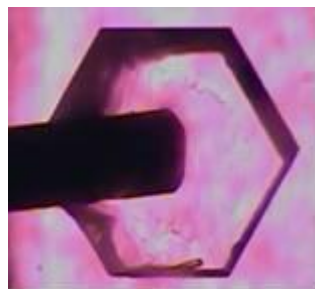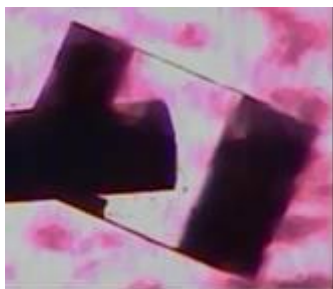
And finally the last place I will present is Nipponbashi. It's a very animated place, where you will find a lot of video games and entertainments.

Osaka is definitively a place where I have enjoyed living.

RESEARCH REPORT

1. Name: Anne Neige CALONNE	（ID No.: SP12203）

2. Current affiliation: CNRM-GAME/Centre d'Etudes de la Neige, Météo-France - CNRS

3. Research fields and specialties: Mathematical and Physical Sciences

4. Host institution: Institute of Low Temperature Science, Hokkaido University   5. Host researcher: Prof. Yoshinori FURUKAWA

6. Description of your current research   During a snowfall, ice crystals accumulate on the ground and gradually form a complex porous medium, which is constituted of air, ice and sometimes liquid water. By condensation/sublimation of the ice grains, the microstructure of this ground-lying snow undergoes diverse kinds of morphological evolutions with time depending on the external conditions (temperature ...). These transformations, called the snow metamorphism, strongly impact the physical and mechanical properties of snow. The study of the metamorphism constitutes thus an important research topic, with large implications such as the operational avalanche forecasting or climate studies. In this context, I am associated with the *DigitalSnow* project (ANR-11-BS02-009), which aims at modelling snow metamorphism in 3D using tools from digital geometry and applied mathematics. My current research consists in studying the physics involved in the snow metamorphism and, in a more experimental way, to observe and analyse the associated microstructural evolutions by using notably X-ray micro-tomography.

7. Research implementation and results under the program
 	
    Title of your research plan:
 	
    Experimental study of ice sublimation using the negative crystal method
 	
    Description of the research activities:
 	
    One of the difficulties of modelling the snow metamorphism is to simulate accurately the growth (condensation) and decay (sublimation) of ice grains. During my research at the Furukawa's laboratory, I focused on these phenomena and I carried out negative crystal experiments as described below. A negative crystal refers to the inverse of a hexagonal ice crystal, i.e. a hexagonal hole of air bounded by ice. To obtain such a negative crystal, a needle is carefully inserted into a single ice crystal. Using a specific vacuum system, an air depression (meaning an under-saturation of

water vapor) is held at the end of the needle. By this way, ice sublimates and a negative crystal grows progressively around the needle. The growth processes are observed in situ using a CCD camera and time-lapse images are recorded. Such processes are complex because it depends on temperature and water vapor content (saturation), but also vary from the prismatic faces to the basal faces of the ice crystal. To observe these dependences, we carried out the experiment at different temperatures and under-saturations, and the camera was focused alternatively on basal and prismatic faces. Our goal was to detect from images the influence of the above parameters on sublimation rate.

Picture of the prismatic (left) and basal (right) face of a negative crystal. Needle appears in black.

Picture of a needle inserted in ice and surrounded by a negative crystal.

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

I really enjoyed my stay in Japan! My research at the institute was interesting and fruitful. Prof. Furukawa and his group were very friendly and helpful to me, so I spent two months in a very pleasant atmosphere. I had the chance to visit many nice places in Hokkaido and to taste so much delicious japanese food! I enjoyed the daily life in Sapporo which is a great city. So I really would like to come back and enjoy Hokkaido also in winter!

9. Advisor's remarks (if any):

To grow a negative crystal in a single ice crystal is very delicate and difficult experiment. But she quickly learned the skill for handling the ice crystal in the cold room and for growing a nice negative crystal. She worked hard in the cold room with the temperature of -10°C (!), and obtained excellent results as she showed above. After returning home, she will analyze the data and be able to obtain evaporation rates of ice surfaces as functions of temperature and under-saturation. It must bring very fruitful results for her future research. Finally, I was very happy that I could welcome her into my laboratory. She has likable personality and puts great effort into not only the research but also the daily life in Japan. It would be wonderful that she had great experiences about the Japanese culture and habitude in spare moments from her research. It will be very nice if she has another opportunity to visit our laboratory in the near future.

RESEARCH REPORT

1. Name: Romain ESPINOSA	（ID No.: SP12204）

2. Current affiliation: Université Paris 2 Panthéon-Assas

3. Research fields and specialties:

   Social Sciences

4. Host institution: Kobe University

5. Host researcher: YASUI Hiroki

6. Description of your current research

The purpose of my PhD is to investigate the role of constitutions in current political systems from a Law and Economics perspective. To do so, I use quantitative and mathematical tools that help me to modelize individual behaviors and to figure out political equilibria of such constitutional systems.

Political games already received a strong focus in the economic literature, especially in the Political Economics and the Constitutional Economics literature. Usually, political games are considered as twofold. A first game is called political competition and deals with the behaviors of the political actors when competing for the access to power. A second game can be characterized, namely the popular attempt to control public officials. Those two common games are of course not exclusive to each other and often merge. My goal is to investigate which role the constitution plays in those two games and how it deals with the interaction of these two games.

The goal of my research in Japan was to obtain a historical perspective of the emergence of constitutions. The choice of cross-comparison between Japan and Germany is motivated by the fact that both countries experienced similar centralization processes in the 19th century but with different political outcomes. The rationale is therefore to understand the driving forces toward constitutionalism and to investigate to which extent the political outcome is determined by the ex-ante balance of social, economic and political powers.

7. Research implementation and results under the program

Title of your research plan:

Balance of Power in Centralization Processes:
A Cross-comparison of the Meiji and Bismarck Experiences

Description of the research activities:

The research activities have consisted in several steps to understand the development toward constitutionalism in both 19th century countries.

The first step consisted in looking at the political outcomes of the two new constitutional systems, namely the constitutional texts that were published after the centralization process. For Japan, I have studied the Japanese constitution and the documents preliminary to its redaction. For Germany, I have had a focus on the final German and the Prussian constitutions. I also had a look at the intermediary constitutional projects of the 19th century.

The second step consisted at looking at the political situation before the centralization process to understand which powers were reluctant to change and which of them fostered political development. In other terms, I investigated the balance of power in each country before centralization.

The third step aimed at taking into account the social changes that participated to the change of political equilibrium. The social changes were driven in both countries by the growing industrialization and the emergence of new classes.

Finally, I had a particular focus on the role that nationalism played in both countries for the development of a central state and its relationship with constitutionalist movements. The relationship was complex since nationalism was shared both by proponents and opponents to constitutionalism.

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

Kobe was a very nice city to live in and a very good place in Japan. For those who are interested in traveling in Japan during the weekends, Kobe is a perfect place: one-day trips to Osaka, Kyoto, Nara, Himeji, Arima or Koya-san are possible. Kobe down town itself is quite small such that you can do everything by bike. Finally, the international residence is very cheap.

RESEARCH REPORT

1. Name: Ariel Genadt	（ID No.: SP12205）

2. Current affiliation: University of Pennsylvania, School of Design, Architecture Department

3. Research fields and specialties:

   Architecture

4. Host institution: Tokyo University, School of Engineering, Kuma Lab

5. Host researcher: Prof. Kengo Kuma

6. Description of your current research

One of the key aspects that determine the capacity of a building to adapt to change and to integrate new technologies and materials is the way its components are assembled. The building envelope is the interface where most of the interaction with the environment occurs and is therefore cardinal to accessing a building's performance over time.

Traditional Japanese houses envelopes used a multilayered system comprising of an exposed wooden structure, storm shatters, latticework, sliding panels, and rolling blinds, all of which are made of natural, renewable resources: wood and bamboo, and assembled only with dry joints, no glue and no nails. This model of an environmentally-minded practice allows for maximum adaptability to change and ware, as well as to the change in weather over the seasons.

My research looks at traditional ways of delaminating the layers of the envelope and at contemporary practices of delamination in Japan. I suggest that there has been a cross cultural exchange in the 20th century between the West and Japan with regards to this practice, in particular with the Modern movement, and that this practice is of particular interest today for its environmentally minded aspects, as well as for the expression of an environmental design philosophy through the building envelope.

7. Research implementation and results under the program

Title of your research plan:

Delaminated building envelopes in Japan - traditional and contemporary practice

Description of the research activities:

During the 2 months in Japan I accomplished a number of goals which relate to both my academic research and future professional development as architect and lecturer. First, I studied up-close many buildings which I have only seen pictures and plans of in literature, some of these works are difficult to access.

Second, I had the chance to examine the resources at Tokyo university libraries as well as other libraries in Tokyo. My main conclusion from this part was that I will have to come back when my level of Japanese is sufficient to make use of those resources.

Third, my collaboration with the host professor and his staff, colleagues and students at Tokyo University was fruitful beyond expectations. His support for my research project was very generous and his positive spirit was always encouraging. Through a series of meetings with a colleague engineer I organized a design and build workshop with students of the school of architecture, based on an idea related to my research. Together we designed and built a tea pavilion on the school grounds, using wood, bamboo, rope and paper, assembled only with dry joints according to traditional methods from Japan and from France.

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

There were difficulties in communication, due to language, mentality differences, lack of clarity as to the organization of the lab and school. But we all learned a lot and the results were very satisfying. This program was a wonderful framework to experiment both culture and research. The freedom to set my schedule was very important for accomplishing different goals. Since there are many unknown parameters in research, especially when cultural differences come in the way, it is important to incorporate doubt into the research from the beginning, and be flexible to change and adapt quickly. I am grateful to both the JSPS and my host Prof. Kuma for having had the opportunity to collaborate at Tokyo University. Important contacts were made, and many seeds were sown, some of which I hope would grow into future collaborations and projects.

RESEARCH REPORT

1. Name: Arnaud LEVEAU	（ID No.: SP12206）

2. Current affiliation: Ecole Normale Supérieure de Lyon

3. Research fields and specialties:

  Social Sciences (Political Science)

4. Host institution: University of Kyoto, Center for Southeast Asian Studies

5. Host researcher: Prof. Junko Koizumi

6. Description of your current research

The intensity of economic relations between Japan and Southeast Asia on one side and between South Korea and Southeast Asia on the other hand raises several questions. Under the situation describes above one may wonder if the state of the Japanese studies on Southeast reflects the importance of relations between the two region and if the lack academic knowledge is not an handicap to the strengthening of the relations between South Korea and Southeast Asia. Based on the Japanese and South Korean examples one may also wonder if the scientific knowledge on a foreign country or region is related to the importance of the economic and cultural exchange? At the same time and still based on the Japanese and South Korean experiences we can wonder what are the main areas of study. How and why these areas are selected ? How theses areas have evolved over the time ? After examining the differences between the Japanese and the South Korean approaches we can finally wonder how these studies are related to the general policy conducted by the two countries in the region and how these studies can influence political and economic decision (and vice-versa).

7. Research implementation and results under the program

Title of your research plan:

A brief comparison between the Japanese and South Korean approaches on Southeast Asia : The case of Thai studies

Description of the research activities:

This work adopted several methods. First, thanks you the CSEAS library we analysed articles related to Thailand published in Japanese academics reviews as well as other publications (monographs, research report series, etc.). We also conduct interviews of senior Japanese Southeast Asianists, to reconstitute the history and the main trends of the Thai studies in Japan. These interviews had been completed by interview of South Korea and Thai Academics also present at the CSEAS. In addition to this research I was invited to participle to several colloquium and research activities held at the CSEAS. I could extend my knowledge on Southeast Asia. I could also develop an important network of contact of Japanese, South Korean, Southeast Asian and also Western experts on Southeast Asia Studies which could be important for the development of my academic career.

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

 I truly appreciate the kindness and the very   useful advices of all the Japanese colleagues I met during my stay at the CSEAS. For the next step, I'm now considering to conduct a post-doc research program focussing on the relationship between South Korea and the Philippines in collaboration with the CSEAS.

I also could enjoy a wonderful time in Kyoto. I was deeply impressed by the historical and cultural heritages of the city and its neighborhood. I tried to visit as much Buddhist Temples, Shinto Shrine, Imperial and historical palaces as possible. I couldn't spend a better summer time than the one offered by the JSPS.

