RESEARCH REPORT

1. Name: Brian Scott Aitken （ID No.: SP11001）

2. Current affiliation: University of Florida

3. Research fields and specialties:

Chemistry

4. Host institution: Kyoto University

5. Host researcher: Chujo Yoshiki

6. Description of your current research.

Using acyclic diene metathesis polymerization (ADMET), we synthesized and photophysically characterized a set of charge transporting materials (conductive plastics) where the charge mobility (similar to conductivity) was controlled by precise variation of the distance between conductive moieties along inert polymer backbones. This work was designed for eventual application as charge transporting layers in light emitting diodes (LEDs) to be studied at a later date at the University of Florida. Using current NSF support (DMR-0703261), we have already demonstrated and published on the utility of ADMET in the preparation of regioregular electroactive polyolefins (a new type of light emitting layer in LEDs) therefore this work was a simple extension of earlier research but required instrumentation (a time of flight charge mobility analyzer) available at Kyoto University and not at UF. While the effect of distance on photophysics in small molecules has been well documented, no such study as the kind conducted here has been undertaken for a polymeric system. This work has provided both a deeper understanding of the relative importance of various structural parameters to charge mobility in polymers (plastics which are much easier and cheaper to process and manufacture than other current electronic materials) while demonstrating a new method for control thereof and is thus of utmost importance to the field of organic electronics. Moreover, as global economic development continues, the field of organic electronics will remain one of the most actively studied due to the ever increasing demand for economical and energy efficient electronic devices, particularly those used for lighting and solar energy conversion.

7. Research implementation and results under the program

Title of your research plan:

Control of Charge Mobility in Electroactive Polyolefins through Modification of Chromophore-Chromophore Distance and Their Potential Application to OLEDs

Description of the research activities:

My daily activities included running organic synthesis reactions and purification of products by various methods including column chromatography, recrystallization, sublimation, distillation, reprecipitation, and Soxhlet extraction. My normal work schedule was significantly less than my Japanese coworkers but was approximately 10-12 hours/day, Mon-Sat. A large set of hole transporting (+ charge conduction) polymers were synthesized and characterized via UV-Vis absorption and fluorescence spectroscopy, various thermal and mechanical measurements, nuclear magnetic resonance spectroscopy, and charge mobility measurements (a measure of conduction of one particular charge type, either electrons or holes, + charges). By carrying out this work, we have confirmed the ability to control hole mobility in polymers; this will prove invaluable to efforts towards efficiency optimization of organic light emitting diodes which are currently among the most researched electronic devices. Furthermore, since I finished my proposed work near the end of July, I decided to begin work on another project in collaboration with one of Chujo Sensei's students, Imoto Hiroaki. While working with him, I synthesized and characterized a new organic molecule (a diphosphenylcyclohexane) to be used as a new polymeric transition metal ligand.

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

While the science I conducted here was interesting, other than access to a few additional instruments, nothing was particularly different from my daily laboratory activities in the states. Therefore, the most valuable and interesting experiences for me were cultural, though I have the space to focus here on only the one I have found most moving: the sunrise from the top of Mt. Fugi. Before climbing, I read many guides written by those who had made the journey; some described it as incredibly difficult while others quoted stories of old men climbing in sandals and shorts. I was wary of the latter tales; however they had the unfortunate effect of minimizing my concern for the elements I would soon experience on Fugi-san. I ended up hiking the trail with sufficient food for two days but with only jeans, a t-shirt, and a remarkably nonwaterproof jacket. I embarked on the Fujinomiya trail along with about 100 other people, my foolish plan being to hike to the top and back in one day to catch the latest bus back to Mishima station. After a grueling 5 hour climb (not the hike I was expecting) to the 9^{th} station, I realized then that I would not make it in time to return that night; I began to panic but to my astonished delight found vacancy at the 9^{th} station hut. After sleeping for only a few hours, I and many others began the surreal experience of climbing that last kilometer with headlamps at 2:00 AM in 20+ km/h 2-3 ^{o}C wind, rain, and fog. After reaching the top at 3:30 AM and waiting in the rain for the indescribably beautiful sunrise at 4:30, I could not honestly believe what I was doing and that I had only needed to write a simple 10 page proposal on light emitting diodes to get there…free of charge.

RESEARCH REPORT

1. Name: Erica Anderson （ID No.: SP11002）

2. Current affiliation: University of Florida

3. Research fields and specialties:

Biological Sciences

4. Host institution: Okazaki Institute for Integrative Bioscience

5. Host researcher: Dr. Taisen Iguchi

6. Description of your current research

Endocrine disrupting chemicals interfere with hormonal balance and can impact reproduction and development. Several species of aquatic animals that live downstream of paper mills have abnormal characteristics that indicate exposure to endocrine disruptors. In the state of Florida, one species of freshwater fish—the mosquitofish—has been observed with abnormal male secondary sexual characteristics at three paper mill-impacted sites. My dissertation project will evaluate how female mosquitofish downstream of paper mills exhibit the characteristics that only male mosquitofish normally have. A combination of lab experiments and field work will be used to determine the role of gene expression in the development of the male secondary sexual characteristic, the anal fin. In the lab, female mosquitofish will be exposed to endocrine disruptors (androgens) that are known to cause anal fin growth. Changes in the expression of genes known to regulate anal fin growth in other fish species will be monitored to determine the role of these pathways in mosquitofish anal fin growth. Further analysis of gene interactions will be determined using mosquitofish fry exposed to androgens and chemicals that can inhibit these genes. Hepatic gene expression analysis will be conducted on the androgen-exposed female mosquitofish using a microarray to quantify the expression of thousands of genes at once. This microarray data will be compared to microarray data from the masculinized female mosquitofish found downstream of paper mills to determine if these fish are being exposed to a chemical that acts like an androgen. A biomarker of reproductive health will also be measured in paper mill field samples to determine if masculinized female mosquitofish may be impaired in their ability to reproduce. Results from this project will enable the mosquitofish to be further developed into an organism that can be sampled from polluted environments to determine the environmental impacts of paper mill effluents and other endocrine disruptors. This research will also provide information on how paper mill effluents in the state of Florida are acting as endocrine disruptors and if this exposure is linked to potential reproductive effects.

7. Research implementation and results under the program

Title of your research plan:

"Molecular mechanisms of secondary sexual characteristic development in mosquitofish"

Description of the research activities:

When I first arrived in Dr. Iguchi's lab, I set up several mosquitofish androgen exposures to obtain tissue samples for several different types of analyses. I exposed mosquitofish fry and adult females to the non-aromatizable androgen 17beta-trenbolone and took samples during the exposures to determine the changes in gene expression and tissue morphology. Two new techniques that I learned while working in the laboratory include *in situ* hybridization and histology. I was able to qualitatively observe changes in the expression of the gene Sonic Hedgehog (Shh) in the anal fins of the androgen-treated adult female mosquitofish and the mosquitofish fry. I also took tissue slices from the androgen-treated adult female anal fins and gonads to observe changes in tissue structure after androgen treatment. I also spent some time working with more familiar techniques such as cloning and qualitative PCR in order to synthesize probes for the *in situ* hybridization and to quantify gene expression changes at additional time points in the androgen-treated fry.

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

During my time in Okazaki, I traveled to Nagoya, Inuyama, Mount Takao, Kyoto, and Tokyo to experience what life in Japan was like outside of my home city. Along with sightseeing around these cities, I also attended a kabuki performance while in Tokyo and greatly enjoyed this experience. I also took a karate class, which has been one of my favorite parts about living in Japan. I was able to learn more about this martial art and the culture of budo, and was also fortunate to meet the grandmaster of the karate school and talk with him individually about the karate culture. I also obtained an English translation of The Tale of Genji; I have only read a small portion of the book so far but I am greatly enjoying this glimpse into life in medieval Japan.

RESEARCH REPORT

1. Name: Kelli Baalman （ID No.: SP11003）

2. Current affiliation: Baylor College of Medicine

3. Research fields and specialties:

Biological Sciences

4. Host institution: Kyoto University

5. Host researcher: Dr. Hiroshi Kuba

6. Description of your current research

My current research is exploring the molecular effects of mild brain injury. Recently, the axon initial segment (AIS) has been found to be a target for proteolysis after certain types of brain injury. The AIS is the part of the axon closest to the cell body and is responsible for action potential initiation and maintenance of neuronal polarity. Additionally, the AIS has recently observed to be a target for plasticity. In these studies, the length of the AIS or its position from the cell body was changed in response to decreased or increased levels of activity, also affecting the excitability of the cell. I am interested in determining if these mechanisms of non-synaptic plasticity are occurring after mild injuries and what their functional consequence is. Non-synaptic plasticity mechanisms at the AIS may also occur as a consequence of other experiences, such as learning and memory. The functional consequences of AIS plasticity are widely unknown and may thus be studied in many different experimental models.

7. Research implementation and results under the program

Title of your research plan:

Mechanisms of non-synaptic homeostatic plasticity in neurons.

Description of the research activities:

Dr. Hiroshi Kuba is a pioneer in AIS plasticity, which is why I wanted to work in his lab. He is very experienced in electrophysiology, a component that my lab at home is interested in adding (and is currently in the process of setting up the necessary equipment for). This summer, I have learned how to make acute brain slices and record from them using patch clamping, a delicate technique in which I had no previous experience. Using both voltage and current clamp, I can measure different electrical properties of cells. Thus far, I have been recording from primary auditory

cortex and comparing cells from layers 2/3 and 5, which have a different morphology and thus may have different electrical properties. After recording, I then use immunofluorescence to label the AIS of the cells I've recorded from and can compare the functional and structural properties of the AIS (currently pending data analysis).

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

Overall, I had an excellent experience. The lab was very gracious and accommodating, teaching me the science that I came for, and involving me in many interesting discussions of Japan and the US, including some informal Japanese lessons, over lunch and coffee breaks. There are several lab members I hope to continue communication with after leaving Japan.

9. Advisor's remarks (if any):

She had a remarkable progress in the procedures and understanding of electrophysiology. She also interacted well with our lab members, and learned a lot about Japanese culture. Thus, she did quite well during her stay, and I believe that her visit was fruitful for both of us. I am grateful for the program to support her visit to our lab.

RESEARCH REPORT

1. Name: Phuong Bui Phuc Nam （ID No.: SP11004）

2. Current affiliation: Virginia Polytechnic Institute and State University

3. Research fields and specialties:

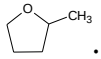
Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Ted S. Oyama

6. Description of your current research

Hydrodeoxygenation (HDO) plays an important role in upgrading raw bio-oil derived from biomass into commercial liquid fuel. This is because raw bio-oil has a high content (35-50 wt%) of oxygen-containing compounds, resulting in thermal and chemical instability of the oil. Therefore, an understanding in oxygen removal from raw biomass oil is vital in developing this promising source of renewable energy.

This project is to investigate the mechanism of catalyzed hydrodeoxygenation of simple model compounds of bio-oil – ethanol and 2-methyltetrahydrofuran (2MTHF) 

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The catalysts used were a series of transition metal phosphides. In a preliminary study at Virginia Tech, two kinds of catalysts stood out for their HDO performance: nickel phosphide (Ni_2P/SiO_2) and tungsten phosphide (WP/SiO_2) supported on silica. The work at the University of Tokyo focusing on numerical simulation of ethanol HDO reaction network and infra-red spectroscopic study of 2-methyltetrahydrofuran HDO.