RESEARCH REPORT

1. Name: Romain MOURY	（ID No.: SP12207）

2. Current affiliation: Université de Montpellier 2

3. Research fields and specialties:

   Chemistry

4. Host institution: Hiroshima University

5. Host researcher: Prof. Takayuki ICHIKAWA

6. Description of your current research

Hydrogen as energetic carrier is one of the most promising way to produce clean energy. In fact, the reduction of oxygen by hydrogen produced, via fuel cell, electricity and water. Oxygen is easily available in atmosphere, but hydrogen, even if it is the most abundant element in universe, doesn't exist in gaseous form on the earth. So it must be produced and stored, to be used. One of the most promising ways to store hydrogen is called chemical solid-state hydrogen storage. It consists to store hydrogen in materials, this hydrogen is chemically bonded and it can be restituted by a slight heating. In our laboratory we work on the synthesis, characterization and comprehension of synthesis and dehydrogenation mechanisms, of some of these materials. The first one is called metal amidoborane, recently re-discover in 2008 as material for hydrogen storage, shows a very interesting properties concerning hydrogen storage. Futhermore, we have developed in our laboratory others news material which are called metal hydrazynilborane. And we work on their structural characterization and understanding of their, synthesis and dehydrogenation, mechanisms. To perform these characterizations, we need some apparatus as powder X-Ray Diffraction (pXRD) Nuclear Resonance Magnetic, or Infra-Red (IR) for structural characterization. Concerning synthesis and dehydrogenation mechanisms, we must used thermal apparatus as Thermo Gravimetric Analysis (TGA) and Differential Scanning Calorimetric (DSC), to identify the different processes during heating of the material. But also thermolytic device to estimate capacity of our materials during heating at constant temperature for an eventual application. All of these apparatus are available in my laboratory. But to deeply determine mechanisms, we need others apparatus, as TGA coupled to Mass Spectrometer (TGMS) to determine the nature of gases during heating. Gas Chromatography (GC) which serves to determine gases nature and quantify it during heating at constant temperature. So if we can identify gases production during heating or reaction and associate these results to other structural results obtained after heating, as in-situ IR, ex-situ NMR and pXRD, we should be able determine these mechanisms.

7. Research implementation and results under the program

Title of your research plan:

Characterization and mechanisms determination for news material for hydrogen storage.

Description of the research activities:

I went to my host institution with two news materials for hydrogen storage. An as I said before, with the need to obtain more information on my material to fully describe it. With their TG-MS I was able to identify the nature of the gases during heating. With GC measurement, I could identify the different steps of the synthesis of one of my material during increasing of the temperature. An also identify and quantify the gases emitted during synthesis, so I could, by this way, find the reaction equation of my material. Furthermore, I have also performed GC analysis during heating at constant temperature and identify the nature of gases. Pressure measurement during heating at different constant temperature allowed me to determine the dehydrogenation and synthesis kinetic for these materials. By comparing these results with structural results obtained after heating (pXRD, *in-situ* IR and NMR), I will be able to determine the dehydrogenation mechanism of the materials. Parallel to these works, I tried to synthesis another material recently published, by using all their devices for mechano-chemical synthesis. Unfortunately, all my tried were unsuccessful.

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

Working in a Japanese laboratory with different approaches concerning work was the best professional experience for me during my PhD thesis. Furthermore, be immersed in Japanese custom was very fulfilling, and learnt me a lot concerning life.

RESEARCH REPORT

1. Name: Marine PERRIER	（ID No.: SP12208）

2. Current affiliation: University of Montpellier 2

3. Research fields and specialties: Chemistry Sciences

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

5. Host researcher: Dr Shuhei Furukawa

6. Description of your current research

Multifunctional nanoparticles represent a class of nano-materials that combines several specific properties, such as mechanical, electronic, optical, and magnetic in a single nano-object which is capable of exhibiting diverse physical responses when subjected to certain external stimuli. For biomedical applications, multifunctional nano-objects are able to combine two or more functions, such as different type of imaging or imaging with drug delivery, targeting, or various therapies. One of the most promising multifunctional nano-objects should present a combination of magnetic and optical properties within a single hybrid nano-system in order to combine luminescence biolabelling and Magnetic Resonance Imaging (MRI).

Very recently, nanoparticles of molecule-based materials as a new type of magnetic inorganic nanoparticles were explored. These nanoparticles present an increasing interest due to their specific nature, which is different in comparison to other inorganic nano-objects. The research group at the Institute Charles Gerhardt from the University of Montpellier where I am conducting my research possesses strong experience in the elaboration of cyano-bridged coordination polymer nanoparticles and their evaluation as new contrast agents and biolabels. The aim of the work done as part of my PhD thesis is to develop a new approach to the synthesis of ultra small magneto-luminescent coordination polymer nanoparticles designed from cyanometallates building blocks and lanthanides ions which can be considered as a new family of bi-functional probe for MRI and optical imaging. This approach is based on an association of luminescent Ln^{3+} and paramagnetic Gd^{3+} ions with paramagnetic cyanometallates building blocks in order to obtain magneto-luminescent cyano-bridged core of nanoparticles stabilized by various biocompatible polymers or ligands. This PhD research work concerns the synthesis of the cyano-bridged coordination polymer nanoparticles, their characterization using various

techniques, the study of their magnetic and luminescent properties, the measure of their efficiency both as contrast agents for MRI and as biolabels both *in vitro* and *in vivo*.

7. Research implementation and results under the program

Title of your research plan:

Elaboration of new hybrid materials at the nanoscale combining nano-MOFs and cyano-bridged coordination polymer nanoparticles.

Description of the research activities:

The aim of the present project is to combine the expertise of both groups in Montpellier and Kyoto to develop new hybrid materials at the nanoscale combining nano-MOFs and cyano-bridged coordination polymer nanoparticles

This project is at its first stage of very fundamental approach which aims at exploring the possibility to incorporate or grow on MOFs, cyano-bridged coordination polymer nanoparticles.

First, I have tried to find the best MOFs compound for elaborating the new hybrid materials. Thanks to strong knowledge of my host institute in this field, we found it.

Now, I'm going to elaborate the hybrid compound (MOFs/cyano-bridged coordination polymer) changing different parameters in order to find the best properties.

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

My host institute including labmates and boss were very nice with me. The team is international, so everybody speaks English. The team integrated me immediately, and I spend very good time to discover Kyoto with them. The experience of two months in Kyoto was amazing; I discovered new food, new culture, and new religion. And I had time for visiting other cities of Japan.

RESEARCH REPORT

1. Name: Thomas SAUVAGE	（ID No.: SP12209）

2. Current affiliation: University of Louisiana at Lafayette

3. Research fields and specialties: 　　Biological Sciences

4. Host institution: University of the Ryukyus   5. Host researcher: Prof. Shoichiro SUDA

6. Description of your current research

　　My research focuses on the genetic diversity of siphonous green algae assigned to the genera *Ostreobium* and *Pseudochlorodesmis* (Bryopsidales). These marine algae colonize calcium carbonate as primary habitat and are thus found growing within coral skeletton (below the animal tissue, for *Ostreobium* specifically), mollusk shells or rubbles (for *Pseudochlorodesmis* particularly). Both genera are ubiquitous in coral reef ecosystems, but easily overlooked due to the specificity of their habitat and their diminutive size. Despite their critical importance as key primary producers and bioeroders, their   diversity, physiology and phylogeny has been very little studied. For instance, the exact nature of the association of *Ostreobium* with corals is poorly understood.

　　My main interest lies in the evolutionary relationships of siphonous green algae, and how simple diminutive genera relate to the more conspicuous, larger and morphologically complex genera (e.g. *Codium*, *Halimeda*, *Caulerpa*) found in 10 families. Preliminary investigations revealed that *Ostreobium* and *Pseudochlorodesmis* exhibit a tremenduous genetic diversity, potentially encompassing multiple undescribed families. More particularly, it appears that families with larger, more complex morphologies evolve multiple times from simple diminutive ancestors. In this context, it is important to further characterize the breadth of genetic diversity of *Ostreobium* and *Pseudochlorodesmis* spp., in order to better reconstruct patterns of diversification and evolutionary histories in the whole order Bryopsidales. For this research, I try to sample at multiple tropical locations to assess comprehensively the diversity of this group of marine algae. Several biodiversity hotspots are known for the Bryopsidales, such as Australia/Australasia, southeast Asia and the Gulf of Mexico/Caribbean, and thus represent prime study areas for my investigation.

7. Research implementation and results under the program

Title of your research plan:

A genetic exploration of siphonous green algal species in the Ryukyu Islands, with a focus on the genera *Ostreobium* and *Pseudochlorodesmis*.

Description of the research activities:

Thanks to the JSPS program, I was able to explore numerous coral reefs in the Ryukyu Islands for my research. Several trips were organized, at Okinawa main island, Ishigaki-Iriomote, and Miyako island. During these travels, my work was greatly facilitated by two graduate students of the host laboratory, who accompanied and guided me throughout the islands, while conducting their own sampling. Field work was carried on at multiple sites, with collections focused on coral species harboring *Ostreobium*, and rubbles exhibiting patches of *Pseudochlorodesmis*. Numerous other genera and species of the larger Bryopsidales (e.g. *Caulerpa*, *Codium*, *Halimeda*) were also gathered to provide phylogenetic context for this project. Upon collections, *Ostreobium* and *Pseudochlorodesmis* samples were brought back live to the laboratory and processed for culturing, in order to establish clean starters for genetic assessment. This step consisted in the careful examination of specimens under the dissecting scope to isolate different strains, followed by their transfer into enriched seawater media, and subsequent bi-weekly subculturing. The last two weeks of the program were devoted to molecular work, which included DNA extraction and amplification for two genes commonly used in genetic assessment of the green algae. Amplified genes were outsourced for sequencing and results will soon be made available for phylogenetic reconstruction, species delimitation, and overall diversity assessment.

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

I feel very lucky to have spent my internship in Okinawa and visit breathtaking places of the Ryukyus during my research activities on tropical marine algae. My experience could not have been any smoother, every member of the laboratory was really helpful getting me set up for my project, with continued assistance throughout my internship. I quickly felt integrated among my laboratory mates, and particularly appreciated the team spirit in the Japanese work environment. I am very thankful to my host for his support and help in planning my research project ahead. Overall, a rich and productive experience in Japan, with lots of potential for international fellows. Lastly, make sure to bring your favorite slippers to Japan, at home like at work, shoes stay at the front door ☺

RESEARCH REPORT

1. Name: Cédric WEILAND 　　　　　　　　　　　　　（ID No.: SP12210）

2. Current affiliation: Laboratoire de Physique Théorique, Université Paris Sud 11

3. Research fields and specialties:

    Mathematical and Physical Sciences

4. Host institution: Kavli Institute for the Physics and Mathematics of the Universe, Todai Institutes for Advanced Studies, University of Tokyo

5. Host researcher: Prof. Hitoshi MURAYAMA

6. Description of your current research

Complementarity of direct and indirect searches of New Physics scales

It has been known for more than twenty years that different flavours of neutrino transform into each others when propagating in vacuum or through matter. The neutrinos being neutral leptons, this phenomenon corresponds to neutral lepton flavour violation. It also implies that neutrinos have a non-zero mass. However, the Standard Model of Particle Physics cannot account for these masses. Minimal extensions of this model like the seesaw mechanisms can easily accommodate it. But their contributions to flavour violation for charged leptons, namely the electron, the muon and the tau, are usually very small. Moreover, the Standard Model suffers from other shortcomings. One of those is the hierarchy problem which requires fine-tuning in the cancellation of different contributions to get the proper Higgs boson mass. Different ideas have been introduced to solve that problem, supersymmetry being one of the most favoured ones. When seesaw mechanisms are embedded in a supersymmetric framework they can generate large contributions to lepton flavour violating observables, well within experimental reach. As a graduate student at the University of Paris-Sud 11, I am currently working on supersymmetric extensions (MSSM, NMSSM) of the inverse seesaw mechanism and their signatures at high energy experiments, like the LHC, and at low energy experiments, like MEG or Belle II. This has already allowed us to put constraints on different parameters of the models and to propose ways to further test them at future experiments. We also found that the phenomenology of the supersymmetric inverse seesaw is quite specific with lepton flavour observables   dominated by the Z-penguin contributions. Surprisingly, these contributions also exhibit a non-decoupling behaviour where a large increase in the energy scale of supersymmetry only decreases the cross-sections by a small factor. Thanks to being a JSPS summer fellow, I was able to present those results at Neutrino 2012, a major biennial conference in my field that was held in Kyoto in June.

7. Research implementation and results under the program

Title of your research plan:

Next-to-Minimal Supersymmetric Standard Model with Scherk-Schwarz supersymmetry breaking

Description of the research activities:

This work is an extension of the one done by Prof. Murayama and his collaborators in a recently released article (arXiv:1206.4993) . The Scherk-Schwarz mechanism is a way of breaking symmetries by dimensional compactification and the use of boundary conditions. Here, we start with an effective theory which corresponds to the 5D formulation of the NMSSM. The gauge and matter fields can propagate in the spatial extra-dimension while the Higgs sector and the Yukawa couplings are restricted to the 4D brane that we access in our everyday life. Physics on the 4D brane can be described by an effective theory where fields propagating in the extra-dimension corresponds to extra particles know as Kaluza-Klein towers. Breaking supersymmetry in this way gives a model with very few parameters and a specific particle spectrum. During the time spent at IPMU, I was able to derive the tree-level mass spectrum and parts of the Lagrangian describing the theory. After my return   to France, we hope to pursue that collaboration by calculating loop corrections and experimental signatures.