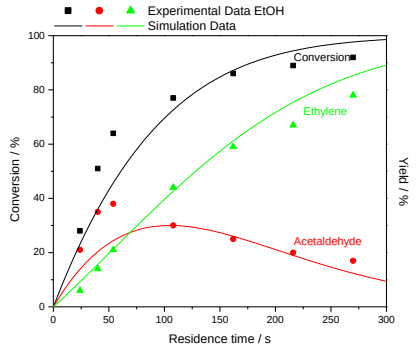
7. Research implementation and results under the program

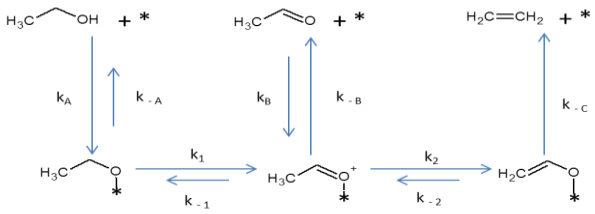
Title of your research plan:

Identification of intermediates in hydrodeoxygenation of 2-methyltetrahydrofuran

Description of the research activities:

1/ Simulation of Ethanol HDO using Polymath: manually adjust rate constants to obtain the best fit. The fit reinforced the validity of the proposed mechanism of ethanol HDO on Ni2P/SiO2. Below are figures of the simulation result and the proposed reaction scheme for ethanol HDO respectively.

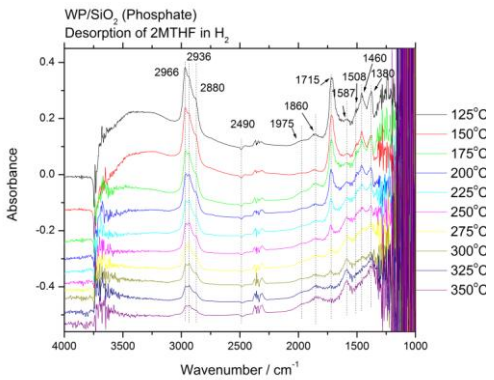


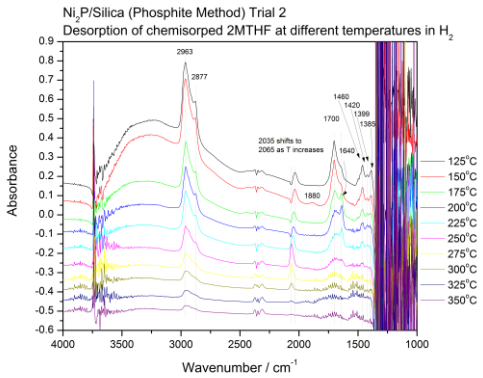


2/ Fourier transformed infra-red (FTIR) spectroscopy study:

a. Equipment improvement: modification of sample chamber to reduce breakage of crystal CaF2 disks which leads to better infra-red (IR) signals

b. The results from FTIR study helped identify the intermediate species in the HDO reaction of 2MTHF. The figures below showed that HDO mechanism differed depending on the kind of catalysts. Group 8 metal phosphides (WP/SiO2 (left)) produced more olefins while iron group metal phosphides (Ni2P/SiO2 (right)) favored alkane and some cracking products. These results are consistent with the preliminary results.





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

I enjoyed life in Japan tremendously, from automatic taxi doors to fresh, delicious peaches [what about toilet? ;)]. Almost everyday was an adventure. I loved seeing Japanese girls in yukata having fun in the middle of the lively Shinjuku – a calming breath of tradition into the busy modern life. It was also my first time tasting the "true summer atmosphere," watching fireworks for an entire hour with friends. I also appreciate the work ethics I learned from my colleagues. There was always a smile on their face though they were working ten to twelve hours a day. The laboratory was one of the most efficient laboratories I have ever worked in. Supplies and technicians came in a timely manner. I am grateful to have this amazing opportunity to finish some experiments here and I am working towards including these results in the next journal paper.

RESEARCH REPORT

1. Name: Kevin Bullaughey （ID No.: SP11005）

2. Current affiliation: University of Chicago, Department of Ecology and Evolution

3. Research fields and specialties:

Biological Sciences

4. Host institution: Graduate University of Advanced Studies (Sokendai), Hayama

5. Host researcher: Hideki Innan

6. Description of your current research

My research centers upon computational modeling of evolution using models that bring more accurate biological architectures to population genetic and evolutionary studies. I currently have two projects. One that I am writing up and one that I have started in Japan. The first, nearly complete work, examines how epistasis at the level of the gene network can result in adaptive evolutionary dynamics that resemble compensatory evolution but are not at all compensatory. Instead, genetic changes that have opposite effects with respect to a particular function (say gene expression level) can be individually adaptive, because other components of the network are evolving simultaneously. I show that this is likely under a particular model of a well-studied, well-supported three-gene biological network.

My new project also involves bringing a more realistic model of genetic architecture to a long-standing question in population genetics, namely why aren't selective sweeps more apparent in genetic data. Selective sweeps are a signature in genetic variation data that results from a new mutation that quickly reaches high frequency in a population because it provides an adaptive advantage. However at least in humans, were we have the best data, these signatures are rare. This may be simply a result of invalid assumptions about the genetic architecture of many biological traits. I use a model of selection on a polygenic trait featuring antagonistic epistasis. Under such a genetic architecture, adaptation can occur without leaving the signature of a selective sweep. In Japan, I have been investigating this possibility and establishing for which genetic architectures a signature should be apparent.

7. Research implementation and results under the program

Title of your research plan: (I have two titles, attributable to my two projects)

Mutations of opposing functional effect may often be separately adaptive

AND

Adaptation of polygenic traits from standing variation and the relevance of genetic architecture

Description of the research activities:

I have worked on a number of fronts. First, I have invested time studying stochastic processes, an area of central importance to my work but one I had not sufficiently mastered. This is an expertise of the lab I'm visiting in Japan and thus an ideal opportunity to acquire a better foundation. Second, I have written most of the manuscript for my project on adaptive reversals. Third, I have begun my new project on polygenic traits. For this project I have worked out the theoretical distribution under neutrality of a quantity of interest to allele frequency changes. I have also implemented a simulation model for polygenic selection whereby genetic loci have antagonistic epistatic interactions. Using this simulation framework, I have demonstrated the several aspects of selection under this model that contribute to an inability to identify selective sweeps.

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

I had a great experience. In particular, I enjoyed the efforts lab members took to involve me in social activities. I believe that having such an active and integrated lab provided much of the insight I gained into Japanese culture and the academic system. I also had a lot of fun while here, largely due to social lab activities. Finally, I particularly enjoyed my stay with my host family, and found it one of the highlights of my time here.

RESEARCH REPORT

1. Name: Michael T. Corbett （ID No.: SP11006）

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

3. Research fields and specialties:

Chemistry

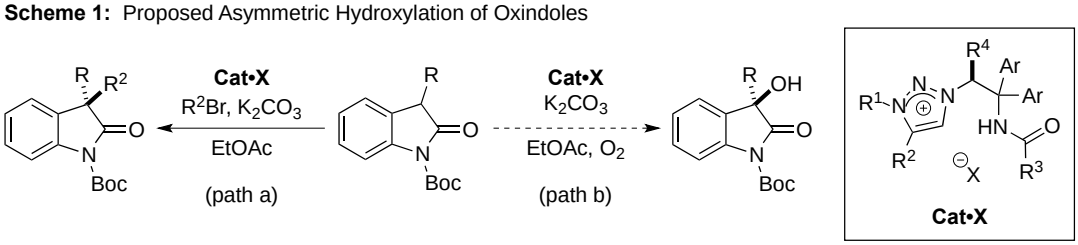
4. Host institution: Nagoya University

5. Host researcher: Professor Takashi Ooi

6. Description of your current research

The oxindole substructure is contained in myriad natural products and leading pharmaceutical candidates and the development of new asymmetric reactions based on this scaffold is of great interest to synthetic chemists. Previous work in the Ooi group has demonstrated the potential applicability of chiral triazolium salts to serve as anion recognizable cations to induce high levels of stereocontrol in C–C bond forming reactions. The triazolium catalyst **Cat•X** was found to efficiently promote the asymmetric alkylation of 3-substituted oxindoles affording the desired products in excellent yield and enantioselectivity (Scheme 1, path a). Based on this precedent, the application of the privileged triazolium catalyst **Cat•X** to the asymmetric hydroxylation of 3-substituted oxindoles will be explored (path b).

Scheme 1: Proposed Asymmetric Hydroxylation of Oxindoles



7. Research implementation and results under the program

Title of your research plan:

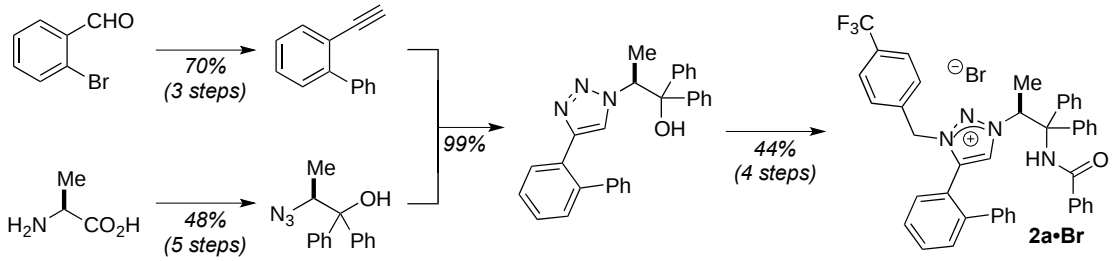
Development of a Chiral Organic Ion-Pair Catalyst for the Enantioselective Hydroxylation of Oxindoles

Description of the research activities:

In preliminary studies, it was determined that the hydroxylation of 3-substituted oxindoles proceeded with molecular oxygen as the stoichiometric oxidant to afford **1** (Table 1, entry 1). Based on this initial discovery, several novel catalysts of the type **Cat•X** were synthesized from L-alanine, L-valine, and L-leucine (Scheme 2). During an extensive catalyst screen, the highest levels of stereoinduction were obtained from catalysts derived from alanine. With an effective catalyst in hand to provide high levels of stereocontrol, a variety of reaction conditions were screened in order to improve the low conversions observed even at prolonged reaction times despite the presence of active catalyst and excess base (Table 1, selected results shown). Although manipulating the reaction conditions could increase the conversion, the products were obtained in substantially lower enantioselectivities. The highest levels of stereoinduction were observed when the reaction was performed

with **2b•Br** (5 mol %) and Cs_2CO_3 in CH_2Cl_2 at -40 °C under a balloon of oxygen (entry 6).

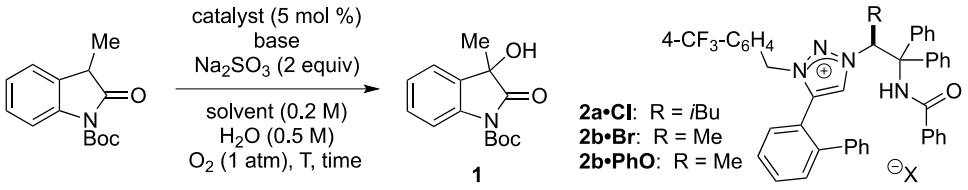
Scheme 2: Representative Synthesis of Triazolium Catalyst **2a•Br**



In the absence of catalyst, Cs_2CO_3 effectively promotes the background reaction affording racemic product in ~50% conversion in less than 2 hours at -40 °C. In order for high levels of stereocontrol to be realized, the rate of cation exchange must be faster than addition of the pronucleophile to molecular oxygen. Various reaction conditions were explored to slow down the reaction, but no increase in enantioselectivity was observed (entries 11, 13-16). Attempts to render the reaction catalytic in base were successful as both DBU and **2b•PhO** effectively promoted the reaction (entries 12 and 17). Employing **2b•PhO** not only improves catalyst solubility at lower temperatures, but also eliminates the need for external base. The role of water, however, is still not well understood. At lower temperatures, the addition of H_2O results in the formation of a layer of ice near the surface of the organic layer; however, running the reaction in the absence of water results in reduced levels of stereoinduction.

Future efforts will focus on developing a better understanding of the reaction pathway. In order to increase the efficiency of the reaction and tap the full potential of this methodology, the role of water and the mechanism by which the reaction stalls need to be better understood.

Table 1: Selected Results



entry	cat	base (equiv)	solvent	T (°C)	time (h)	yield (%)	ee(%)
1	**2a•Cl**	K_2CO_3 (2.0)	toluene	0	24	32	29
2	**2a•Cl**	Cs_2CO_3 (2.0)	toluene	0	10	56	27
3	**2a•Cl**	Cs_2CO_3 (5.0)	toluene	0	10	61	28
4	**2b•Br**	Cs_2CO_3 (2.0)	toluene	0	10	55	34
5	**2b•Br**	Cs_2CO_3 (2.0)	CH_2Cl_2	0	10	48	48
6	**2b•Br**	Cs_2CO_3 (2.0)	CH_2Cl_2	-40	24	33	72
7[a]	**2b•Br**	Cs_2CO_3 (2.0)	CH_2Cl_2	-40	10	55	46
8[b]	**2b•Br**	Cs_2CO_3 (2.0)	CH_2Cl_2	-40	10	23	71
9	**2b•Br**	Cs_2CO_3 (2.0)	CH_2Cl_2	-78	12	19	44
10[c]	**2b•Br**	Cs_2CO_3 (2.0)	CH_2Cl_2	-40	24	21	70
11[d]	**2b•Br**	Cs_2CO_3 (2.0)	CH_2Cl_2	-40	24	31	14
12[a]	**2b•Br**	DBU (0.2)	CH_2Cl_2	-40	12	60	46
13[e]	**2b•Br**	Cs_2CO_3 (2.0)	CH_2Cl_2	-40	16	31	71
14[f]	**2b•Br**	Cs_2CO_3 (2.0)	CH_2Cl_2	-40	16	39	72
15	**2b•Br**	Cs_2CO_3 (sat. aq.)	CH_2Cl_2	-20	16	37	57
16[g]	**2b•Br**	Cs_2CO_3 (2.0)	CH_2Cl_2	-40	16	24	62
17	**2b•PhO**	none	CH_2Cl_2	-40	24	40	58

[a] no H_2O; [b] $[H_2O]$ = 0.25 M; [c] $P(OEt)_3$ used instead of Na_2SO_3; [d] air (1 atm); [e] catalyst (10 mol %); [f] catalyst (20 mol %); [g] $[CH_2Cl_2]$ = 0.1 M

RESEARCH REPORT

1. Name: Jeremy Chase Crawford （ID No.: SP11007）

2. Current affiliation: University of California, Berkeley

3. Research fields and specialties:
Biological Sciences

4. Host institution: Waseda University

5. Host researcher: Professor Kazuyoshi Tsutsui

6. Description of your current research

My research interests broadly pertain to mammalian reproductive and social behavior. I am particularly interested in how the interaction among genetic, environmental, and endocrine factors shapes social affiliations and mating preferences. I am also interested in the role that communication plays in enabling animals to engage in adaptive social and reproductive interactions. Studying these questions at the proximate level requires utilizing an integrative approach that incorporates field behavioral ecology, captive manipulations, neuroendocrinology, and various molecular techniques. I also endeavor to ground these studies in a comparative framework, because elucidating the mechanisms that control variation in behavior within and across taxa furthers our understanding of how these behaviors evolve and are maintained.

My JSPS-funded summer research project developed as an amalgamation of many of these research interests. My goal for the summer was to investigate a novel neuropeptide, gonadotropin inhibitory hormone (GnIH), as a potential mechanism for the mediation of sexual fidelity. Originally discovered by my Japanese host professor, GnIH has been shown to vary in response to stress and photoperiod and inhibit both reproductive behavior and the hypothalamic-pituitary-gonadal axis. I hypothesized that GnIH also plays a functional role in the inhibition of extrapair mating among pair bonded animals, and thereby mediates sexual fidelity in monogamous species. To test my hypothesis, I investigated GnIH expression in two species of Peromyscine mice, the deer mouse (Peromyscus maniculatus) and the California mouse (P. californicus). These closely related congeners are highly sympatric and ecologically similar, but differ radically in social mating system: whereas P. maniculatus are highly promiscuous, the strictly monogamous P. californicus are characterized by bi-parental care of offspring and exclusive, lifelong pair bonds. Support from JSPS Summer Program enabled me to

investigate the function of this novel gonadotropin inhibitory hormone as a function of mating system and a number of other important behavioral and experimental variables.

7. Research implementation and results under the program

Title of your research plan:

Gn-inhibitory system and sexual fidelity: Comparisons of GnIH expression across mating systems

Description of the research activities:

My time at Waseda Univerity's Laboratory of Integrative Brain Sciences allowed me to train in a number of analytical techniques that were vital to the completion of my proposed research. For instance, I learned to clone gene product fractions in order to sequence the GnIH gene in each of my study species. By comparing these GnIH gene sequences to sequences from other species, I was able to elucidate variation in the amino acid structure of the GnIH peptide between Peromyscine and non-Peromyscine rodents. More importantly, these gene sequences facilitated the design of DNA primers that were both species and gene-specific. These highly specific DNA primers were integral to the process of measuring GnIH expression in my experimental samples. Lastly, I used quantitative, real-time reverse transcription PCR to quantitate the expression of GnIH in each of my focal species. Although I am still analyzing the data that I collected using this technique, my preliminary analyses suggest that the results of this project will contribute a distinctive behavioral and reproductive framework in which to contextualize ongoing molecular investigations of the GnIH system.

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

The JSPS Summer Program provided me with the opportunity to completely integrate myself with everyday Japanese life. Not only was this opportunity transformative in terms of my academic development and professional career, but also I will leave Japan with a much-broadened worldview and a genuine appreciation for Japanese culture. In addition to the many academic contacts I made in Japan, I also formed a number of close friendships that I believe will endure even after I return home. In short, I have cherished every aspect of my summer here, and I sincerely look forward to returning to Japan in the future.

RESEARCH REPORT

1. Name: Agnieszka Anna Czeszumska （ID No.: SP11008）

2. Current affiliation: University of California, Berkeley

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Japan Atomic Energy Agency

5. Host researcher: Dr. Satoshi CHIBA

6. Description of your current research

The research I conduct at UC Berkeley concerns cross section measurements (or reaction probabilities) of short-lived actinides. In particular, I used the Surrogate Ratio Method (SRM) to deduce the neutron-induced fission cross section of Np-239, which could have implications in proliferation-resistant nuclear reactor designs. Since Np-239 has a short half-life (about 2 days), a direct measurement would be practically impossible. However, an indirect method – the Surrogate Ratio Method – enables such challenging cross section measurements.

The surrogate method takes advantage of the properties of a compound nucleus reaction, where a compound nucleus formed in two different ways decays with the same probabilities. Hence, one can use a surrogate reaction on a stable target to deduce cross section of the desired reaction. However, the SRM relies on certain properties of the compound nucleus that yet still need to be tested and verified.

7. Research implementation and results under the program

Title of your research plan:

Exploring Experimental and Theoretical Aspects of the Surrogate Ratio Method

Description of the research activities:

Due to the Great East Japan Earthquake, some facilities at JAEA this summer were undergoing repairs and hence unusable, including the tandem accelerator that was going to be used for the surrogate experiment. Since no experiment would take place until after I leave, my research plan had to be modified, and instead of conducting one cohesive project, I split my time learning about various aspects of the surrogate method and participated in preparations for the upcoming experiment.

I spent approximately half of the summer analyzing data from an efficiency calibration measurement of LaBr3(Ce) gamma ray detectors, to be used on future

surrogate experiments. Through this experiment I was able to learn about a calibration technique, which uses a proton beam on aluminum target to induce a resonance-capture reaction, producing high-energy gamma rays of known intensities.

Throughout the summer, I also participated (under Dr. Nisho's guidance) in characterization of other detectors for the surrogate experiments, such as silicon detectors for ion detection, and multi-wire proportional chamber detectors for fission fragment detection. This surrogate detector system is different from the one in Berkeley, and hence I found it worthwhile to learn about these various detectors. Dr. Nishinaka also showed me how to prepare targets for the experiment using the electrodeposition method, which I found very interesting, since I have not done target preparations before.

As for the theoretical aspects of the surrogate method, Dr. Chiba and Dr. Aritomo generously devoted their time to explaining nuclear models and results of their calculations to me. I made my own calculations using an open source software TALYS. In these calculations I am trying to confirm the validity of the surrogate ratio method for the Np-239 experiment, through calculating fission probability for various spin values of the compound nucleus. For the surrogate method to be valid, the fission probabilities need to converge under different spins.

Overall, this summer was a good chance for me to learn about experimental and theoretical aspects of experiment preparation, and the skills I acquired will certainly benefit my future research endeavors.

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

Although living in Tokai (a village about 2.5 hours from Tokyo) was a little isolating, I was able to fully immerse myself in the Japanese culture, and my summer was full of adventure and growth, both academic and cultural. I am very grateful for having been given this opportunity, especially at this difficult time, and to experience Japan's rich culture and its superb research facilities. I am very thankful to my host researcher, Dr. Chiba, for being an incredibly helpful and resourceful host, and to all the other members of the research group for teaching me numerous skills.

RESEARCH REPORT

1. Name: Andrew Davis （ID No.: SP11009）

2. Current affiliation: Georgia Institute of Technology

3. Research fields and specialties:

Mathematical and Physical Sciences

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

5. Host researcher: Sanae Chiba

6. Description of your current research

The Kuroshio is the Western Boundary Current corresponding the North Pacific subtropical gyre, transporting warm, nutrient-poor water northward. It is also an area of considerable biological productivity, supporting communities that comprise Japanese fisheries. Biological variability is impacted considerably by physical variability. Nutrients are upwelled by and entrained in mesoscale features, and horizontal transports can influence the growth and migration of populations.

The focus of our research was on the linked interannual and decadal variability of physical variables and biological productivity. Using the output of OFES, a global high-resolution ocean model, we measured variables such as eddy kinetic energy (EKE), a measure of activity on short spatial scales, and eddy count, a measure of mesoscale eddy features. We also used the Odate collection, a 30-year record of zooplankton biomass measurements taken off the coast of Japan.