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

I would like to thank Prof. Murayama and the people from IPMU for their warm welcome. Working in Japan this summer has been an amazing experience. I had the opportunity to take Japanese lessons at IPMU and have scientific and cultural exchanges with other researchers and Japanese students. I was able to discover traditional Japanese arts like kabuki or gagaku. Going to music festivals and fashion exhibitions, I have also been very impressed by the artistic vitality of contemporary Japan.   I enjoyed very much visiting temples and shrines in Kyoto, Nara, Tokyo or Kamakura. One of the highlights of those trips was a discussion at 7am with a Japanese man while waiting for the doors of the Engaku-ji to open during the annual Zen summer course.

9. Advisor's remarks (if any):

Cédric Welland is actively studying the origin of neutrino masses and their possible experimental consequences.   After he came to Kavli IPMU, I got him involved in studying collider signatures of a new theory of supersymmetry I had proposed recently. Even though the subject was not very close to what he had studied before, he quickly got on board, understood the concept, replicated the known results, and started to look into new predictions.   In addition, he was actively interacting with our members as well as fellow summer students.   He was an impressive summer student.

RESEARCH REPORT

1. Name: Shoh Michael ASANO	（ID No.: SP12301）

2. Current affiliation:　Technical University Munich

　　　　　　　　　　　　Max Planck Institute of Biochemistry

3. Research fields and specialties:

　　Chemistry, Biological Sciences, Interdisciplinary and Frontier Sciences

4. Host institution:　The University of Tokyo, Department of Cellular Neurobiology

5. Host researcher:　Prof. Shigeo OKABE

6. Description of your current research

My current research in Germany is conducting structural studies of synapses.

The methods used in our lab of Prof. Baumeister at the Max Planck Institute of Biochemistry are broad in range, spanning from simple biochemical assays to highly complex experiments involving a combination of state of the art technologies, such as cryo-electron tomography, correlative microscopy and/or focused ion beam milling.

Our group within the laboratory is led by Dr. Vladan Lucic and is concentrating on the ultrastructure within synapses. My work is determining the structural configurations and their roles involved in basic synaptic processes. Applications of pharmaceutical treatments are done to visualize effects on the fragile synaptic architecture.

With our current setup, we are able to image synapses in an (cryo) electron microscope with a resolution of less than 3 nm, far better than any light microscopic approaches. The drawback of such resolution is the (necessary) fixation of the sample. Thus, by definition, it is not possible to see any living tissue with this technique. It is therefore necessary to work with both techniques in order to get closer to the full biological picture.

7. Research implementation and results under the program

　　　Title of your main research plan:

　　　Learning advanced techniques in culturing neurons and fluorescence microscopy

Description of the research activities:

By observing all the steps more than a few times, I was able to do my own preparation, including dissection and specimen removal. Prof. Okabe's lab was very generous with providing the animals and tools, so I was able to develop my skills on a weekly basis.

Transfections of neuronal cultures were done with the Ca-Phosphate technique, which was easy to learn and adapt and yielded in constant transfection rates throughout my stay.

I was able to learn fluorescence microscopic techniques on machines equipped with the latest innovations, like total internal reflection (TIR) or two-photon (2P). I was very lucky being allowed to conduct microscopy studies on my own on an almost daily basis.

My samples were "self-made" and were transfected with a newly developed compound from a collaborator of Prof. Okabe. A good portion of my time here I spend my time in investigating the intensive kinetic studies on the compound and was able to find interesting results within this short timeframe, which might be used in a scientific paper.

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

Climbing Mount Fuji was fun, so were karaoke with the group (Prof. Okabe is very talented!) and other events, like the summer fireworks. But due to my history with Japan, I was aware of most touristic places, so I spend my Sundays mostly cycling around Tokyo, meeting friends and/or colleagues.

9. Advisor's remarks (if any):

Dr. Asano is a talented and well-motivated student and effectively organized his short stay in my laboratory. We initially planned to carry out two types of experiments, one is the biochemical purification experiment combined with structural biology and the other is imaging study of neuron culture preparations. In both directions he has been quite successful during his stay. Although the cell biological techniques required for the latter experiment were new to him, he quickly acquired necessary skills and even obtained interesting results with new probes. I believe his stay in my laboratory has been mutually beneficial and will lead to further collaboration in future.

RESEARCH REPORT

1. Name: Andreas Finke	（ID No.: SP12302）

2. Current affiliation: Heidelberg University

3. Research fields and specialties:

 Mathematical and Physical Sciences

4. Host institution: Tokyo University of Science

5. Host researcher: Prof. Shinji Tsujikawa

6. Description of your current research

One class of approaches to explain the accelerated expansion of the universe consists of models of modified gravity. A new proposal is C-Gravity, which can interpolate between the much-studied Metric f(R) and Palatini f(R) modified gravity. It was originally motivated by cosmology in this spirit. But the interest is not restricted to phenomenology. From a fundamental viewpoint, C-Gravity is valuable: In General Relativity (unmodified gravity) the equations can be obtained from extremizing a functional which has the geometric interpretation of measuring curvature of spacetime. To this end a mathematical tool, the connection, is employed. Usually one makes the assumption that it is equivalent to a special connection with some physical meaning that arises elsewhere. In C-Gravity the setting is generalized, allowing for models with recursively curvature dependent departures from the standard connection after specification of two free functions. Such theories could be effectively describe yet unknown theories of quantum gravity and their study is valuable in learning about the latter. Interestingly, cosmology now can again be used to put observational bounds on the theories. Since this should be done for the general, meta-theoretical C-Gravity setting before specification of the functions, the mathematical analysis is a delicate issue.

7. Research implementation and results under the program

 Title of your research plan:

 Modified Gravity approaches to Dark Energy

Description of the research activities:

Using the field equations and their cosmological specialization in C-Gravity I derived earlier I found that the accelerating deSitter solution (sourced externally) and the radiation dominated epoch are stable. There is no genuine source for acceleration, though. Late time modification requires introducing a mass scale of the size of the Hubble constant, not solving the cosmological constant problem.

The work of another student on inflation inspired me to start studying the high energy limit of C-Gravity in addition to the Dark Energy scenario. This is work in progress, the next step being quantizing the free curvature field. Furthermore, from the newest observational data I got to know while staying here and discussions I now believe strongly in a cosmological constant being the Dark Energy and got interested in approaches to solving the related problems by invoking holographic and entropic arguments and taking the viewpoint that gravity is an emergent phenomenon. I spent a considerate amount of time learning about these things and want to pursue work in this direction in the future.

In this field, usually no equipment apart from office space and computers is required. Both have been provided to me in a generous way, creating the most convenient environment imaginable. The motivation of my Japanese colleagues has worn off on me and made me stay longer than usual, some days even into the early morning, not creating a problem with the guest house two streets away. I enjoyed having lunch with Prof. Tsujikawa almost daily and discussions with lab members. I got to know two young Japanese cosmologists giving talks in our lab, one of which recently became Director of a Max-Planck Institute in Germany, and could take part in lessons given by a post-doc of the group. All the time I was independent in my work and could profit and learn much.

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

I had an amazing time living in Tokyo and traveling in the area. As least as much as scientifically, I may profit character-forming-wise from this program (of course, the academic outreach can not be estimated at this point and may prove to be enormous). The experience of being a foreigner is not always easy but very valuable. I made some friends where I expect the contact to stay alive even when I am back.

RESEARCH REPORT

1. Name: Martin FISCHER	（ID No.: SP12303）

2. Current affiliation: I. Physikalisches Institut, Justus-Liebig-Universität Gießen

3. Research fields and specialties:

    Mathematical and Physical Sciences

4. Host institution: Research Center for Integrated Quantum Electronics, Hokkaido University, Sapporo

5. Host researcher: Associate Professor Shinjiro Hara, Ph.D.

6. Description of your current research

Research on magneto-electronic devices is of major interest for future applications. In comparison to common semiconductor-based devices, conventional metal/oxide based device structures exhibit different functionalities due to the exploration of collective magnetic phenomena e.g. creating miniaturized switchable devices by using magneto-resistance effects.

Manganese arsenide nanocluster arrays are promising building blocks for new, highly miniaturized magnetic field sensing devices, as they are used e.g. in non-volatile storage media. The layered structure of common sensors limits the further miniaturization potential and restricts the easy integrability into planar structures. With the use of a new, bottom-up growth based sensor arrangement production, the possibilities for further miniaturization and integration of magneto-electric components can be widely enhanced.

My current work is focused on the investigation of magneto-electric properties of single MnAs nanoclusters and nanocluster arrays of different shapes, sizes and arrangements. Therefore, the conductivity of the nanostructured samples is measured in high magnetic fields up to 10 T with varying orientation relative to the clusters, and at different temperatures between 1,6 K and 280 K.

The MnAs nanoclusters are produced by selective-area metal-organic vapor-phase epitaxy (sa-MOVPE), which allows one to design and control the shape, size and position of the clusters very exactly. This technique is based on a SiO_2 mask structure, generated by electron beam lithography, which defines the areas for the clusters to grow on. The growth is performed in a MOVPE process.

The sa-MOVPE technique, as well as the high-resolution contacting lithography, is carried out at the Research Center for Integrated Quantum Electronics in the group of Prof. Hara.

7. Research implementation and results under the program

Title of your research plan: Development and Production of new-fashioned Manganese arsenide nanocluster arrays

Description of the research activities:

The starting point of my research consisted on the development of new mask structures for the nanocluster growth. Based on our experience in the measurements on the previous MnAs nanocluster series, I developed three new structure patterns, containing interesting new geometries and enhancing the number of involved clusters in one array. All structure patterns were created with six different cluster distances from 30 nm to 200 nm, to vary the merging grade between the clusters. Those arrays were formed into a SiO_2-mask layer on a semi-insulating GaAs(111)B-substrate, using a physical etching step. The MnAs growth step was modified to achieve a better controlled cluster shape. This could be reached by a slight variation of the growth temperature. Due to the better controlled shape of the clusters, the marks for the alignment of the contact lithography were also grown in a better shape, which however turned out to show a very poor contrast during the mark detection process. This issue could be solved by adapting the mark detection parameters.

After my participation to the JSPS Summer Program 2012, I am glad to be able to take several very interesting and promising samples with me. We succeeded in creating the desired, new structures, as well as in improving the growth parameters and the contacting procedure of the nanoclusters.

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

This Summer Program turned out to be an amazing experience for me both as scientist and human being. I learned to carry out the central procedures to create the samples i use for my work, including the use of a high-end electron-beam lithography system and the insight into the very exciting field of MOVPE crystal growth. Besides this, I could experience the breathtaking Japanese culture and a beautiful country. My highest thanks go out to Hara-sensei to make this unforgettable experience possible, and to all colleagues at the RCIQE for their helpfulness.

RESEARCH REPORT

1. Name: Nicole Hartig	（ID No.: SP12304）

2. Current affiliation: University College London (UCL Cancer Institute)

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Kobe University

5. Host researcher: Prof Yasuhiro MINAMI

6. Description of your current research:

  Cancer is the second leading cause of death and affects one in three people.　My research focuses on Ras proteins, which are found mutated in about 30% of human tumours.

During my PhD studies I was able to identify and characterize a novel interaction between Ras subgroup members (R-Ras) and Wnt-Planar Cell Polarity (PCP) protein Vangl1 as a novel R-Ras effector protein.

  The PCP pathway coordinates complex cell migration processes during development and perturbations in the PCP pathway contribute to the pathogenesis of a variety of diseases including cardiac and neuronal tube defects, cilia based disorders and invasiveness of cancer cells.

I order to confirm Vangl1's conserved role in polarity, I performed biological assays that show that Vangl1 and R-Ras are critically required in migration. Furthermore, certain Frizzled (Fz) receptors cooperate with the Ror2 tyrosine kinase to selectively stimulate Vangl1 function and possibly activate R-Ras GTPases.

  In conclusion, the identification of Vangl proteins as novel effectors of R-Ras GTPases provides an exciting new link between Ras signalling and the Wnt-PCP pathway regulating cell migration and invasion.

7. Research implementation and results under the program

Title of your research plan:

Investigation of R-Ras and Vangl1 involvement in Wnt-Planar Cell Polarity signalling

Description of the research activities:

During my research period at the Kobe University I employed biological readout systems and explored existing methods of Wnt-PCP pathway activation in order to analyse if reduced Vangl1 or R-Ras level (RNAi techniques) have an effect on a Wnt ligand or Ror2 induced biological responses.

Therefore I used NIH3T3 cells and investigated Wnt5a dependent migration (wound closure assays) or employed mouse L cells to test if Vangl1 or R-Ras have an effect on Ror2 induced filopodia formation.

In addition, I studied using the osteosarcoma cell line Saos2, if changes in Vangl1 or R-Ras expression alter invadosome formation (matrix-degrading cell adhesions) using Alexa-gelatin degradation assays. In this experimental setup, I was also able to monitor metalloprotease 13 expression levels in R-Ras or Vangl1 manipulated samples (qRT-PCR method).

Besides bench work, I participated in weekly lab meeting to show and discuss obtained results.

Moreover, we plan to investigate Wnt ligand dependent integrin activation and potential links between R-Ras and Ror2 in the future as a collaborative effort.

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

I enjoyed my time in Japan very much and I would like to express my highest gratitude to Prof Yasuhiro Minami and all the lab members, who welcomed me warmly and made my stay in Kobe an unforgettable experience. I was able to learn about Japanese culture and history on various occasions like lunch and dinner invitations (restaurants and private homes), sightseeing with lab members and various lab outings and parties. Furthermore, we plan to establish a strong collaboration between the Minami laboratory in Kobe and my home laboratory at the UCL Cancer Institute.

RESEARCH REPORT

1. Name: Thomas Helten	（ID No.: SP12305）

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

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: Graduate School of Media and Governance, Keio University

5. Host researcher: Prof. Yuji OHGI

6. Description of your current research

In the last months, I have researched on motion analysis and classification problems within a specific sports application. Here, I considered the scenario of trampoline motions, where an athlete performs a sequence of predefined trampoline jumps. Each jump follows certain rules and belongs to a specific motion category such as a pike jump or a somersault. Then, the classification problem consists in automatically segmenting an unknown trampoline motion sequence into its individual jumps and to classify these jumps according to the given motion categories. Since trampoline motions are very fast and spacious while requiring special lighting conditions, it is problematic to capture trampoline motions with video and optical motion capture systems. Inertial sensors that measure accelerations and orientations are more suitable for capturing trampoline motions and therefore have been used for this project. However, inertial sensor output is noisy and abstract requiring suitable feature representations that display the characteristics of each motion category without being sensitive to noise and performance variations. A sensor data stream can then be transformed into a feature sequence for classification. For every motion category, a class representation (or in our case, a class motion template) is learned from a class of example motions performed by different actors. The main idea is to locally compare the feature sequence of the unknown trampoline motion with all given class motion templates using a variant of dynamic time warping (DTW) in the comparison. Then, the unknown motion stream is automatically segmented and locally classified by the class template that best explains the corresponding segment. Extensive experiments have been conducted on trampoline jumps from various athletes for evaluating various feature representations, segmentation and classification.

7. Research implementation and results under the program

Title of your research plan:

Classification of walking motions using low-dimensional inertial sensor input.

Description of the research activities:

During my stay at Keio University I was able to test my classification algorithms in the context of a realistic application scenario. To this end, we considered several kinds of walking motion conducted on land and in water that are typically performed in rehabilitation scenarios. The goal was to automatically detect which motions were performed by the patient using only very sparse acceleration data coming from one chest mounted sensor. This information can then be used to give a patient feedback about the effectiveness of the conducted training. It turned out, that my algorithms were not directly applicable to the indented application and I had to use a different approach to solve the task. But first experiments showed that the current approach is promising and I will continue the research when I return. In addition, we plan to publish results in a joint publication.

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

During my stay in Japan I was given the opportunity to stay at the houses of several Japanese families, this gave me an interesting insight into the daily living in Japan. Also, these families introduced me to various kinds of Japanese food and weekend activities. Furthermore, I was able to practice my Japanese language skills in practical situations.

RESEARCH REPORT

1. Name: Nina Holzschneider	（ID No.: SP12306）

2. Current affiliation: M.A. Student at Ruhr-University Bochum, Germany

3. Research fields and specialties: Humanities (Japanese History)

4. Host institution: University of the Ryukyus

5. Host researcher: Prof. Kurayoshi TAKARA

6. Description of your current research

After the kingdom of Ryûkyû was transformed into Ryûkyû-han in 1872 and then became full part of the Japanese national state in 1879 by transforming the *han* into Okinawa-ken, there were many of the inhabitants of the islands of the former independent kingdom who had ideas and visions for the future-position of Okinawa. Some tried to strengthen the relation with China and to reverse the prefecture into the kingdom once again. This group was labeled *gankotô* ("stubborn-group") but it was only until the Sino-Japanese War of 1894/95 that this group had political influence. The other group, which was labeled *kaikatô* (group of enlightenment), consisted of those, who favored Okinawa being part of Japan – but they had many different visions of how this should take place. Jahana Noboru belongs to the *kaikatô* and in my opinion he is an excellent representative for one of the many viewpoints that existed in this group. For once, he introduced the ideas of *the jiyû minken undô* (movement for freedom and peoples rights) to Okinawa and thereby nurtured the ideas of those who tried to encourage the position of the peasantry and non-elite social sphere. Another point that makes him a very interesting person for closer research are his frequent proposals to the Meiji-Cabinet by which he tried to push trough with his political goals, since the governor of Okinawa was reluctant to those. Jahanas political "opponent" – Narahara Shigeru – is an ambiguous person when it comes to value his role in the modernization of Okinawa. He is either depicted as the one who brought all important reforms to Okinawa or on the contrary the one who tried to halt these reforms as long as possible. His position between the Meiji-government and the people of Okinawa and the fact that there was no instance who controlled his work makes a closer look at his role not only interesting but almost necessary if one is to fully understand the process of modernization in Okinawa in the late 19th century.

By comparing Jahana and Narahara I want to get away from the simple dichotomy of the developing Nation state that is assimilating the – help- and idealess – periphery. This is likely to be the result when you take the two entities "Japan" vs. "Ryûkyû/Okinawa" for comparison. Another reason is that I want to shed light on the political gray area that existed between the Meiji government and the governor of Okinawa as well as between the governor and the people of Okinawa. By doing that I hope to show to which extent people like Jahana Noboru could participate in and actually contribute to the building of the prefecture.

7. Research implementation and results under the program

Title of your research plan:

Visions and Plans on the Okinawan Prefecture in the latte 19th Century

Description of the research activities:

During my stay in Okinawa I had several meetings with my supervisor Professor Kurayoshi Takara and his colleague Professor Hiroyuki Shiode in order to select the necessary literature and sources as well as to discuss the focus of my master thesis. I also received very helpful advice from Mr. Hitobumi Anzaki and Mr. Shinichi Isa, who are both conducting research on Jahana Noboru. Next to research in the library of the University of the Ryukyus, I collected literature and sources in the prefectural library of Okinawa and the municipal library of Uruma-town. My research activities included a field trip to the island of Miyako in order to search for sources related to a peasant uprising in the 1890's, which was initiated by Jahana Noboru.

My research was very successful since I found more material than I expected. Due to the support of my supervisor and my Tutor Akiko Yamashiro I was also able to copy some 19th century sources that will help me deepen my understanding of the way Jahana Noboru and other intellectuals thought about Okinawa. Most of the material I was able to collect is not available outside of Okinawa which is the reason why I had to renew my view on certain parts of my thesis.

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

When it comes to studies on the history of Okinawa it is necessary to conduct the research at least partly in Okinawa. One reason is that many studies are only published by okinawan publishers and these books are usually not available outside of Okinawa. Another reason is that since many of the historians who are conducting research on okinawan history are also working in Okinawa in order to get an insight into the present research it is necessary to stay in Okinawa.

RESEARCH REPORT

1. Name: KOREN István	（ID No.: SP12307）

2. Current affiliation: Master Student

3. Research fields and specialties:

   Computer Science

4. Host institution: Shizuoka University, Faculty of Informatics, Ishikawa Laboratory

5. Host researcher: ISHIKAWA Hiroshi and YOKOYAMA Shohei

6. Description of your current research

Before coming to Japan, I worked on creating a framework for collaborative applications on mobile devices. The goal is to enable mobile app developers to easily include collaborative features like messaging, shared document editing and file sharing to their apps. By having a common base for these features over a wide variety of applications, also protocol settings may be analyzed and improved in future.

Especially, my latest work was about including various types of devices to a common collaborative space in order to enable interaction over device borders. To achieve our goals, standards like XMPP and HTML5 were used. XMPP as a protocol standard is also used by Google Talk and Facebook to power their respective instant messaging services.

7. Research implementation and results under the program

   Title of your research plan:

   Dynamic Configuration of a Tiled Display Surface over XMPP

   Description of the research activities:

   While the original research plan for my time at Shizuoka University in Japan included using the existing Tiled Display Wall of Ishikawa Lab, upon my arrival at Hamamatsu, we decided to conduct a modified version of the planned research on an array of tablet computers running on the Android operating system. The portability of tablet computers in contrast to the matrix style fixed layout of the 4x4 High Definition (HD) monitors allows a dynamic arrangement of multiple displays, which is a highly interesting research topic especially when thinking about today's wide availability and adoption of tablet computing technology with products like the Apple iPad and Google Nexus 7. We wanted to create a way to dynamically link

tablets so that a high-resolution image could be displayed on the entirety of all, independent of the resolution of the particular displays. In addition, the touchscreen of tablet computers allows user interactivity beyond the mouse and keyboard based interaction possibilities of the Tiled Display Wall.

The concrete time plan was as follows. First, I conducted a small evaluation of mobile device browsers to check their implementation status of the HTML5 standard. Then, the source code of the Tiled Display Wall was modified to support devices with varying resolutions. Finally, based on my previous work at Technische Universität Dresden in Germany a new prototype software was developed to be able to use the XMPP communication protocol for device-to-device messaging.

The final research outcome of my stay in Japan within the JSPS Summer Program 2012 is a flexible framework for apps that stretch over the displays of multiple devices. Therefore, the displays need first to be layed out on a table. Second, neighboring devices are linked by a pinch gesture to register their proximity to each other in the system. Finally, the system calculates the position of each tablet within a global coordinate system. The framework created can now be used for further research topics whereof enabling gestures over multiple touchscreen devices seems to be the most promising one.

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

What encouraged me the most to enjoy Japanese culture and sightseeing was the large community of JSPS fellows in Facebook both within the particular country groups as well as the overall group. A lot of helpful tips were posted and it was easy to organize joint trips.

Unfortunately as the lab working hours were exceptionally long compared to those of Germany, I was not really able to strengthen my skills in Japanese language.

RESEARCH REPORT

1. Name: Christian E. MAYR	（ID No.: SP12308）

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

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: Kyushu University

5. Host researcher: Prof. Chihaya ADACHI

6. Description of your current research

My research project focuses on the enhancement of light outcoupling efficiency of organic light-emitting diodes (OLEDs) which is reduced especially due to energy dissipation to surface plasmons (SPs) by their excitation at the interface to the metallic cathode. Even though there are possibilities to outcouple a fraction of the light coupled to SPs by using a prism, a grating, high-index substrates or index-coupling approaches, these methods are complicated to establish and expensive. The orientation of molecules in films used in OLEDs has a huge effect on the coupling to SPs. Numerical simulations show that a horizontal molecular orientation with respect to the substrate can enhance the efficiency by up to 50%. This approach offers the possibility to enhance light-outcoupling by using inherent properties of the molecules without the use of any external means.

An expeditious method to determine the orientation of the transition dipole moment of molecules has been developed using angular dependent photoluminescence spectroscopy. By comparing measurement with simulation, the orientation can be quantitatively determined. The method can be applied to different fluorescent and phosphorescent emitters in order to gain a deeper understanding of OLEDs and possibilities to enhance light outcoupling. Understanding the origin of molecular orientation and developing ways to actively influence the degree of orientation are major topics under investigation.

7. Research implementation and results under the program

Title of your research plan:

Efficiency enhancement of organic light emitting diodes (OLEDs) by control of molecular orientation

Description of the research activities:

My research visit was aiming at the efficiency enhancement of OLEDs by controlling the molecular orientation of the molecules in the emitting layer. At the beginning of my study many different and novel molecules in guest/host-systems have been screened for orientation effects and a couple of promising candidates have been chosen for closer investigation. The host molecules were investigated by using ellipsometry and the guest by using photoluminescence measurements. By applying a special treatment to the investigated emitting layers, changes of the orientation have been found. By investigating both, the guest and the host molecules, the change of the orientation could be addressed to the guest molecules.
The implementation of these results in OLED structures and their characterization is still under investigation.

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

I am very grateful for receiving the possibility to go to Japan under the JSPS-Summer Program. I also want to thank Prof. Adachi for hosting me at his excellent laboratory. The time in Japan was an unforgettable experience for me and I hope I can come back to Japan in the future!