We attempted to correlate these variables both with large-scale climate indices and measurements of zooplankton, in order to gain a fuller understanding of the interplay between climate, mesoscale activity, and biological productivity.

7. Research implementation and results under the program

Title of your research plan:

Ocean Vortices in the Kuroshio-Oyashio extension and their Effect on Zooplankton Distribution

Description of the research activities:

Relatively early on we discovered that while we could quantify mesoscale activity and identify linked modes of variability well, we were unable either to find correlations with climate indices or zooplankton populations. Although we will attempt to further these ideas in the future, we decided to put them on hold to look more directly at transport pathways.

It was in this area we had our greatest successes. We used a Lagrangian tracking algorithm to release and follow virtual particles from March to September. A yearly index of this transport we found to be extremely well correlated with our zooplankton

observations. This indicates that much of the yearly variance in zooplankton populations is due to transport, which has a large degree of interannual variability. Next we will attempt to tie this variability with large-scale climate indices.

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

Highlights of my trip were my three mountain climbs (Mt. Fuji, Mt. Tanzawa, and Mt. Hou-ou), and my two trips diving in Manazuru. My labmates were extremely helpful in making recommendations.

RESEARCH REPORT

1. Name: John DeGrave （ID No.: SP11010）

2. Current affiliation: University of Wisconsin-Madison

3. Research fields and specialties:

Mathematical and Physical Sciences, Chemistry

4. Host institution: University of Tokyo and RIKEN

5. Host researcher: Yoshinori Tokura and Yoshinori Onose

6. Description of your current research

My research with Song Jin at UW-Madison focuses on the synthesis and physical characterization of silicide and germanide nanowires. We implement a combination of single-source precursor and metal halide delivery techniques in chemical vapor deposition reactors to synthesize silicide nanowires. Among the many nanowire materials that have been synthesized by the Song Jin research group, I am primarily focused on higher manganese silicide, MnSi, and Fe1-xCoxSi nanowires. Higher manganese silicide nanowires have a complex crystal structure and have shown promise for their enhanced thermoelectric properties compared to the bulk system. MnSi and Fe1-xCoxSi belong to the B20 class of silicides and have attracted attention recently owing to their complex magnetic structures as elucidated by Lorentz transmission electron microscopy (Yu et al.). Namely, these silicides have shown helimagnetic and Skyrmion spin textures. In my research, single nanowire devices of MnSi and Fe1-xCoxSi are fabricated using electron-beam lithography and metal deposition techniques to measure the electromagnetic properties. We have identified the electrical signature of helimagnetism in MnSi nanowires, and we have developed Andreev reflection spectroscopy with Fe1-xCoxSi nanowires for spin polarization measurements.

7. Research implementation and results under the program

Title of your research plan:

Investigation of Exotic Magnetic Textures in B20 Silicide and Germanide Nanowires

Description of the research activities:

I have worked with my Japanese host researchers to identify both helimagnetic and Skyrmion magnetic textures in MnSi and Fe1-xCoxSi nanowires. We have implemented observation by Lorentz transmission electron microscopy (LTEM) which allows for real-space imaging of magnetic structure. Nanowire samples for LTEM observation were prepared by three different methods: transferring as-synthesized nanowires to TEM grids, ion milling to create thin (less than 50 nm) cross-sections of nanowires, and by focused ion beam (FIB) cross-section preparation. All three methods were used to prepare suitable TEM samples, however we were unable to observe distinct magnetic contrast in the LTEM. We believe the failure to observe the magnetic structure by LTEM was partly due to surface roughness of the nanowires in addition several other convolving factors. This first attempt at observation of nanowires by LTEM has demonstrated the strict sample requirements and will help to guide further synthetic efforts. In addition to LTEM observation, we have attempted to make single nanowire devices for electronic noise measurements. It has been proposed that the motion of Skyrmions causes periodic electrical noise, and one-dimensional nanowires present a great opportunity for realizing this measurement. We found that implementing routine electron-beam lithography techniques from my home institution was quite difficult due to software compatibility and several other issues, but we are still hopeful that we can maintain future collaboration with both projects.

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

I have been very impressed by the outstanding quality of science in Japan. Everyone I work with has been very accommodating and eager to enter into discussions about science as well as Japanese culture. I received great recommendations for sightseeing that I was able to take advantage of in Tokyo, Kyoto, Nikko, and Matsumoto. It was a great experience, and this trip has provided the opportunity for a long and fruitful collaboration between my home institution and my host researchers here in Japan.

RESEARCH REPORT

1. Name: Sara Di Rienzi （ID No.: SP11011 ）

2. Current affiliation: University of Washington, Department of Genome Sciences

3. Research fields and specialties:

Biological Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Dr. Yuichi Hongoh

6. Description of your current research

Termites are unique organisms capable of digesting plant material. This ability gives termites extreme destructive power and makes them a key part of the nitrogen cycle. Termites digest plant material through a combination of their own enzymes and the actions of microbes living within their gut. This set of microbes, the termite gut microbiome, has evolved in the presence of a very specific environment. In particular, the termite gut microbiome is predicted to have adapted to the termite diet. Not all termites, however, have the same diet. Some termites are wood-eaters while others are soil-eaters. The bacterial group, TG3, comprises 10% of the termite microbiome. It is found in both wood-eating and soil-eating termites. How then has a diet of wood versus soil affected TG3 bacteria?

In order to understand the specificity of TG3 to the termite gut, I undertook an attempt to obtain genome sequence for TG3 bacteria. TG3 are unfortunately unculturable bacteria and are naturally found in the presence of numerous other bacterial species in the termite gut. I therefore, attempted to use single cell genomics in order to 1) isolate single TG3 cells and 2) sequence the genome of a single TG3 cell.

After obtaining genomic sequence for TG3 isolated from both wood-eating and soil-eating bacteria, TG3 sequence is to be analyzed for the presence or absence of genes related to the digestion of plant carbon sources. I anticipate observing a different spectrum of carbon digesting enzymes encoded in TG3 isolated from wood-eating versus soil-eating bacteria.

The results of this work will serve to not only aid in understanding how termites are able to degrade plant material but will also provide insight into how microbiomes adapt to their host.

7. Research implementation and results under the program

Title of your research plan:

How have termite gut bacteria adapted to their host diet?

Description of the research activities:

I was provided with wood-eating termites (*Nasutitermes takasagoensis*), freshly collected from Okinawa. I dissected the guts from these termites. Single TG3 cells were successfully isolated by way of laser dissection. In this technique, termite gut material was spread onto a membrane and viewed under a microscope. The microscope is equipped with a laser capable of cutting the membrane. Using this microscope, I was able to direct the laser to cut out single TG3 cells.

Single cells, however, do not have enough DNA for genome sequencing. I therefore used whole genome amplification (WGA) in order to amplify all of a single TG3 cell's DNA.

I succeed in amplifying DNA from TG3 cells. After sequence confirmation, unfortunately, the DNA was found to not be from TG3 but rather from contaminating bacteria.

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

During my stay, Dr. Hongoh introduced me to many of Japan's most prominent scientists. Talking with them has given me incredible insight into the challenges researchers face working in Japan.

I have been able to share my experiences working in Japan through a blog. Though originally only intended for a group of high school students, the blog has received over 600 hits.

9. Advisor's remarks (if any):

The JSPS fellow, Ms Sara DiRienzi, here engaged in single-cell genomics of unculturable bacteria in termite guts. The methodology is very novel, immature and challenging, and so it is not easy to succeed in a short period. Her results of experiments were not successful, but I believe the experiences help and provide inspiration to her future works in US. I hope she enjoyed the life in Japan and visits here again.

RESEARCH REPORT

1. Name: John Eimes （ID No.: SP11013）

2. Current affiliation: University of Wisconsin-Milwaukee

3. Research fields and specialties:

Biological Sciences

4. Host institution: Graduate University for Advanced Studies

5. Host researcher: Dr. Yoko Satta

6. Description of your current research

The Major Histocompatibility Complex (MHC) is the most polymorphic coding region in the vertebrate genome and genetic variation at these loci is important for disease resistance and survival in many taxa. MHC class I and II genes code for proteins that primarily recognize and bind to foreign or defective peptides and initiate the adaptive immune response; thus, the MHC is most likely under strong selection from parasites and pathogens.

Most of what we know about the evolution of the MHC comes from studies of mammals, and our understanding of MHC evolution in birds is relatively poor. For example, the divergence of orthologous MHC genes in primate species has been studied for decades and there are several estimates of the selection coefficient at the MHC, but until recently, few examples of orthology in MHC genes have been described in birds (reviewed by Hess and Edwards 2002) and the selection coefficient at the MHC has not been measured reliably. Advances in DNA sequencing have increased the number of MHC sequences in public databases dramatically, and new studies have been able to firmly establish orthology of some bird MHC genes making possible a new estimate of the selection coefficient and divergence of MHC genes in avian Order: Galliformes.

7. Research implementation and results under the program

Title of your research plan:

Estimation of Divergence and Selection in Ancient Avian Immune Function Genes

Description of the research activities:

In order to calculate the selection coefficient: s, the non-synonymous substitution rate must be estimated. We used the minimum-minimum method described by Satta et al. (1993) in which orthologous sequences from a subset of closely related species with known divergence times are compared in a pairwise fashion. The divergence (synonymous substitution rate per site = dS) of MHC II exon 2 sequences from each species was calculated and plotted in species pairs according to species divergence time. Because species divergence time estimates based on non-MHC genes are known for these taxa, the pair of alleles with the smallest substitution rate, should reflect the "true" rate. The slope of the line of these minimum dS values across species pairs yields the synonymous substitution rate, Dm. Computer simulations (designed by Dr. Satta) previously evaluated the amount of synonymous divergence that is required for accurate estimates of the number of neutral substitutions at 5. After this evaluation, using the appropriate the number of substitutions, we will calculate the selection coefficient, s, by using the equations: s = S/2 Ne, where S = KB2/$\sqrt{}$2 (see Satta et al. 1994 for complete list of equations).

We have compiled, aligned and analyzed all of the MHC sequences necessary to complete our estimates of Dm and s. Further analysis of species divergence estimates, saturation rates and species pair dS rates are currently being finalized. We anticipate reporting estimates of both Dm and s before the end of the summer program (24 Aug 2011).

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

I enjoyed my stay in Japan very much and would like to come back to work here again. I enjoyed visiting the many shrines and temples and especially Kyoto.

RESEARCH REPORT

1. Name: Keary M. Engle （ID No.: SP11014）

2. Current affiliation: The Scripps Research Institute

3. Research fields and specialties:

Chemistry

4. Host institution: University of Tokyo

5. Host researcher: Professor Kyoko Nozaki

6. Description of your current research

In the research laboratory of Professor Jin-Quan Yu, my research focuses on the design of new reactions to convert unactivated carbon–hydrogen (C–H) bonds into carbon–carbon (C–C) bonds. Through the discovery and development of novel transformations of this type, we aim to streamline how chemists synthesize medicines, agrochemicals, and materials by lowering energy consumption, minimizing step count, and eliminating unnecessary waste. To this end, we recently discovered that commercially available mono-*N*-protected amino acid ligands are capable of accelerating Pd(II)-catalyzed *ortho*-C–H olefination of phenylacetic acids, providing an efficient route to transform feedstock chemicals into synthetically versatile intermediates. This highly atom-economic transformation utilizes an aerobic oxidation system, producing the desired products in quantitative yields, while generating water as the sole byproduct. The method is a valuable alternative to Mizoroki–Heck chemistry, which requires the pre-installation of an aryl–halide bond, and to many other arene C–H olefination reactions, which are lacking in catalytic efficiency and generate large quantities of waste. Since our initial work in this area, our group has gone on to extend ligand-accelerated C–H functionalization to other classes of substrates, including phenethyl alcohols and benzyl sulfonamides. We have also observed beneficial effects of amino acid ligands in other, categorically distinct C–H functionalization reaction, such as C–H carbonylation and C–H/R–M cross-coupling. In the long term, we hope application of this class of ligands will improve the efficiency of known Pd(II)-catalyzed C–H functionalization reactions and lead to the discovery of fundamentally new transformations.

7. Research implementation and results under the program

Title of your research plan:

C–H Activation Polymerization: An Expedient Route to Novel Electroluminescent PPV Polymers

Description of the research activities:

My proposed research project sought to utilize the reactions described above in polymer synthesis. However, after arriving in Japan, results from preliminary experimentation were not encouraging. Thus, we made a strategic decision to shift the focus of my work to an ongoing project in the Nozaki lab concerning CO_2 hydrogenation as a means of synthesizing formic acid. In 2009, the Nozaki lab reported that homogenous pyridine-containing [PNP–IrH_3] complexes could catalyzed CO_2 hyrdogenation with the highest activity reported to date. My project was to synthesize a pyrazine-containing [PNP–IrH_3] catalyst, as well as other target complexes, with the aim of finding improved reactivity. My efforts culminated in the synthesis of three novel ligands/complexes, and examination of the reactivity of these species is ongoing. One ligand was particularly challenging to synthesize. Thus, its completion represents and important step forward in the identification of increasingly efficient catalysts in CO_2 hyrdogenation for potential commercial applications.

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

With four fellow JSPS Summer Program students, I completed an overnight climb of Mt. Fuji, reaching the summit just in time for sunrise. I traveled by Shinkansen to Kyoto, where I delivered a lecture at Kyoto University and enjoyed the festivities of Gion Matsuri. My labmates and I attended a baseball game between the Tokyo Giants and the Yakult Swallows, and we also went as a group to an entertainment center with high-tech batting cages to celebrate 4th of July.

9. Advisor's remarks (if any):

Mr. Engle made great contribution to our group during his stay. Scientifically, he developed a promising method for the synthesis of new class of ligand, pyrazine-based PNPs. By this methodology, now it became possible to synthesize a family of pyrazine ligands, hopefully applicable to wide variety of reactions. In addition, his positive attitude for science and open-minded personality extremely stimulated my group members to open their eyes to the world. I believe the network he created in our lab will be beneficial for both sides in the future and deeply appreciate the financial support by JSPS.

RESEARCH REPORT

1. Name: Charles M. Enloe （ID No.: SP11015）

2. Current affiliation: Colorado School of Mines

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Nobuhiro TSUJI

6. Description of your current research

To capitalize on the increased processing temperature capability and reduction in processing times associated with high-temperature vacuum carburizing, existing commercial carburizing alloys must be modified for high temperature grain stability while maintaining or improving existing fatigue performance standards. It is well established that grain stability may be achieved by small additions of Nb to carburizing steels due to grain boundary effects of Nb-rich carbonitride precipitation. By obtaining a fundamental understanding of the thermodynamic and kinetic behavior of Mo in high-temperature vacuum carburizing alloys with respect to microalloy precipitate formation, dissolution and coarsening, it becomes increasingly feasible to tailor alloy content and optimize process parameters to retard the onset of abnormal grain growth at increasingly high processing temperatures by manipulation of precipitate distribution and composition. Current research is focused the effect of Mo on the evolution of precipitate distributions and precipitate composition and morphology upon reheat, at a fixed heating rate, to vacuum carburizing temperatures. Precipitate evolution, in turn, will dictate the high temperature grain stability in experimental alloys. Both quantitative optical microscopy and transmission electron microscopy are used as primary characterization tools.

7. Research implementation and results under the program

Title of your research plan:

The Effect of Molybdenum on Niobium, Titanium Carbonitride Precipitate Stability and Grain Refinement in High-Temperature Vacuum Carburizing Steel

Description of the research activities:

Transmission electron microscopy confirms the presence of greater carbonitride density non-uniformities in Mo-free alloys relative to Mo-containing alloys in both as-received and pseudo-carburized samples. Quantitative microstructural analyses show that the tested experimental alloys containing a nominal Nb addition of 0.10 wt pct greatly retard the onset of abnormal grain growth at 1100 °C. The grain refining effect of a Mo addition of 0.3 wt pct is evident, though the exact mechanism has not been established. It is speculated that in addition to possible effects of Mo on Nb diffusivity and Nb-rich particle/matrix interfacial energy, the ability of Mo to refine as-hot rolled microstructures and lessen precipitate spatial non-uniformities may also lessen the coarsening rate of precipitates upon reheat due to short-range diffusion phenomena.

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

Cultural experiences are too many to list properly. I would just like to add shortly that I greatly enjoyed my brief time working with Prof. Tsuji and his lab, and I look forward to continued collaboration.

RESEARCH REPORT

1. Name: Terry Ferrett （ID No.: SP11016）

2. Current affiliation: West Virginia University

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Yokohama National University

5. Host researcher: Hideki Ochiai

6. Description of your current research

My current research is the analysis and design of a high-performance technique for wireless communication in a specific network – the two-way relay network, containing a pair of end nodes which exchange data through a relay node. There are many protocols for exchanging data in this network, however, the technique I am considering is shown to provide the maximum achievable data rate under certain communication scenarios.

The technique, physical-layer network coding, increases data rates by allowing the end nodes to transmit simultaneously to the relay and deliberately interfere with one another. The relay receives the sum of received signals and performs detection on this sum, rather than attempting to detect the signal from each node separately. Simultaneous transmission saves time and bandwidth over conventional protocols which require that the sources transmit in different times or frequency bands.

The specific goals of my research are to derive the rules for detecting the sum of received signals at the relay in a fashion which can be used to perform channel decoding, and to analyze practical schemes for estimating the state of the wireless channel during signal reception, using a modulation scheme which does not require phase information at the relay.

7. Research implementation and results under the program

Title of your research plan:

Parallel-Computing Assisted Performance Comparison of Cooperative Networking Techniques

Description of the research activities:

The goal of my project is to compare the energy efficiency of two wireless communication protocols in the three-terminal relay network. The initial task was to modify the simulation code which implements the one-way relaying technique to use the same digital signaling as used in the two-way relaying technique -

frequency-shift keyed modulation. Verification of the modified code was performed against the original by simulation.

The second task was to combine the one-way and two-way relaying technique into a single simulation. It was discovered that the channel coding techniques applied in the one-way and two-way relaying cases were sufficiently different to require a complete re-implementation of both simulations. To make effective use of contact with the host researchers , the focus of the project was shifted from computer simulation to mathematical analysis, as the original simulation author was no longer in the laboratory.

The error-rate performance of the two-way relaying technique was bounded analytically, which provided a closed-form expression for the energy efficiency. The mathematical model of the two-way relaying technique yields a multi-dimensional integral which cannot be solved in closed form, motivating the search for a bound.

The derivation of a performance bound for the two-way relaying technique motivates the search for a bound on the performance of one-way relaying. A fully analytical performance comparison would allow an inexact but rapid performance comparison. Performance comparison by simulation provides exact performance measures, but requires more time to compute than analytical bounding.

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

The Japanese people are extremely friendly, polite, disciplined, and helpful to a foreigner lost in Tokyo asking for directions! On my way to the NSF luncheon at the end of July, I approached a group of four Japanese on the streets of Tokyo, asking for directions to the Homat Viscount. After clarifying the name of the building by typing it directly into the phone of one of my benefactors, the group kindly spent five to ten minutes plotting a route map between our location and the Viscount.

When it was clear that I was having difficulty interpreting the directions on the map, the matriarch of the group suggested that we all walk together to the destination. If it weren't for the kindness, I probably would have circled the same city blocks for hours before arriving, stopping at every Starbucks to keep me going!

The extent of group-oriented culture was made very clear to me on the basketball court at my host university. While working on my game individually, I made a friend who invited me to play with a group of students. Interestingly, they deferred to me on the logistics of rules and picking teams.

I suggested picking teams in a manner often used in the US: ten players line up at the free-throw line and take turns shooting until five make their shots. It was obvious that the Japanese students were uncomfortable being singled out in this manner, and after three shots, one of the players suggested forming teams by dormitory! The contrasts between Eastern and Western cultures to which I've been exposed over the past three months were crystallized at that moment.

RESEARCH REPORT

1. Name: Katherine B Follette （ID No.: SP11017）

2. Current affiliation: University of Arizona

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: National Astronomical Observatory of Japan

5. Host researcher: Dr. Motohide Tamura

6. Description of your current research

My doctoral research has been mainly focused on the disks of gas and dust surrounding young stars. I am specifically interested in the transition from the thick disks of gas and dust that surround young stars to young planetary systems with very little disk material remaining. How and when planets form from such disks and by what mechanism they clear out the surrounding material is a major unanswered question in modern astrophysics.

I study these disks at infrared wavelengths with the MMT telescope in Arizona, and am also a member of the Magellan Adaptive Optics team. We have designed a suite of instruments to compliment the new "Adaptive Secondary Mirror" (ASM) being brought to the Magellan telescope at Las Campanas observatory in Chile in 2012. This revolutionary ASM will correct for the blurring effects of the earth's atmosphere to very high order, allowing us to achieve correction not only at infrared wavelengths, but also in visible light. I design the science cases for these new instruments, many of which center around its ability to image disks around young stars at very high resolution.

One-third of my doctoral thesis will also be focused on educational research regarding how best to improve quantitative literacy and numerical skills in undergraduate students through introductory science courses for non-majors.

7. Research implementation and results under the program

Title of your research plan:

Detection of Exoplanets and Planet-Forming Disks with Subaru SEEDS Data

Description of the research activities:

As a member of the SEEDS team this summer, I was charged with data reduction of the disk around the star SR 21. As this data was gathered in a common SEEDS observing mode, I was also asked to compile a manual on the data reduction and analysis steps for this mode (Polarized Differential Imaging). I have written versions of the manual in both English and Japanese because the SEEDS team has many members abroad as well as in Japan. We hope that this manual will be of use to current and future SEEDS collaborators and will help to standardize and streamline the PDI data reduction process.

I have also completed my own PDI data reduction of SR 21. Although we may iterate on some of the data reduction steps in the future, the final products are approaching publication quality. I attended a workshop held by another member of the SEEDS team on computer modeling of disks in July, and have now begun running these models to try to understand the physical conditions in the disk.

We are confident that we have imaged the SR 21 disk in this mode, and we plan to submit a paper on our results after my return to Arizona. I also hope to present my preliminary results at the "Signposts of Planets" Conference at Goddard Space Flight Center this coming October.

Finally, I was able to attend a SEEDS observing run at the Subaru telescope on Mauna Kea in Hawaii in early August. This allowed me to see the data collection method firsthand, to broaden my observing experience and to expand my contacts within the SEEDS team.