RESEARCH REPORT

1. Name: Michael OEHL	（ID No.: SP12310）

2. Current affiliation: Leuphana University Lueneburg & Berlin Institute of Technology

3. Research fields and specialties:

   Social Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Prof. Dr. Taro KANNO

6. Description of your current research

Since cars are becoming increasingly computerized, my current research focuses on emotional interfaces in cars. Researchers and manufacturers are still facing severe problems of detecting the drivers' emotional state reliably. Once we will have understood driving anger and driving anger expressions of Japanese drivers, we will address this issue in a second step after the JSPS Summer Program 2012. Therefore, we will convey our previous and current research on intelligent Human-Machine Interfaces (HMI; Kanno, Nakata, & Furuta, 2003; 2006; Oehl, Siebert, Tews et al., 2011; Siebert, Oehl & Pfister, 2010; Tews, Oehl, Siebert et al., 2011) to develop emotional HMI for Japanese drivers.

7. Research implementation and results under the program

    Title of your research plan:

   Driving Anger and Driving Anger Expression of Japanese Drivers

    Description of the research activities:

    Although general car safety has increased progressively and the safety of road environments has been improved, the number of traffic accidents in Japan is still remaining alarmingly high. Traffic psychological research has shown that emotions leading to maladjusted driving behavior are main contributors to traffic accidents. Despite this evidence, it is currently far from clear to what extent emotions are influencing driving behavior in Asian countries like Japan. In many western countries anger or more precisely driving anger, as a more frequent and intense anger while operating a motor vehicle, was found to correlate significantly with risky and aggressive driving behavior leading to a higher probability of getting involved into traffic accidents. Preliminary results hint at a difference of experienced driving anger

by Japanese drivers compared with US drivers (McLinton & Dollard, 2010). However, the expression of Japanese drivers' anger is neglected. Extensive and detailed studies on this critical issue have so far not been conducted in most Asian countries. In a first step, our current collaborative research aimed to bridge this gap.

We created a cultural specific Japanese version of the Driving Anger Scale (DAS; Deffenbacher et al., 1994) and of the Driving Anger Expression Inventory (DAX; Deffenbacher et al., 2002). Both standardized questionnaires are well-known in the research field of driving anger. In an empirical extensive study we are examining the reliability and validity of these new Japanese versions of the questionnaires. In addition, we are evaluating the validity of these specific questionnaires in comparison to other standardized questionnaires assessing general anger, e.g., the Japanese version of the State-Trait-Anger-Expression-Inventory (STAXI; Suzuki & Haruki, 1994). Results of our collaborative research within the JSPS Summer Program 2012 might help to understand driving anger and driving anger expressions of Japanese drivers and therefore increasing safety in Japanese traffic as well as they might serve as a basis for further research on emotional interfaces in cars, i.e., emotional HMI. Moreover, the new Japanese versions of the questionnaires will provide new methodical measures for the Japanese research community.

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RESEARCH REPORT

1. Name: Tobias Trost	（ID No.: SP12312）

2. Current affiliation:

Fraunhofer Institute for Wind Energy and Energy System Technology IWES

3. Research fields and specialties:

Energy System Analysis and Renewable Energy Sources

4. Host institution:

International Research Center of Advanced Energy Systems for Sustainability (AES Center), Solutions Research Laboratory, Tokyo Institute of Technology

5. Host researcher:

Professor Kosuke KUROKAWA and Associate Professor Takuya ODA

6. Description of your current research:

The transformation from the current fossil and nuclear based energy supply towards a sustainable renewable energy system is inevitable in order to keep the anthropogenic climate change within limits. Recently it has gained global importance as a result of the Fukushima Daiichi nuclear disaster. Therefore, further development and implementation of flexibility options within the energy system (e.g. demand side management and energy storage technologies) for the integration of fluctuating renewable energy sources is of particular importance.

My current research at Fraunhofer IWES focuses on the dynamic simulation of energy supply systems with high shares of renewable energy sources, the development of scenarios for the transformation of energy systems, and the Power-to-Gas technology as large-scale energy storage system by linking power and gas grids. The Power-to-Gas technology consists of two major process steps. First, hydrogen gas is generated by electrolysis of water using surplus renewable energy. In the next process step the produced hydrogen is converted into synthetic natural gas with the help of carbon dioxide in the Sabatier reaction. Renewable methane has nearly the identical chemical properties as natural gas, which is the major benefit of the technology as it allows for the full integration of renewable energy into the existing gas infrastructure.

In this context, I am investigating the systematic and environmental aspects of the Power-to-Gas technology with a focus on the possibilities as alternative fuel option for the mobility sector. This mainly includes the analysis of the effects on the power supply caused by low or zero emission mobility (e.g. hydrogen, methane or electro mobility) using a dynamic simulation model with high temporal and spatial resolution. In particular the technical, ecological, and economic effects of the various mobility options are analyzed. The major aim is to acquire a detailed understanding about the interaction between the energy, heat, and mobility sector in the future.

7. Research implementation and results under the program

Title of your research plan:
Heat and Electricity Integration in the Next Generation Energy Network

Description of the research activities:

In close cooperation with major Japanese energy companies the AES Center carries out research programs for the development of key technologies for the next generation energy network in order to create a low-carbon society. In this respect, my research work in Japan focused on large-scale photovoltaic systems as well as combined heat and power generation.

Due to this specific cooperation between industry and university research at the AES Center, I had the great opportunity to undertake many technical visits, which were directly related to my current research. For example, I had the chance to visit several sites along the liquefied natural gas (LNG) and hydrogen value chain (e.g. Ogishima LNG Terminal by Tokyo Gas or Tokyo-Suginami off-site hydrogen station by JX Nippon Oil & Energy Corporation) as well as major solar power plants and research facilities (e.g. Ukishima solar power plant by TEPCO, Hokuto mega solar project by NTT Facilities or the Central Research Institute of Electric Power Industry CRIEPI). These visits gave me the opportunity to exchange very valuable experiences as well as to meet new people and discuss prospects for future collaborations.

Another focus of my research was the analysis and evaluation of dynamic energy data, which was obtained from a smart energy system demonstration site of Tokyo Gas. At this demonstration site several distributed energy supply systems were installed to determine and optimize the interaction of these systems (e.g. combined heat and power generation units using natural gas or photovoltaic systems). Based on this data example evaluations and dynamic simulations of the capacity factor, CO_2 reductions and overall performance of the distributed energy system were performed.

During my research visit I was also invited to present my current research at various locations (companies and research institutions) and to give lectures as well as regular seminars. This opened up the great possibility to address and speak about the current challenges and opportunities of the energy system transformation in Germany and additionally led to interesting discussions about the current energy situation in Japan.

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

My time at the Tokyo Institute of Technology was an excellent research opportunity and an invaluable personal experience for me with great prospects for future collaborations. The unique geographic situation of Japan led to a variety of social and cultural specificities which makes this country exceptionally interesting. I really enjoyed getting to know these specificities in more detail as well as the very friendly and always welcoming hospitality.

RESEARCH REPORT

1. Name: Alexander M. WEIGAND	（ID No.: SP12313）

2. Current affiliation: Dept. Phylogeny and Systematics, Institute for Ecology, Evolution and Diversity, Goethe University Frankfurt am Main, Germany

3. Research fields and specialties: Biological Sciences

4. Host institution: Atmosphere and Ocean Research Institute (AORI), The University of Tokyo   5. Host researcher: Associate Professor Yasunori KANO

6. Description of your current research

My PhD project investigates processes responsible for the evolution of a group of microsnails (Ellobioidea, Carychiidae) inhabiting permanently wet and dark surface habitats (*Carychium* spp.) or caves (*Zospeum* spp.). As different factors can drive diversification, e.g. ecological differentiation, genetic differentiation, morphological differentiation or reproductive isolation of lineages, I analyse micro- and macroevolutionary patterns in an integrative approach, thus to obtain data from independent methods which will provide complementary and synergistic information. In general, a high degree of cryptic species can be revealed. No less than 50% of all examined morphospecies comprise more than one separately evolving genetic lineage or potential new species. Microhabitat conditions seem to play a predominant role during diversification of that group. Phylogenetic results point to an Asian distribution for the last common ancestor of the *Carychium* lineage.

7. Research implementation and results under the program

Title of your research plan:

Molecular Characterization of Japanese *Carychium* microsnails

Description of the research activities:

Since East-Asia is assumedly the geographic origin of the *Carychium* lineage, analyses of the diversity of Japanese lineages and their distribution are of paramount importance to understand the evolution of the whole group.

Type-localities, i.e. the populations based on which the species have been described, were visited for all six *Carychium* morphospecies known for Japan. At four localities, sampling was successful. A fifth population is close to another type-locality and should be sufficient to re-evaluate the status of this morphospecies. Additional populations were sampled all over Japan, leading to a total number of 32 populations obtained and over 250 specimens collected. General habitat parameters were collected for all populations. All individuals were identified based on the six known morphospecies descriptions. A laboratory protocol was established for a non-invasive DNA isolation of *Carychium* specimens. Intact shells will later on serve as voucher material in an institutional or museum collection. PCR and sequencing were performed to generate DNA barcodes for all populations and to connect the type-morphology with genetic data. Preliminary barcoding results support the existence of those morphospecies but simultaneously point to so far unrecognized lineages distributed in Japan (cryptic lineages or potential new species). After acquisition of all relevant data (i.e. morphology, habitat characterizations and DNA barcodes of collected populations, type-material from museum collections, additional museum data, distribution data of lineages/morphospecies) a joint manuscript will be prepared between researchers of the Goethe University Frankfurt a.M., The University of Tokyo and the Tohoku University.

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

Thank you for the easy-to-use policy of the money provided by the JSPS. This has made many things much easier. As I was performing field sampling for several weeks, collecting all receipts and other expenses would be really troublesome.

9. Advisor's remarks (if any):

Get a JR Rail Pass if you plan to do any trips. An interesting ticket-option could be the 4-day flexible pass (e.g. for JR East).

RESEARCH REPORT

1. Name: Georg Schendzielorz	（ID No.: SP12314）

2. Current affiliation: PhD at Forschungszentrum Jülich, Germany

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Biotechnology Research Center, The University of Tokyo

5. Host researcher: Prof. Makoto Nishiyama

6. Description of your current research

Microbial metabolites like vitamins, amino acids, antibiotics and organic acids are important biotechnological products. They are used as animal feed, as food additives, in pharmaceuticals and as precursors for chemical syntheses.

The institute for bio- and geosciences (IBG-1, Biotechnology) focus on biotechnological research on *Corynebacterium glutamicum*, a soil bacterium which is used worldwide to produce more than 3 million tons of L-amino acids annually. There is strong demand to enhance the productivity of Corynebacterium strains and to discover new production abilities by modification of microbial metabolism.

Conventional methods to optimize production strains are highly time consuming and inefficient. Recently a completely new technique was developed in the research group of Dr. Lothar Eggeling that enables a high-throughput screening of modified producer cells based on quantifiable biosensor response to enhanced intracellular metabolite concentrations.

These metabolite sensors are constructed with transcriptional regulators, whose target genes are involved in amino acid export. Promoter sequences of these target genes are replaced by a fluorescence protein encoding sequence. Thus, expression of fluorescent protein is regulated in dependency on metabolite concentrations. Fluorescence emitting cells are detectable by FACS (Fluorescence Activated Cell Sorting) and can be sorted for further analysis. Many key enzymes and regulators of amino acid biosynthesis are already known. The aim of my PhD thesis is to generate, isolate and characterize stabilized or feedback resistant muteins of these enzymes.

Mutations are introduced by undirected mutagenesis techniques and plasmid libraries are created. Transformed *C. glutamicum* cells, carrying the biosensor are subsequently screened for fluorescence by FACS. Sorted cells are further analyzed and finally corresponding genes are sequenced to identify responsible mutations.

7. Research implementation and results under the program

Title of your research plan:

Characterization of enhanced enzymes for the biotechnological production of fine chemicals.

Description of the research activities:

The enzyme Aspartate kinase, which is of high industrial importance, was modified and analyzed with biochemical methods. We observed enhanced activity of this enzyme which could explain higher product yields of bacterial cells, carrying this altered variant. In an additional step, another enzyme of high biotechnological interest was prepared for larger scale production and purification. Successfully purified enzyme was then used to determine biochemical characteristics, which are important for further studies in Germany. Finally, modifications even in this enzyme should enable an improved synthesis of valuable products, which are uses in food, feed and pharmaceutical industry.

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

I spent an extraordinary great time in Japan! The Support of my host researcher was perfect. Aside from scientific and work-related things, I was introduced to Japanese culture, food and events by my host researcher and team members. For me it was a unique opportunity to get to know real life in Japan and I will return to Germany with new friends. For sure I will stay in contact with them and I am looking forward to return to Japan in the future.

RESEARCH REPORT

1. Name: Carrie Khou	（ID No.: SP12315）

2. Current affiliation: University of Mannheim, Germany

3. Research fields and specialties:

   Humanities

4. Host institution: Doshisha University, Kyoto

5. Host researcher: Prof. Takashi SASAKI

6. Description of your current research

Turn-of-the-century (late 19th and early 20th century) short fiction in the United States and East Asia (Japan, Korea, and China) portray the New Woman as a figure of hybridization subverting the legitimacy of binary gender codes. Hybridity refers to the dissolution of dualistic alignments such as male vs. female. Hybridization connotes the merger of attributes set apart by dualisms. Both serve to revise the New Woman as a narrative figure and a theme. Especially, the distinction between conventional and unconventional types of womanhood represented by the True Woman (good wife, wise mother) / New Woman (atarashii onna, sin yŏsŏng, xīn nǚxìng) dichotomy are called into question. Thus, my thesis project aims to reread the New Woman as negotiating womanliness beyond the binary scheme and as subject to multiple cultural interpretations.

7. Research implementation and results under the program

    Title of your research plan:

    New Woman, New Paradigms: Transnational Hybridity in Modern American and East Asian Short Fiction

Description of the research activities:

At Doshisha University, Kyoto I continued my research on the Japanese New Woman and the historical context of her development in women's short fiction during the Meiji period. Investigating the Japanese perspective of the American New Woman and the Progressive Era shed new light on the transnational and hybrid character of the concept. My primary objectives were to find more novels and short stories written by Meiji women writers in English translation and in their original version. Furthermore, I was enticed to learn about American Studies in Japan and how Japanese scholars of American Studies (including literary and media studies) evaluated the impact and significance of my project. In several meetings I presented my research project to Prof. Sasaki and his colleagues. The debates and questions following my presentations were very helpful and taught me a lot about the Japanese perspective of women writers during the Meiji period. As a result, I was enabled to evaluate the standing of women writers such as Araki Iku and understand how significant she and other modern women writers are in current-day academia. Based on the questions asked and suggestions made during these meetings, I researched and evaluated additional sources at the library of Doshisha University. While researching I did come across another novel titled "The Mirror of Womanhood" by Kimura Akebono. As Araki Iku, Kimura Akebono was very critical of Japanese womanhood in the modern era. Both considered the status quo of women as outdated and restrictive and, thus, pursued to revise the understanding of womanhood in their works of fiction. Unfortunately, I was not able to find the English version of this story. Despite the incessant efforts of librarians, authors and other professors, the translation remains untraceable. Nevertheless, my research project was considerably advanced on account of the sources available and the thoughts shared in the numerous meetings attended while being in Japan.

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

My summer in Japan was a culturally and academically enriching experience. An experience I would not have wanted to miss.

RESEARCH REPORT

1. Name: Philipp BERG	（ID No.: SP12316）

2. Current affiliation: Karlsruhe Institute of Technology (KIT), Germany

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Mie University

5. Host researcher: Prof. Nobuyuki IMANISHI

6. Description of your current research

Limited resources of fossil fuels, political instabilities in oil-exporting countries, climate change and a rising price of gasoline make it necessary to think about new ways in individual mobility. At the moment electric mobility is the most famous option to face the mentioned problems. Most limiting part of this technology is the battery because of limited energy storage capacity and high cost. Therefore a lot of research is in progress to improve existing materials and technologies on the one hand and to find new materials on the other hand to improve security, energy-/power-density and durability of lithium batteries and to reduce cost and degradation at the same time. Most promising technology is the Lithium air-battery, because of the highest theoretical energy density due to a lithium metal anode and usage of O_2 from ambient air as active material on cathode side. But this technology is facing a lot of challenges, like safety issues due to dendrite growth, high losses (overpotentials) or a lack of durability.

So it is necessary to understand and separate the inner processes (e.g. diffusion, charge transfer) and their distribution to degradation or polarization losses. A powerful tool is the electrochemical impedance spectroscopy (EIS) to record the impedance of a system in a wide frequency range (e.g. 1MHz – 100mHz). Because of overlapping frequency ranges in most cases it is a highly non-trivial task to separate the different loss contributions. Targeted variation of parameters (temperature, pressure, material composition, current density…) can help to identify the different processes. Furthermore the impedance plots have to be checked for validity (causality, linearity, time-invariance), e.g. by use of Kramers-Kronig transformations. Valid data are the basis for further research, like e.g. proving Arrhenius behavior or different kinds of cell modeling (e.g. physically motivated, mathematical, behavior modeling) with respect to the intended use.

7. Research implementation and results under the program

Title of your research plan:

Synthesis of cubic garnet-type $Li_7La_3Zr_2O_{12}$ (LLZ) and differentiation of the different loss processes by impedance spectroscopy with focus on charge transfer reaction at Li-LLZ-interface

Description of the research activities:

$Li_7La_3Zr_2O_{12}$ (LLZ) is a relatively new candidate for the usage as solid electrolyte in all-solid-batteries, which promise some advantages (safety issues, cathode performance…). My research in Japan covers the whole process from preparation of the LLZ-samples by solid state reaction, crystal structure analysis by powder x-ray-diffractometry (XRD), preparation of symmetrical Li-LLZ-Li cells and investigation by EIS (see 6.). XRD results showed successful preparation of cubic LLZ. There are several publications about bulk- and grain boundaries-conductivity, but little information about Li/LLZ interface reaction. By use of EIS this process is visible, but the system has shown to be very unstable and hardly reproducible. Due to inhomogeneous lithium deposition and agglomeration a small current density ($10\mu A/cm^2$, 60 sec) is sufficient to change the interface significantly. Therefore special care has to be exercised to the proof of time-invariance and $f< 100mHz$ are not measurable. Because of high sensitivity to production parameters (attached pressure, exact interface shape/size) it is very likely that cells differ from each other. So my further research will be assigned to improvements of cell assembling to increase reproducibility and then deeper investigation of the interface charge transfer process with reproducible and sustainable values (Area Specific Resistance, Arrhenius behavior, Butler-Volmer equation…).

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

The time in Japan was a very interesting, intensive and imprinting experience up to now. With regard to my research as well as to my cultural experience. The following is just a really small extract of so many experiences. What will I remember? Firstly the friendliness and helpfulness of the Japanese people and especially of all my labmates, which involved me in the lab activities so friendly (welcome and birthday parties or playing soccer together after lunch just as a few examples). Secondly the lot of things I have seen at my small weekend trips: the beautiful shrines and temples in Kyoto or Ise, the colorful life in Osaka, sumo fighters in Nagoya, or the agonies of climbing Fuji-san and the stunning sunrise on the top. Thirdly all things for which I do not have enough space here….

RESEARCH REPORT

1. Name: Elijah BULTZ	（ID No.:SP12401）

2. Current affiliation: Queen's University

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Mitsuo SAWAMOTO

6. Description of your current research

My current research involves using transition metals to perform living radical polymerization in aqueous dispersed systems. Free radical polymerization is commonly used in industry to produce commodity polymers, but only with broad molecular weight distributions and little precision. Living radical polymerization is a method to produce polymers with precise and specific molecular architectures, which can be performed at relatively mild conditions, compared to techniques such as anionic polymerization, which require monomers to be highly purified, very low reaction temperatures (approximately -80°C) and strict reaction conditions including the removing all water and oxygen from reaction system. The method of living radical polymerization that I commonly use is transition metal mediated living radical polymerization, which is also known as atom transfer radical polymerization (ATRP). Aqueous dispersed polymerizations (including emulsion, miniemulsion, and suspension polymerization) begin with monomer dispersed in a continuous water phase. There are numerous benefits to conducting polymerizations in aqueous dispersions including eliminating the use of volatile organic compounds as solvents, better control of temperature, lower viscosities of the reaction mixtures and lower process cost.   The economic viability of a commercial ATRP process would be much improved if the polymerization was conducted in an aqueous dispersion (e.g. emulsion polymerization).

The purpose of this project is to develop a catalyst that could be easily removed from the polymer after polymerization without the common technique of dissolving the emulsion up and removing the catalyst by adsorbing it on a solid material (which is not economically viable).

7. Research implementation and results under the program

Title of your research plan:

'Smart' thermally responsive ruthenium (II) catalysts for easy removal in living radical polymerizations in miniemulsion.

Description of the research activities:

Prof. Sawamoto's laboratory developed the first transition metal catalysts for living radical polymerization in 1995 and they have optimized procedures for these polymerization systems. This summer I learned the air-free techniques that they use for polymerization using standard catalyst systems that have been previously developed. Next I synthesized a similar catalyst, which contained a temperature responsive polymer so it could switch between hydrophobic and hydrophilic as the temperature was increased or decreased respectively. With these catalysts I determined the temperature responsive behavior and used this catalyst in aqueous dispersed systems to produce stable miniemulsions. After polymerization I used techniques including centrifugation to remove the polymer from the dispersion and analyzed the synthesized polymer for remaining catalyst.

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

This summer, living in Kyoto I had numerous opportunities to see both the modern and traditional aspects of Japanese culture. I went to see a many of the major temples and shrines in Kyoto area with other JSPS fellows or my Japanese lab-mates. I also went to numerous festivals around Japan. In terms of contemporary Japan, I went to sporting events including J. League soccer and baseball matches. Overall this program was a success and I hope to be back in Japan in the near future

RESEARCH REPORT

1. Name: Patrick de Perio	（ID No.: SP12402）

2. Current affiliation: University of Toronto

3. Research fields and specialties:

    Mathematical and Physical Sciences

4. Host institution: Research Center for Cosmic Neutrinos (RCCN),

                    Institute for Cosmic Ray Research (ICRR),

                    University of Tokyo

5. Host researcher: Kimihiro Okumura

6. Description of your current research

In the Standard Model of particle physics there are three types, or flavors, of leptons: electron (e), muon (μ), and tau (τ), as well as their corresponding anti-particles. There are the massive leptons that we are most familiar with (the electron) and massless ones known as neutrinos (ν): ν_e, ν_μ and ν_τ. If the neutrinos have no mass, the quantum mechanical phenomenon of *neutrino oscillation*, in which the neutrino appears to transform from one flavor to another as it propagates through space, is forbidden. However, recent experimental evidence has shown that neutrinos do in fact exhibit oscillation, meaning that neutrinos have mass, the first hint of physics beyond the Standard Model.

Neutrino oscillation can be described by the Pontecorvo-Maki-Nakagawa-Sakata (PMNS) formalism, which calculates the transition probability between each flavor of neutrino. The model contains a parameter, δ_{CP} (charge-parity), which allows for different behavior between neutrinos and anti-neutrinos. If we observe a different rate of oscillation between neutrinos and anti-neutrinos, this suggests a non-zero δ_{CP} and CP violation in the lepton sector (CP is typically a conserved quantity, like energy). This is required for deeper theories, like Leptogenesis, that attempt to answer the fundamental question about the matter anti-matter asymmetry in the universe leading to our current existence.

The T2K (Tokai to Kamioka) long-baseline accelerator neutrino experiment is designed to provide measurements of the PMNS oscillation model parameters. The world's highest intensity ν_μ beam is produced from the J-PARC (Japan Proton Accelerator Research Complex) in Tokai. The beam is directed through a "near" detector (ND280) situated ~280 m downstream of the neutrino production point, toward a "far" detector 295 km away, Super-Kamiokande (SK), the world's largest water Čerenkov neutrino detector. ND280 measures the beam flavor content and properties prior to oscillation, while SK measures the beam after oscillation. These two sets of measurements can then be used to extract the oscillation parameters.

7. Research implementation and results under the program

Title of your research plan:

Completion of the 2012 Neutrino Oscillation Analyses
AND
New Particle Event Reconstruction for the SK Detector

Description of the research activities:

The primary effort of T2K is the measurement of two other oscillation parameters θ_{13} and θ_{23}, the first of which is necessary before a measurement of δ_{CP} can be made. A prerequisite for these measurements is the determination of neutrino-nucleus cross sections, which are used to predict interaction rates in ND280 and SK. We use cross section predictions based on theories with free parameters fitted to previous neutrino data. However, in addition to low statistics, there are systematic discrepancies between these experiments which cannot be explained by current theory. This, and the modeling of the propagation of particles through the nucleus, will be the largest uncertainty in the T2K oscillation analyses. ND280 will produce detailed cross section measurements of various neutrino interaction channels. Our high statistics results will help explain the current discrepancies and better constrain the theoretical modeling of neutrino interactions and particle propagation through the nucleus. Prior to this work term, I had developed a suite of software tools used to constrain these uncertainties, as well as a generic interface to all dependent analyses. I assisted physicists in SK and around the world on the implementation and validation of this framework in their oscillation analyses.