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

I had a wonderful and very productive summer in Japan. Culturally, I have enjoyed sightseeing in the greater Tokyo area (Tokyo, Yokohama, Kamakura and Hakone) and improving my Japanese, particularly my scientific vocabulary, through interactions with my Japanese colleagues.

RESEARCH REPORT

1. Name: Kevin Foster （ID No.: SP11018）

2. Current affiliation: Virginia Tech

3. Research fields and specialties:

Engineering

4. Host institution: Chuo University

5. Host researcher: Professor Takaji Kokusho

6. Description of your current research

1. Analysis of KiK-net site amplification data from the March 2011 Tohoku Earthquake. KiK-net is the name given to an extensive strong-motion seismograph network that was installed in Japan after the 1995 Kobe earthquake. It is the densest seismograph network of its type in the world. KiK-net is unique because each seismograph location has one instrument at the ground surface, and another "downhole" instrument that is installed in a borehole. The downhole instruments are located at the interface between bedrock and soil. By comparing the nature of the recorded motions at the two locations at each site, details of seismic wave amplification near the earth's surface can be inferred. Site amplification is of great interest to earthquake geotechnical engineers and strong-motion seismologists, as it plays a major role in determining the nature of earthquake motion at the ground surface, and the extent to which they will be damaging to infrastructure when earthquakes occur.

2. Laboratory testing of liquefaction characteristics using the Kokusho Mini-Cone Triaxial Device. This device is a one-of-a-kind device that allows for the direct correlation between two parameters of great importance in geotechnical earthquake engineering: 1) CPT (cone penetration testing) cone resistance, an empirical measure that is frequently employed in field testing of soils for geotechnical site characterization purposes; and 2) liquefaction resistance, the ability of a soil deposit to withstand the tendency for liquefaction during earthquake shaking. Liquefaction is a phenomenon that can occur in loose sandy soil deposits, whereby the soil loses shear strength for a short time during dynamic loading.

7. Research implementation and results under the program

Title of your research plan:

1. Analysis of site amplification during the 2011 Tohoku Earthquake using the KiK-net strong motion array.
2. Investigating the liquefaction characteristics of sands containing non-plastic silts using the Kokusho Mini-Cone Triaxial Device.

Description of the research activities:

1. At the end of my time in Japan, I delivered a database of frequency-dependent amplification functions from KiK-net seismograph stations located throughout Japan, which will be used in research analyzing the site amplification observed during the March earthquake.
2. The main purpose of my time with this equipment was to facilitate future collaboration using the equipment, and possibly aid in constructing a similar device for the geotechnical engineering laboratory at Virginia Tech. To that end, I observed and assisted in laboratory liquefaction testing in the Kokusho lab. I also documented the testing equipment, procedures, and data reduction in a laboratory manual format in English.

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

My favorite experiences were climbing Mount Fuji and Mount Kitadake. I attended a Japanese geotechnical engineering conference in Kobe. I traveled with my sensei and labmates to the recently destroyed town of Onagawa to study liquefaction of building foundations before the tsunami impact. I also enjoyed regular conversation with a JSPS postdoctoral fellow from New Zealand, who worked in our neighboring lab. This experience opened an opportunity to contribute to open-source seismic hazard analysis software, a task I will begin in the near future when I return to Virginia Tech.

9. Advisor's remarks (if any):

Kevin has brought international atmosphere among our students and a great impetus for them to be interested in international affairs in our research field and in general as well. He seems to have enjoyed exchanges with Japanese students and also has gained computational results on seismic site amplifications during the Tohoku-Pacific earthquake and know-hows on the lab test using the Mini-cone triaxial apparatus.

RESEARCH REPORT

1. Name: Seth Frey （ID No.: SP11019）

2. Current affiliation: Cognitive Science Program, Indiana University

3. Research fields and specialties:

Social Sciences

4. Host institution: Hokkaido University

5. Host researcher: Tatsuya Kameda

6. Description of your current research

I use methods from experimental economics to explore questions of interest in social psychology, organizational behavior, and complex systems. I collect groups of subjects to play simple games for money. Between experiment and individual-level cognitive modeling, I try to understand collective outcomes in terms of individual behavior, with a special focus on the emergence of group structure (how groups adapt to the problem they are solving) and dynamics (describing the time course of individual and group behavior, and its evolution).

Previous work in multi-player economic games has shown that large groups (established exogenously by the experimenter) can work together better if they grew incrementally from small groups. My goal this summer was to examine this finding in endogenous groups---subgroups that emerge as a result of individual interactions in the task.

The results suggest that subjects transferred their experience in a very different game to their new environment, and groups with this theoretically irrelevant experience actually performed better than groups who had only experienced the test environment. Learning transfer in groups is a new field with implications for interaction design.

7. Research implementation and results under the program

Title of your research plan:

Crowdsourced Experiments on the Internal Structure of Coordinating Groups

Description of the research activities:

I arrived in Japan with a second draft of my experiment, as planned, and I spent the first week incorporating feedback from my host and preparing it for implementation on the novel platform that we used. This experiment was implemented on a web-based platform called Mechanical Turk. Experiments that use it engage users from around the world simultaneously, and its requirements are unique.

Over the next three weeks I collected data, and then performed a preliminary analysis which motivated another condition. I spent the next two weeks running the other condition. This condition involved an increased pay rate, and I was grateful for the summer program's support of my research expenses. My results were very interesting and unexpected. They are motivating some followup experiments back in the states.

The last part of my plan was to implement a behavioral model of the data. I chose to digress from the plan to take advantage of some of the opportunities that my visit has made possible. I benefitted from an unexpected opportunity to collaborate with a professor in the Mathematics department. Professor Yuzuru Sato has written a complex analytic model that encompasses my work. My past results coincidentally provide a behavioral observation of his model's predictions, observations that have not been made before. I thus chose to analyze his model to flesh out its predictions in my special case. We have already met many times to discuss the implications, and the predictions that his model makes for future work in this domain. I am very grateful that my trip made this serendipitous collaboration possible.

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

My love for tayaki got me a reputation in the lab.

RESEARCH REPORT

1. Name: Alyssa Fu （ID No.: SP11020）

2. Current affiliation: Stanford University

3. Research fields and specialties:

Social Sciences

4. Host institution: Yokohama National University

5. Host researcher: Yukiko Muramoto

6. Description of your current research

Students often experience difficulty in the classroom, for example failing a test or struggling to understand complex concepts. How students interpret these events can be important for maintaining motivation afterward on future tasks and assignments in the classroom. In my research, I examine how students' reactions to difficulty in the classroom can differ across cultural contexts. In the United States, people tend to see themselves as independent individuals and the dominant source of action. Action is seen as reflecting internal desires and drives as well as personal preferences and goals. In other cultures, however, such as East Asian cultures, people tend to see themselves as interdependent and parts of a larger social whole. Action is guided not by internal states but by what is required in the situation and includes paying attention to other people's expectations and social obligations. These differences in how people see themselves and their actions across cultural contexts is relevant to understanding how students react to academic difficulties and remain motivated in those situations. I hypothesize that in East Asian contexts students that are made to consider others with whom they are connected (e.g., mother) will be more motivated after failure, while in European American contexts, even reminders of close others will be demotivating. In European American contexts, people are expected to be internally motivated and the influence of others on one's actions delegitimizes that action. In East Asian contexts, however, people are expected to be responsive to close others and so will not experience a conflict in including others in their actions. In several studies I have found preliminary evidence to support these predictions. Asian Americans are more likely to think about others after experiencing a negative academic experience and are more motivated by close others compared to European Americans.

7. Research implementation and results under the program

Title of your research plan: Culture and academic achievement: A cultural comparison of students' reactions to close others after failure

Description of the research activities: While in Japan, I created a survey to administer to Japanese students in order to examine how they experience failure and the effects of considering close others after that failure. In Japan, people tend to see themselves as interdependent and connected to others; a person cannot be understood without understanding his or her relationship with others. In the United States, people tend to see themselves very differently. There the emphasis is on being an individual, separate from others. A person is understood through his or her internal traits, attributes, and goals. We expect to find then that academic failure in Japan and the United States will be experienced very differently. In Japan, we expect that students will be more likely to consider how a failure may affect those people with whom they are interconnected (e.g., family, classmates), while in the United States we expect that students will be more likely to consider what the failure means about their personal selves. In the survey for Japan, we present undergraduate participants with a vignette prompt in which we describe a student who is experiencing a difficulty and ask participants to imagine that they are in the student's position. Participants then answer a series of questions aimed at measuring the extent to which they are considering others after the difficult academic experience or themselves. We also plan to run a version of this study in the United States. We expect to find that Japanese students will be more likely to consider others after the academic failure compared to the European American students.

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

I attended several classes on history and social psychology that were taught in Japanese. I also attended a club that visited the local elementary school to teach the children English. I spent some time with my host family, and they took me around the Minatomirai area in Yokohama Bay. I attended a conference in Kyoto and so was able to experience and visit some of Japan's shrines and temples.

RESEARCH REPORT

1. Name: Jessica M. Glicken （ID No.: SP11021）

2. Current affiliation: The University of Montana, Department of Chemistry and Biochemistry

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Kinki University, Institute of Advanced Technology, High Pressure Protein Research Center

5. Host researcher: Professor Kazuyuki Akasaka

6. Description of your current research

At the University of Montana, we use nuclear magnetic resonance (NMR) spectroscopy to study protein structure and dynamics. One of our proteins of interest is fibronectin, a large glycoprotein that is essential for cell survival, movement, and differentiation. Cells convert soluble fibronectin into an insoluble fibrillar form, but the mechanism for this process remains elusive. Anastellin, a truncated fragment of fibronectin, interacts with soluble fibronectin in vitro converting it to an insoluble form resembling the fibronectin fibrillar matrix. One of the binding sites for anastellin in fibronectin is the third type-III domain (3FN3). Unbound 3FN3 yields high-resolution NMR spectra; however, conformational fluctuations of 3FN3 bound to anastellin prevent acquisition of spectra suitable for structural studies.

We have recently completed the structure of 3FN3; however, our focus is on the anastellin:3FN3 complex. To better understand this complex we have begun to explore methods such as hydrogen-deuterium (H/D) exchange and limited proteolysis. Using the H/D exchange we have identified regions of 3FN3 that are solvent protected when bound to anastellin. The limited proteolysis is also providing us with information about fragments of 3FN3 that bind to anastellin, and is proving to be complimentary to our H/D exchange data. While these methods provide us with information on the dynamics of the complex and likely interaction sites, further information is necessary.

7. Research implementation and results under the program

Title of your research plan:

Using High Pressure NMR Spectroscopy to study the Anastellin, 3FN3, and the Anastellin:3FN3 protein complex.

Description of the research activities:

At the Kinki University I was introduced to high pressure NMR. This method is useful for studying protein dynamics. Monitoring protein NMR spectra while increasing pressure can provide us with information about changes to hydrogen bond (H-bond) length and torsional angles, small and fast conformational fluctuations, and identify regions of higher stability with in the structure.

My samples included unbound anastellin, unbound 3FN3, and two anastellin:3FN3 complexes (one with each component ^{15}N-labeled). Anastellin and the complexes did not yield high-resolution spectra at higher pressure due to extensive line broadening; however, we were able to collect sufficient data for unbound 3FN3. Analysis of the data has shown changes to H-bond length complimentary to earlier H/D exchange studies of unbound 3FN3. Further analysis and additional experiments will be completed at a later time. This will allow us to better understand the dynamics of unbound 3FN3 and its role in the interaction with anastellin.

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

Being the only program participant in the Wakayama area, as well as one of maybe only a handful of foreigners in the town, I experienced and learned so much more about everyday Japanese life and the Japanese culture. I was able to visit several other small towns in the vicinity and participate in festivals and events such as the Kokawa Matsuri and Yosakoi dancing in Wakayama. This experience has been amazing, not only for my professional career, but also personally as it has allowed me to reconnect with my Japanese relatives.

RESEARCH REPORT

1. Name: Kathleen J. Gosnell （ID No.: SP11022）

2. Current affiliation: University of Connecticut

3. Research fields and specialties:

Chemistry, Mathematical and Physical Sciences

4. Host institution: National Institute for Environmental Studies

5. Host researcher: Dr. Yasuyuki Shibata and Akinori Takeuchi

6. Description of your current research

I am investigating the transfer of mercury (Hg) and methyl mercury (MeHg) from primary producers (phytoplankton) to primary consumers (zooplankton) in the marine environment. To test this I am cultureing native phytoplankton, enriching them with isotopically distinct mercury and methylmercury, and then feed them to cultured native zooplankton. Then I will assess the assimilation efficiency, as well as transfer concentration. Collected samples will be analyzed in the analytical lab at the University of Connecticut using our high sensitivity Element2 ICP-MS in low resolution mode. Through carefully controlled laboratory experiment the effects of different water Hg concentrations and the presence of different amounts and forms of organic matter will be quantified for various phytoplankton and zooplankton species. I am additionally collecting field samples of plankton and measuring them for Hg and MeHg in order to determine 'real world' boundaries of biomagnifications and trophic transfer.

7. Research implementation and results under the program

My primary aim of this research was to become familiarized with the sample preparation and methodology for measuring mercury isotopes on the Cold-Vapor Multi-Collector Inductively Coupled Plasma Mass Spectrometer (CV-MC-ICPMS). My current research institution (UConn Avery Point) does not have this machine, though we do have an ICP-MS, thus this research could potentially help me advance my skills and technique on the ICP-MS. My JSPS host institution had 'pristine' lake sediment samples and fish samples which we had planned to measure for mercury isotopes. If the mercury isotopes could be determined in the sediment and fish samples, then the potential sources of the mercury could be deduced from the samples. Through the mercury isotopic signature of the samples the background 'pristine' mercury could be distinguished from the anthropogenic mercury addition into the system. Thus, my secondary aim for this research was to get some interesting data about the mercury isotopes in Lake Mashu.

As is prone to occasionally happen in science, we experienced some equipment issues during the summer. After quickly moving through the method and obtaining some good signals for the first two weeks of research, and getting very excited, the CV-MC-ICPMS then lost sensitivity for several weeks, and we were unable to run anything during that time. Thus, we lost about 3 weeks of research. During this time I also took the chance to learn some other methods which I believe will be very useful towards my thesis work. I primarily worked on phytoplankton purification and bivalve preparation. When we finally got the CV-MC-ICPMS up and working again, we were set back immensely from the initial time table and plan. Therefore the rest of the summer was devoted to working through the methods for measuring mercury isotopes. We decided to focus on comparing two different mercury extraction methods in order to make sure that these methods were

comparable. One method we focused on was an acid digestion method and the other one was a thermal decomposition method. We had some success with the acid digestion method, and obtained good mercury recovery from standards and some lake sediment samples yielded good results as well. However, we were still experiencing issues with the thermal decomposition method, and attempting to solve the recovery problems with that method.

Though we did not get a significant data set analyzed this summer, I believe it was still productive and fruitful, as I was able to meet my preliminary goal and learn techniques and methodology for measuring mercury isotopes on the CV-MC-ICPMS.

Title of your research plan:

Isotopic variations of mercury sources and cycling in the pristine Lake Mashu

Description of the research activities:

My primary research activities were to learn the methodology and how to operate the CV-MC-ICPMS for measuring mercury isotopes in sediment and biological samples. Once we had enough standards and extractions prepared, I would operate the CV-MC-ICPMS for an analysis.

We also attempted several different mercury extraction techniques from the sediment samples in order to determine which method would work best for our samples. So we went through a microwave digestion technique, which would be used for fish and biological samples. We also worked on both acid digestion and thermal decomposition methods in for extracting mercury from sediment samples. Sample preparation was time consuming, thus it would take approximately one week to prepare 6-8 samples. Each method had to be done with clean-lab techniques and with extreme care and precaution. I also took the time to learn some phytoplankton purification and biological sample preparation techniques, though I will not get a chance to analyze those samples.

I additionally had the chance to help with field sampling for the research group, and we were able to travel to the study site and obtain biological samples (fish) from Lake Mashu, in addition to helping check water clarity.

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

It was very interesting to be living in Japan for the summer. And very hot! (I will admit…it was a little too hot for me…but I am one of those crazy people who likes winter). I was impressed with how much nature and country there is in Japan. I always knew Japan had beautiful gardens, but it was nice to see so much forests and nature as well. And the gardens are beautiful. When most people think of Japan they think of densely packed cities and fast trains, so it was nice to see that there was so much more than that. I was really glad that I got a chance to go up to Hokkaido and see Nikko, as those two areas were my favorite. Very beautiful and peaceful. In other areas, it was neat to find a random shrine or temple in the middle of nowhere or in a random neighborhood, as happened to me several times. The people in Japan are very polite and nice. It is true that they are much shyer than Americans, and many are wary of foreigners, but I don't necessarily think that is a bad thing. I met several Japanese friends outside of my research group, and they were great. Though I am a vegetarian, I was able to find adequate food choices. Japanese food is very tasty. And Japanese convenience stores put American ones to shame. I loved the vending machines and awesome drink selections they offered! I'm going to miss peach water and good bottled green tea.

RESEARCH REPORT

1. Name: Alison L. Gould （ID No.: SP11023）

2. Current affiliation: The University of Michigan

3. Research fields and specialties:

Biological Sciences

4. Host institution: The University of the Ryukyus, Sesoko Station

5. Host researcher: Dr. Kazuhiko Sakai

6. Description of your current research

I am investigating the host-symbiont relationship between a tropical cardinalfish, *Siphamia versicolor,* and luminous bacteria, *Photobacterium mandapamensis*. Through experimental colonization of the light organs of the fish, I am determining the timing and specificity of the onset of the symbiosis. In addition, I am determining how the symbiont is acquired in nature by understanding the homing behavior and larval recruitment of *S. versicolor.*

7. Research implementation and results under the program

Title of your research plan:

Analysis of a coral reef vertebrate-microbe symbiosis

Description of the research activities:

I collected and cultured Siphamia versicolor (urchin cardinalfish) from reefs surrounding Sesoko Station. I cultured larvae aposymbiotically through to juvenile stage and experimentally colonized the light organs of the fish at different time points. I also observed fish in the wild to determine the timing of the use of their luminescence as well as their homing behaviors using mark-recapture methods.

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

I really got a feel for the culture of Okinawa. I was staying on a very small island off of the mainland of Okinawa, and got a real taste of island life here, including the traditional local cuisine. I participated in a dragonboat race here with some other students from the marine lab, a really unique experience (and difficult too). During my home stay I was able to see Tokyo for one day. It was such a contrast to the slower pace here on Okinawa, but I'm glad to have seen a glimpse of such an international metropolis.

RESEARCH REPORT

1. Name: Mel Hainey, Jr. （ID No.: SP11024）

2. Current affiliation: Pennsylvania State University

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Kyushu University

5. Host researcher: Dr. Taizoh Sadoh

6. Description of your current research

At Penn State, my research focuses on the growth and characterization of vertically aligned silicon nanowires. These wires are commonly grown on single-crystal silicon (111) substrates to ensure vertical growth, but this approach has a few drawbacks. The single-crystal silicon makes for an expensive growth substrate, and furthermore, the substrate is not transparent, a major drawback for potential solar cell applications. Oriented, high quality transparent silicon thin films are therefore highly desirable, and one of the best methods for thin film fabrication is aluminum-induced crystallization (AIC). Silicon films with thicknesses less than 50nm are especially appealing, since the morphology of the surface they grow on can influence their crystallization behavior, making patterned thin film fabrication feasible. In addition, these thin films form with the desirable (111) orientation, making them an ideal low-cost, transparent substrate for nanowire growth and other applications. In my time at Kyushu University, I have investigated the growth and characterization of these films, and their feasibility for use as substrates.

7. Research implementation and results under the program

Title of your research plan:

Patterned Substrates for Controlled Grain Morphology in Silicon Thin Films Fabricated via Aluminum-induced Crystallization

Description of the research activities:

Patterned quartz substrates were made at Penn State prior to coming to Kyushu University. For some substrates, 45nm aluminum and silicon layers were deposited at Penn State, while others had both layers deposited at Kyushu University. At Kyushu University, aluminum-induced crystallization was performed, and the samples were subsequently characterized to determine the orientation and crystal quality of the thin films. During the summer program, samples were also taken to Tohoku University in Sendai and in-situ observation was performed during the aluminum-induced crystallization process. The results show that the aluminum induced crystallization was successfully performed. Furthermore, crystallization within patterned regions occurs at a faster rate, and permits larger crystal domains to be formed. As the aluminum-induced crystallization temperature is lowered, the crystallization rate is decreased, but larger domains are possible. The final film orientation is not clear at the moment due to the presences of large silicon islands on the films' surface. Further studies at Penn State should allow for removal of these islands and precise characterization of the film orientation

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

I would like to comment on the excellent level of support I received from my host professor and students. I enjoyed my time working with them as well as my time participating in other activities with them. The softball tournament, bowling nights, and July 4th beach trip were some of the highlights of my time in Japan.

RESEARCH REPORT

1. Name: Erica M. Hartmann （ID No.: SP11025）

2. Current affiliation: the Biodesign Institute at Arizona State University

3. Research fields and specialties:

Biological Sciences

4. Host institution: Toyama Prefectural University

5. Host researcher: Dr. Toshiyuki Sakaki

6. Description of your current research

My dissertation work aims to develop proteomics methods appropriate for environmental samples and to directly compare quantitative measurements of gene, transcript, protein and substrate levels to determine optimal methods for bioremediation monitoring. This work will culminate in a validated method for monitoring the effectiveness of bioremediation of dioxin-contaminated environments using *Sphingomonas wittichii* RW1, as a bioaugmentation agent delivered to target environments for accelerated cleanup.

Sphingomonas wittichii RW1 is a bacterium capable of degrading toxic polychlorinated dibenzo-*p*-dioxin and therefore an organism of relevance for bioremediation. In my dissertation work, I will develop environmental monitoring techniques for the detection of the dioxin dioxygenase, the first enzyme in the dioxin degradation pathway. These techniques will quantitatively measure the dioxin dioxygenase gene, transcript and protein, measurements which could provide useful feedback for optimization of bioremediation. The techniques will then be applied to environmentally relevant samples from laboratory microcosms and field sites, including surface water, groundwater, soil and sediment. Those measurements will also be correlated to dioxin removal rates in batch cultures and microcosms.