A neutrino interaction event in the SK water tank produces particles, which subsequently generate Čerenkov radiation (light) that can be observed by the ~11000 photo-multiplier tubes (PMTs) on the walls. Particles can also be born from a proton decay event, a currently unobserved process predicted by Grand Unified Theories (GUTs) that attempt to describe the fundamental forces in a single framework. In a given event, there can be delayed light relative to the initial light due to particle decays that produce new particles at a later time. A new *event reconstruction algorithm*, which uses the PMT information for characterizing particle tracks from both neutrino interactions and proton decay, is being developed. During this work term I developed the PMT *hit clustering algorithm* that groups hits into "sub-events" based on the hit times, which is important for identifying any decay particles in an event. A performance metric was created for optimizing the algorithm to have high efficiency for finding low light clusters, while rejecting false clusters that arise from PMT dark noise fluctuations. The resulting sub-events are then passed to the *particle reconstruction algorithm* which then tries to identify the particle types and properties in the sub-event. This new event reconstruction is already showing improvements compared to the current reconstruction and is expected to produce increased precision in the neutrino oscillation measurements and increased sensitivity to observing proton decay.

RESEARCH REPORT

1. Name: Michael Dupuis	（ID No.: SP12403）

2. Current affiliation: The University of British Columbia

3. Research fields and specialties: Engineering Sciences

4. Host institution: Tokyo Institute of Technology   5. Host researcher: Dr. Shizuo Hayashi and Dr. Susumu Kono

6. Description of your current research

Architects continually push the envelope of structural design in their pursuit of innovative and aesthetically appealing structures. Although simple, uniform systems are more desirable from a structural point of view, building owners and architects often strive for unique systems. It has consistently been observed that as structural systems become more irregular, the reliability of the system during a seismic event decreases. Continual refinement of building codes is often necessary to account for new types of irregularities.

In recent years there has been a new trend in building design to incorporate inclined facades in high-rise buildings. There are several structural systems which can accommodate inclined facades; however, the structural implications are the same. A permanent eccentric load is applied to the lateral force resisting system. This permanent eccentric load raised concerns due to the perceived potential for a 'ratcheting' effect to occur during cyclic loading. This effect, if present, would be beyond the scope of consideration of the current structural building codes in Canada. To determine the influence of this effect on seismic performance, my project was initiated to explore the dynamic response of structures possessing this type of irregularity and to identify if there is behavioral degradation beyond the scope of the Canadian code.

Nonlinear, parametric analyses were conducted in OpenSees on both single- and multiple-degree-of-freedom models. The sensitivity of inelastic displacements to permanent eccentric loading was then investigated under a variable regimen of structural characteristics including period, force reduction factor, loading, material properties, and the type of structural system. Thus far, the analyses have demonstrated that any seismic 'ratcheting' effect is highly dependent on the assumed hysteretic models and on the type of structural system. Currently, the risk to specific structural systems is being quantified and recommended design provisions are being prepared to address permanent eccentric loads on lateral force resisting systems in Canada.

7. Research implementation and results under the program

Title of your research plan:

Analysis of Reinforced Concrete Buildings Damaged in the 2011 Great Tohoku Earthquake

Description of the research activities:

A two story reinforced concrete (RC) frame building with a steel concentrically braced frame seismic retrofit was damaged in the 2011 Tohoku earthquake. After their reconnaissance following the earthquake, the Building Research Institute conducted modal and three-dimensional time history analyses with analytical models to identify the damage mechanisms responsible. In order to confirm the accuracy of these original models, I developed new models using OpenSees, shown in Figure 1 (left). These models were used to validate the modal behaviour predicted by the original work, and to compare the resulting predicted spread of inelastic behaviour in the models with that observed during the initial reconnaissance. The OpenSees models predicted a dominant torsional mode, consistent with the original modeling, and the extent of damage predicted was similar to that observed. In addition to my analytical modeling, I was fortunate to be able to assist with experimental testing of high strength RC columns and visit testing facilities across Japan, including E-Defense. This research process differed greatly from my analytical work, and was an eye opening experience. In my free time, I was able to assist another JSPS summer fellow by conducting seismic analyses on a pavilion that he constructed, shown in Figure 1 (right).
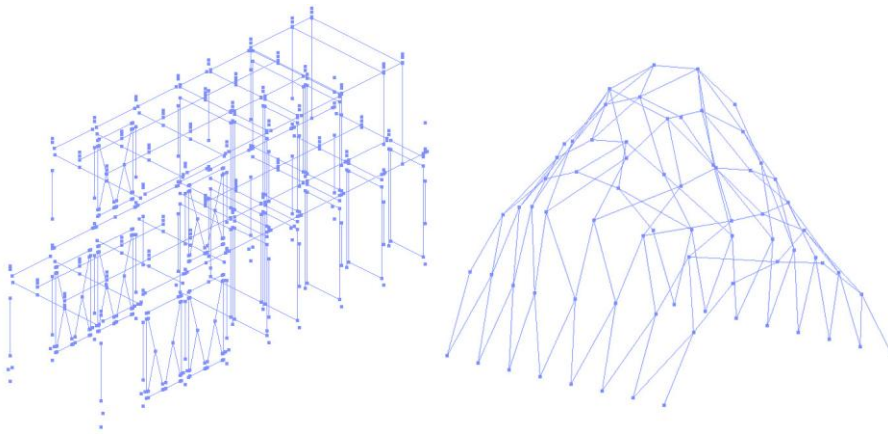

Figure 1: OpenSees models of RC building (left) and Ariel Genadt's pavilion (right)

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

Thanks to JSPS, NSERC, Prof. Susumu Kono, Prof. Shizuo Hayashi, and Prof. Ken Elwood for allowing me to experience this wonderful opportunity. This program has allowed me to experience Japanese culture, conduct experimental testing, and to make many new friendships.

RESEARCH REPORT

1. Name: Patrick Miller	（ID No.: SP12405）

2. Current affiliation: University of Calgary

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: Kumamoto University

5. Host researcher: Dr. Takuya Maruyama

6. Description of your current research

In the 21st century the majority of humanity will live in cities. As a result there is an urgent need for the development of urban areas to become more resilient and sustainable. It is often argued that well developed mass public transportation can be a key driver of sustainable urbanization by reducing the environmental, social, and economic costs of transportation while creating a variety of benefits. However the specific sustainability gains of different transit systems are not completely understood. This research is part of an investigation into the sustainability mobility gains and requirements of different urban mass transit systems including BRT, LRT, and RRT/Metro from around the world. As Japan is known worldwide for effective transit systems and transit oriented development, using Japanese urban centers as case studies is a key component of this research. From June 12th –August 21st a Japanese field study was conducted.

This study had three goals:

1. To develop and test a framework that can assess the contributions to sustainable mobility of Japanese mass transit systems.

2. To use this framework to analyze a set of Japanese mass transit systems in order to develop an understanding of how these systems contribute to sustainable mobility.

3. Analyze Japanese household travel data to investigate the impacts of household and municipal economic, demographic, and geographic factors impact the usage of mass transit.

7. Research implementation and results under the program

Title of your research plan:

"An Assessment of the Contributions to Sustainable Mobility of Japanese Public Transportation"

Description of the research activities:

Research in Japan was focused on two primary tasks: framework finalization and data collection. A focused review of sustainability policy and research, with a focus on transportation systems, allowed the framework to be finalized. This framework measures public transport sustainability using a variety of indicators across economic, social, environmental, and effectiveness factors. Once the framework was completed, it was tested on available data from other nations. For the sample data, a complete set of sustainable transportation indicators were prepated for comparison with Japanese data.

Unfortunately, data collection proved more difficult than anticipated and a result Japanese data has not yet been analyzed. As of the end of August, data for research goal 3 has been obtained and the study will continue upon return to Canada with a goal of generating a research paper on sustainable trip making behavior.

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

I thoroughly enjoyed exploring Japan during this summer. Due to the nature of my research I was able to experience the unique character and culture of many Japanese cities and prefectures. A highlight of the summer was attending the Hiroshima Peace Ceremony – the ceremony encouraged deep reflection on my role in creating a more just and peaceful world.

9. Advisor's remarks (if any): Mr. Patrick Miller was an excellent fellow and he worked very hard not only on his research but also on several activities in Japan. His strong motivation and friendship had very good impact on Japanese students in my laboratory. This would be good starting point for future research collaboration. I appreciate JSPS and related organizations' support for this fruitful experience.

RESEARCH REPORT

1. Name: Rachael L'ORSA	（ID No.: SP12406）

2. Current affiliation: University of Calgary

3. Research fields and specialties: Engineering Sciences

4. Host institution: Tokyo University   5. Host researcher: Dr. Mamoru MITSUISHI

6. Description of your current research There is a trend in medicine towards Minimally-Invasive Surgery (MIS), where surgeons operate via long, slender instruments and cameras that are inserted into a patient's body. This paradigm has been shown to greatly benefit patients for a number of different procedures, particularly by reducing post-operative recovery times. A major drawback for MIS though, is that by placing such implements between surgeon and patient, it effectively removes a surgeon's sense of touch. Surgeons normally rely on touch during traditional open surgery for both navigation within the patient's body and identification of abnormal tissues. However, the sense of touch (termed 'haptics' in this context) may be restored to surgeons by using a robot to guide force-sensor-laden surgical tools. The forces produced during interactions between the tool-tip and patient tissue can then be reproduced for the surgeon in a mechanical device called a haptic interface, which the surgeon uses to guide the robot's movements somewhat similarly to how a construction crane is operated using a joystick. Thus in haptics-enabled robot-assisted MIS, the surgeon can again 'feel' the environment he or she is operating on, with the added benefit of super-human accuracy and precision provided by computer-controlled robotics.   The addition of haptics to such a so-called 'telesurgical' system complicates the design and implementation of the robot control software. These systems must be both stable (never behaving in an unsafe manner) and transparent (giving the impression that the surgeon is actually touching the real environment that the robot interacts with), but there is a tradeoff between stability and transparency: as one increases, the other decreases and vice-versa. This tradeoff is particularly apparent when the robot's tool-tip encounters boundaries in its environment, such as when it collides with hard objects like bone or when it punctures through soft tissue. My current research focuses on investigating system behaviour at these transition points and developing adaptive control algorithms that can moderate this behaviour appropriately, such that neither is the patient harmed nor the sophisticated robotic system damaged. I am particularly interested in the implementation and utility of environmental parameter estimation techniques for incorporation in control algorithms, and how system behaviour is affected by time delays and by the assumption of varying environmental models in both stiff (bone) and compliant (soft tissue) environments.

7. Research implementation and results under the program

Title of your research plan:

Experiments in Control for Teleoperated Surgical Robots

Description of the research activities:

I designed a standardized simulation framework that will facilitate rapid, straightforward control system testing for both the laparoscopic robot here in Japan and the neurosurgical robot I work on in Canada. The framework allows all system components to be either simulated or interfaced directly with hardware, which streamlines the control system design lifecycle from pure simulation through to real-time implementation. I was introduced to the individual components and configuration of Dr. Mitsuishi's system, which enabled me to develop portions of the framework (particularly the simulated human user, system visualization, parameter estimation, and simulated environment modules) that are either directly compatible or easily integratable with his system. I implemented a basic parameter estimation simulation to test the prototype framework. A version of said prototype is also being implemented in Dr. Mitsuishi's system, and basic experiments comparing system behaviour during soft and hard contacts are being performed. While my development and improvement of the framework will continue upon my return home, I now have enough familiarity with the laparoscopic robot to ensure framework compatibility with both his system and ours. This will not only become a useful standalone tool for both our laboratories, but will also facilitate the communication between our two systems necessary for future inter-continental experiments between Canada and Japan.

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

In Canada, I generally work on software by myself. It was a fantastic change to work in the lively, social atmosphere of Dr. Mitsuishi's laboratory, where mentorship on skillsets that would normally take me days to acquire was available immediately upon request. It was my first taste of academia as a true team effort, and also one of the first opportunities I've had to tinker with actual hardware. I remained mostly in Tokyo for the duration of the program, where my lab mates introduced me to baseball, karaoke, and beach barbecues – Japanese-style, of course! I feel as though this laboratory is a family of which I am now a part, and I am loathe to leave. I look forward to the many future collaborations that will be enabled by our accomplishments together this summer.

9. Advisor's remarks (if any):

Rachael implemented "estimator" software during her stay, which displays force information to an operator. She worked excellently during her stay in Japan, and the developed software will be useful for both universities. We are planning to continue the collaboration using a telesurgical system based on the developed software and the surgical hardware at the University of Tokyo.

RESEARCH REPORT

1. Name: Shyam K. Paudel	（ID No.: SP12407）

2. Current affiliation: University of British Columbia, Canada

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Faculty of Human Science, Waseda University

5. Host researcher: Prof Amano Masahiro

6. Description of your current research

Climate change impacts and mitigation:

The global impacts of climate change are already apparent which has significantly contributed to drought, flood, ecosystem shift, change in biodiversity, change in flowering and fruiting time impacting total productivity, water borne disease, reduction in tree growth rate, decline in forest regeneration etc. It has become necessary to limit atmospheric CO_2 concentrations below 450 parts per million (ppm) to limit global temperature increase to less than 2°C. To achieve this goal, major climate change mitigation strategies are required.

Deforestation, forest degradation and changes in landuse practice contribute about 18% of global green house gas emissions. Therefore, reducing emissions from deforestation and forest degradation has become a prominent potential mitigation strategy. As the clean development mechanism (CDM) benefitted only the new plantation projects providing no opportunities and benefits for reducing deforestation and sustainable forest management, the thirteenth Conference of Parties (COP-13) meetings held in Bali, Indonesia in 2007, conceived a new mechanism for reducing emission from deforestation, as well as forest degradation; known as Reducing Emissions from Deforestation and Forest Degradation (REDD). The COP-15 meetings formally endorsed REDD+ in December 2009.

REDD+ has three phases; (i) preparatory phases, (ii) implementation and (iii) emissions trading. Currently REDD+ participant countries are working on 1st phase which focuses on developing baseline scenarios for CO_2 emissions, developing forest management activities for REDD+, revising policy and institutional set ups and creating conducive environment for REDD+ implementation.

I worked as a member of research team to develop REDD+ mechanism for Central Kalimantan, Indonesia. The project has developed REDD+ activities, baseline scenarios and measurement, reporting and verification system.

7. Research implementation and results under the program

Title of your research plan:

Climate change mitigation efforts in Asia: Developing REDD+ Mechanism for Central Kalimantan Indonesia.

Description of the research activities:

I reviewed literatures regarding the drivers of deforestation and forest degradation in Indonesia, current forest policies to reduce deforestation and forest degradation in the country, possible REDD+ activities to reduce deforestation and provide alternative income sources to local people and progress on REDD+ activities. Remote sensing data from 1985 to 2008 were considered to detect the landuse changes and forest degradation in the countries. Similarly, destructive sampling was used to estimate forest biomass. Allomatric equation was developed to estimate the CO_2 baseline scenarios. Socio-economic studies were carried out to address the local social and economic issues.

Based on the remote sensing and ground data, a report has been prepared. A version of report entitled "developing new mechanism for REDD+ : Experiences from Central Kalimantan, Indonesia" has been submitted to International Journal of Forestry Research, myself as one of the co-authors

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

Besides research works, I thoroughly enjoyed sight seeing and cultures in Japan. I climbed Mt Fuji, which was one of the life experiences. Similarly I went to small village Odai in Mie Prefecture which was great fun. I also visited Kyoto and Osaka.

RESEARCH REPORT

1. Name: Haley Sapers	（ID No.: SP12408）

2. Current affiliation: University of Western Ontario, Earth Sciences, specialization in planetary sciences; astrobiology

3. Research fields and specialties:

    Physical Sciences, Biological Sciences

4. Host institution: Okayama University, Institute for Study of the Earth's Interior, Pheasant Memorial Laboratory

5. Host researcher: Dr. Eizo Nakamura

6. Description of your current research

    Impact cratering is a ubiquitous geological process on solid planetary bodies. Any hypervelocity impact into a water-rich target has the potential to generate hydrothermal systems. Impact-induced hydrothermal systems share many characteristics with submarine volcanic hydrothermal systems including the presence of chemical and thermal disequilibria for microbial metabolism. Recent research suggests that such impact-induced environments may be conducive to microbial colonization. In submarine volcanic environments, bioalteration of basaltic glasses produces characteristic tubular textures. Examination of glasses from the Ries impact structure, Germany, has revealed tubular textures with remarkably similar morphologies to textures observed in volcanic glasses. Post-impact hydrothermal systems represent an understudied habitat with potential relevance to early life and the evolution of early life on Earth as well as the potential for life on other terrestrial planets such a Mars.

    The bioalteration textures observed in submarine basaltic glasses are formed by microorganisms via local dissolution as they extract bio-essential elements. It is hypothesized that the tubules in the Ries glasses are formed by similar mechanisms. Many elements present in natural glasses are essential macro and micronutrients such as Fe, Ca, K, Na. It is expected that the heterogeneous distribution of major, minor and trace elements in the Ries glasses is an important constraint on the potential habitability of the glass and that the presence (or absence) of micro-borings can be correlated with enrichment and depletion patterns of elemental nutrients. This chemical heterogeneity in the Ries glass was assessed through complimentary, multi-analytical geochemical techniques at the Pheasant Memorial Laboratory (PML) at the Institute for Study of the Earth's Interior, Misasa, Japan.

7. Research implementation and results under the program

Title of your research plan: Geochemical heterogeneities in impact glass: a basis for a novel endolithic habitat

Description of the research activities:

Detailed optical petrography was conducted to identify regions of interest (ROIs) for chemical analyses. ROIs were selected to contain tubules, crystallites, both, or neither to assess chemical differences in the host glass. Twenty-one representative ROIs were selected and entered into the visual stage linkage (VSL) system, a unique analytical software tool available at PML to correlate ROIs between analytical instruments. Secondly, scanning electron microscopy was carried out in backscatter electron mode for high-resolution imaging using a JEOL JSM-7001F FE-SEM equipped with an Oxford X-max energy dispersive X-ray spectrometer (EDX). Approximately 1500 EDX analyses were completed sampling variation in each of the pre-determined ROIs. EDX allows for quantitative determination of major element (Na, Mg, Al, Si, K, Ca, Ti, Mn, Fe, Ni) variation. Each analysis spot was cross-correlated between SEM and optical petrography using the VSL system to separate the analyses into 4 groups: presence of tubules, presence of crystallites, presence of both, and absence of both. Harker diagrams were prepared for each major element to assess chemical variation. It is noted that at Si concentrations >80% there is a significant decline in the presence of both tubules and crystallites. A subset of 91 EDX spots was statistically selected to represent each of the major element trends for secondary ion mass spectrometry (SIMS) to access trace element variation. A suite of 18 trace elements (Ba, Nb, La, Ce, Pr, Sr, Nd, Sm, Zr, Hf, Eu, Gd, Dy, Li, Y, Er, Yb, Lu) was analyzed using a Cameca ims-5f SIMS with a focused 10 μm beam. Trace element variation diagrams were prepared to assess variability.

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

PML comprises an incredible geochemical analytical facility. All of the research members are incredibly helpful and willing to collaborate. I was able to assemble an unprecedented geochemical dataset assessing the variability of major, minor, and trace elements in my samples. During my time in Misasa I had the opportunity to participate in the town festival, the Marie Curie Festival. I was taught traditional dances which we preformed in full kimono dress in the town parade. This was a wonderful and unique cultural experience.

RESEARCH REPORT

1. Name: Mohammed Selman	（ID No.: SP12409）

2. Current affiliation: University of Ottawa

3. Research fields and specialties:

  Biological Sciences

4. Host institution: Institute for Virus Research Kyoto University; Kyoto University

5. Host researcher: Dr. Takashi Fujita

6. Description of your current research

Microsporidia are obligate intracellular eukaryotic parasites that lack conventional mitochondria and Golgi apparatus. Microsporidia are known to infect a wide array of hosts ranging from protists to insects and vertebrates. Microsporidian genomes are all very small in size and simplistic in content (approximately 2000 genes). The lack of many genes means that many biochemical pathways are absent in these parasites.

Very recently, a new species in the Encephalitozoon genus (Microsporidia) was isolated from grasshoppers. This species, which was named Encephalitozoon romaleae, represent the very first Encephalitozoon species found to infect an invertebrate.

Under the supervision of Dr. Corradi, I am currently working on the sequencing and analysis of Encephalitozoon romaleae genome. Primary analysis of the genome, enable me to discover the first horizontal gene transfer between an animal host and eukaryotic parasite. Overall, this present research will lead to a better understanding of the genome evolution of a medically and economically important group of parasites.

The **influenza A viruses** are composed of 8 RNA segments, known to encode for up to 11 proteins. A number of Influenza A viruses have adapted to acquire the ability to cross the species barrier and thus have gained the capacity to infect, and cause disease in several new hosts including humans. However little is known on the biochemical changes required by a virus to become virulent in a new host.

Under the supervision of Dr. Brown, I am currently working on the biochemical changes that occurs went a virus become virulent in a new host. I am looking at how mutations in the virus is changing its biology, specifically in expression of viral protein, in cellular interferon production, and binding to cellular protein (ie. PKR, RIG-I)

This will bring us a better understanding of the adaptation of influenza A viruses, and avenues for further research but more importantly, better prepares us for future pandemics.

7. Research implementation and results under the program

Title of your research plan:

Localization of IPS-1 CARD domain in infected living cells

Description of the research activities:

Today, newly emerging and re-emerging viral diseases still continue to pose a significant threat to global health. Upon infection of a cell, viral RNA is sensed by different receptors, such as the RIG-1-like receptors, which activate a number of proteins to initiate an antiviral response. At Kyoto University, I focused on establishing a method to monitor molecular associations in living, infected cells. I took a closer look at the different sensors and adaptor proteins, such as the mitochondrial adaptor proteins IPS-1, which are activated upon infection of live cells. I observed how localization of those sensors are modulated between the nucleus, the cytoplasm, and the mitochondria during viral infection, by over expressing IPS-CARD domain in Hela cells, and infecting cell with NDV (Newcastle disease virus) followed by immuno-staining.

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

I really had a great time here in Japan: working and living in Kyoto, travelling around Japan, the home stay experience, the wonderful people I meet in Japan, or just experiencing different Japanese tradition like Suikawari, or even cutting down bamboos for Nagashi Soumen.

RESEARCH REPORT

1. Name: Christopher T. L. SMEENK　　　　　　　　　　（ID No.: SP12410）
2. Current affiliation: University of Ottawa (Ottawa, Canada)
3. Research fields and specialties: 　　Mathematical and Physical Sciences
4. Host institution: Tohoku University
5. Host researcher: Prof. Kiyoshi UEDA
6. Description of your current research

We have studied ionization of ethane (C_2H_6) by intense, infrared laser pulses. In ethane the three highest occupied molecular orbitals are all relatively close in binding energy. We were interested to study if all three orbitals respond simultaneously to a strong laser field, or if the problem can be simplified to single orbital ionization. Ethane is a prototypical saturated hydrocarbon molecule, so our results are relevant to a wide class of organic molecules.

Experimentally we used 100 fs laser pulses at 800 nm and 1300 nm and in the intensity range (2.5 – 10) x 10^{13} W/cm^2. We did two different variations of the experiment: (a) non-coincident detection of the photoelectron spectrum, and (b) coincident detection of the photoelectron and photo-ion spectrum.

Experiment (a) allows us to acquire data very rapidly with high signal/noise ratio. This enables us to see features in the photoelectron spectrum from electron scattering off the $C_2H_6^+$ ion. The re-scattering electron spectrum can provide structural information about the parent ion. Changing the laser wavelength (800 vs 1300 nm) allows us to access different electron scattering energies. We have measured electron spectra at these two wavelengths and a range of intensity values.

Experiment (b) allows us to select electron spectra correlated with different fragments of the parent molecule C_2H_6. At 800 nm we measured the fragments CH_3^+ (8%), $C_2H_2^+$ (5%), $C_2H_3^+$ (13%), $C_2H_4^+$ (41%), $C_2H_5^+$ (11%) and $C_2H_6^+$ (23%). By detecting the correlated photoelectron spectrum, we determine how the valence electrons in the ethane molecular orbitals respond to the strong laser field. However, to ensure the detected events are valid, the experimental count rate must be very low and the experiment must run stably for a long time. Over the summer we have collected over 100 hours of coincidence data, not including set-up time.

7. Research implementation and results under the program

   Title of your research plan:

   Ionization of Ethane (C_2H_6) by Intense Laser Fields

   Description of the research activities:

   Future work concerns analysis and interpretation of the measurements on ethane this summer. The high resolution photoelectron spectra show peaks corresponding to excited electronic states, or vibrational states, or both. We must assign the photoelectron peaks to a molecular state. Secondly, after understanding the origin of the photoelectron peaks it should be possible to draw a conclusion regarding the multi-electron response of ethane to the strong laser field. Lastly, with the help of theoretical modeling, the re-scattering electron spectra we have measured can be used to extract the structure of the C_2H_6 molecule.

   One extension of this work is to repeat the coincidence experiment at 1300 nm. At longer wavelength, different electronic states are resonant and the peaks in the photoelectron spectrum should reflect this. We have also observed fewer fragments at 1300 nm meaning that signal/noise in the coincidence experiment will improve compared to ionization at 800 nm.

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

I am extremely grateful to my hosts at Tohoku University and the JSPS Program for offering me this opportunity for the summer. My colleagues made the working environment very comfortable for me. Culturally, I had the opportunity to see many summer festivals. I found Japan to be fascinating, friendly and welcoming.

9. Advisor's remarks (if any):

Mr. Chistopher Smeenk spent at our laboratory for about two months. During this period, he has been very active. At his arrival, he discussed with us and proposed an interesting experiment. He quickly learned how to operate our apparatus and carried out the proposed experiment enthusiastically, continuously discussing with us intensively.   I very much enjoyed hosting him. I hope that JSPS continues this excellent program.