My research represents one of the first applications of protein biomarker detection for tracking bioremediation progress and comprises an exhaustive examination of monitoring techniques for *S. wittichii* RW1.

7. Research implementation and results under the program

Title of your research plan:

Site-Directed Mutagenesis of the Dioxin Dioxygenase to Improve Activity Towards 2,3,7,8-Tetrachloro-Dibenzo-p-Dioxin

Description of the research activities:

Under this program, I constructed a plasmid for the expression of four genes from *Sphingomonas wittichii* RW1 in *Escherichia coli*. These genes were the dioxin dioxygenase alpha and beta subunits, a feredoxin and a reductase; together they can catalyze the first step in dibenzo-*p*-dioxin degradation in *S. wittichii* RW1. I used mutagenesis PCR to introduce five point mutations into the alpha subunit of the dioxin dioxygenase. I transformed the mutated construct into *E. coli* and sequenced the resulting plasmids. I used polyacrilamide gel electrophoresis to assess whether or not the cloned genes were being expressed. I also looked for activity in the clones using resting cell assays and high performance liquid chromatography to measure dibenzo-*p*-dioxin and the expected metabolite.

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

I really appreciate all the help that I received from my coworkers, not only in getting settled in Japan and on my project in the laboratory, but also in discovering festivals, food and other Japanese specialties. I owe them an enormous debt of gratitude. More than anything, they have shown me how kind, generous and fun Japanese people can be!

9. Advisor's remarks (if any):

First, I greatly appreciate the JSPS summer program.
I'm very happy to hear from Erica that she has very much enjoyed Japan.
All of the members of my laboratory like her because of her charming personality and outstanding research skills. We would like to continue this collaboration with Erica until she gets her Ph.D.

RESEARCH REPORT

1. Name: Kara Hawthorne （ID No.: SP11026）

2. Current affiliation: University of Arizona

3. Research fields and specialties:

Social Sciences

4. Host institution: RIKEN

5. Host researcher: Dr. Reiko Mazuka

6. Description of your current research

Human infants appear to be helpless, yet they are capable of learning all the complexities of any human language very quickly and without explicit instruction. My dissertation research provides support for the hypothesis (e.g., Gleitman & Wanner, 1982) that prosody (the rhythmic and melodic aspects of speech, such as stress and pitch contours) is an important tool that children use for locating syntactic constituents. More specifically, I have found that 19-month-old English-learning children can use English prosodic cues to locate clauses, even when they are listening to sentences made up entirely of nonsense words.

In Japan, I tested 19-month-old Japanese-learning children using the same English-based stimuli. Since Japanese and English have several striking prosodic differences, testing Japanese children on sentences with English prosody allowed me to investigate the mechanism underlying prosody's role in syntax acquisition. If Japanese-learning children can use English prosodic cues to locate syntactically-relevant units, it would suggest that they are capitalizing on the acoustically-salient nature of those cues. 0n the other hand, if Japanese-learning children cannot use English prosody, it would suggest that children must first learn about the language-specific nature of prosody before they can apply that knowledge to the task of syntax acquisition.

My results provide support for the first hypothesis: Japanese-learning children are able to use English prosody to locate syntactically-relevant units, although it takes them slightly longer to do so than it does for English-learning children. This suggests that children can use acoustically-salient cues in the speech stream to jump-start syntax acquisition, even when those cues come from an unfamiliar language.

7. Research implementation and results under the program

Title of your research plan:

Using Sound to Learn Syntax

Description of the research activities:

This summer, I achieved two research goals. First, I successfully completed an experiment with Japanese-learning 19-month-old children looking at their ability to use English prosody to locate syntactic units. Second, I designed and recorded Japanese-based stimuli to use with English-learning children in the United States.

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

During the JSPS/NSF Summer Program, I significantly advanced my research agenda and I learned about research and life abroad with tremendous support from my host lab. I also took advantage of my weekends to travel around the country and to learn about Japanese culture. Participating in this summer program makes me look forward to future research experiences abroad.

9. Advisor's remarks (if any):

Hosting Ms. Hawthorne for the JSPS summer program was a great experience for us. The students and coworkers who worked closely with Ms. Hawthrone benefited greatly from her not only in terms of learning about her research project but also in getting to know her personally. I am looking forward to finding out how her project with the Japanese stimuli would turn out.

RESEARCH REPORT

1. Name: Irrgang, Lucia （ID No.: SP11027）

2. Current affiliation: Purdue University

3. Research fields and specialties:

Mathematical and Physical Sciences, Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Yamakawa, Hiroshi

6. Description of your current research

Currently (before summer program), I investigate transfers to and from the triangular Lagrange points in the Circular Restricted Three Body problem.

7. Research implementation and results under the program

Title of your research plan:

Transfers to distant direct orbits in the Sun-Earth Circular Restricted Three Body Problem.

Description of the research activities:

1. Performed background literature search
2. Computed periodic orbits of interest around the Earth using the Sun-Earth Circular Restricted Three Body Problem (CR3BP) model.
3. Identified stable and unstable distant direct orbits (DDOs) of interest around the Earth.
4. Investigated DDO properties.
5. Computed DDO manifolds, flow into and out of periodic orbit.
6. Used manifolds to compute preliminary transfer costs and times to travel between distant retrograde orbits (DROs), a different type of orbits around the Earth, and unstable DDOs.
7. Use manifolds to compute preliminary transfer cost and time from unstable to stable DDO.
8. Identified close proximity between stable DDO and the Moon's orbit as a potential source of instability for DDO.

The research completed under the program demonstrates that travel to stable DDOs is possible and feasible. The identification of close proximity of final orbit to the

Moon's orbit presents new alternatives and research interests for further investigation under collaboration.

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

During my stay in Japan I had many cultural experiences beginning with orientation at Sokendai. My first experience was during cultural night, when I had the privilege to wear a full kimono. My home stay was my first strong cultural experience. The two things that stand out the most in my memory are taking a Japanese bath every night and making home-made udon with my host family. This was my first time to knead dough with my feet! However and more importantly, I am very thankful for the rare glimpse into the life of a Japanese family that revealed a powerful sense of unity among them and the enormous respect for parents and elder siblings. Soon after my home-stay, I moved to Kyoto.

In comparison to other Japanese cities, Kyoto is a very traditional place. Hence, during my stay in Kyoto I have had a lot of cultural exposure as well. One of my first cultural activities was learning to prepare matcha. There are also many summer festivals in Kyoto. I had the opportunity to go to Gion-Matsuri and Ujihanabi. I bought a yukata for these occasions. Thanks to my colleague and friend, Bando-san, I can now put on my yukata by myself, including the obi. Among traditional things, I also love traditional Japanese music. In particular, I love wadaiko music. Hence, during my stay in Kyoto I enrolled in wadaiko group classes in Japanese. During these classes, I had the chance to practice speaking and understanding Japanese and learn how to drum on wadaiko.

I also enjoy current Japanese Pop music. In particular, I like Perfume. Therefore, I decided to go to サマーソニク music festival in Osaka to see them. I not only got to listen and see Perfume perform, but I also listened to YUI and 木村カエラ. This was a great cultural experience for me in terms of not only the music but also the food and music fans.

Another very important cultural and professional experience for me was attending the 2011 JAXA アストロダイナミクスシンポジウム in ISAS at Sagamihara. Most presentations were in Japanese, hence, I was able to appreciate Japanese formalities and presentation manners. I met many important people and established connections with researchers in my field. I was also very lucky to run into YAMADA-Sensei who gave a special lecture during orientation at Sokendai, and I was invited to visit him in his office.

Yet another aspect of my cultural experiences in Japan, and probably the most important one, has been my everyday life with my office mates. Going to eat lunch and dinner with my office mates almost every day, I learned how to eat many things with おはし. I also tried foods like たまごかけごはん. While most students talked to me in English, I was able to understand more Japanese as the summer progressed. Also, greetings like "おはようございます" and "おつかれさまです" became ingrained in my head. Thanks to my office life, I was able to experience the communal aspect of work in Japan.

RESEARCH REPORT

1. Name: Brian Johnson （ID No.: SP11028）

2. Current affiliation: Florida Atlantic University

3. Research fields and specialties:

Engineering Sciences, Biological Sciences

4. Host institution: Chiba University, Center for Environmental Remote Sensing (CEReS)

5. Host researcher: Ryutaro Tateishi

6. Description of your current research

My research deals with mapping land cover (forest types, urban areas, etc.) from satellite imagery using automated classification techniques. My interest is in developing new classification methods that incorporate spatial information (multi-scale information, information related to spatial autocorrelation, etc.).

7. Research implementation and results under the program

Title of your research plan:

Using geographically-weighted variables for image classification

Description of the research activities:

We implemented a new method for mapping forest types (natural broadleaf forest, Japanese Cedar planted forest, Japanese Cypress planted forest) using multispectral satellite data. Pixels in the satellite imagery were automatically classified into one of three forest types (or one non-forest class) using a support vector machines classification algorithm. Unlike previous studies, we created geographically-weighted variables to use for classification, based on the assumption that features of a forest type (f) will be more similar if they are located closer together (while features of forest type f may be quite different when located farther apart). Use of geographically-weighted variables improved classification accuracy by 3.70% over the use of spectral information alone.

After finishing this research, I presented the results to the rest of the department in one of the weekly seminars. The results of this research have also been submitted for

publication to an international journal (“Remote Sensing Letters”). I will continue with this research back in the U.S., and implement some of the suggestions provided by Dr. Tateishi to see if results improve.

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

Thank you for this wonderful experience! I learned a lot about working with foreign researchers and enjoyed learning many things related Japanese culture. I hope to visit Japan and Chiba University again in the near future. Because of the great experience I had, I plan to apply for jobs in Japan, as well as in the U.S., starting next fall.

RESEARCH REPORT

1. Name: Jenna Judge （ID No.: SP11029）

2. Current affiliation: University of California Berkeley

3. Research fields and specialties:

Biological Sciences

4. Host institution: University of Tokyo

5. Host researcher: Dr. Takenori Sasaki

6. Description of your current research

My current research focuses on the evolutionary history of gastropods that live in unique habitats in the deep-sea. One group of gastopods, the Lepetelloidea, has successfully colonized a high diversity of substrate types including hydrothermal vents, cold seeps, sunken whale carcasses, sunken wood, algal holdfasts, elasmobranch egg cases, cephalopod beaks, sponges, seagrass rhizomes, and polychaete tubes. I am interested in the relationships between the lineages that inhabit each substrate, habitat shifts over evolutionary time, changes in the rate of lineage diversification, and how morphology has either promoted the invasion of a new habitat or changed to accommodate one. In order to examine all these factors in the evolution of this group, I am using comparative phylogenetic methods. These methods take the relationships between lineages into account and allow one to test evolutionary hypotheses and hypotheses of character evolution. In order to build the framework phylogeny to use these methods a deep understanding of the morphological characters and the variation in these characters across lineages in required. The gastropods in the Lepetelloidea are minute (0.5~10mm), so special techniques are needed to examine their morphology. These techniques are time consuming and require many hours of practice to become skillful at using them to gather data from the organisms of interest. For examining detailed external anatomy, three-dimensional structure, and radulae (gastropod teeth), Scanning Electron Microscopy (SEM) is the method that is preferred. For examining detailed internal anatomy, thin section histology is the preferred method, from which the sections can be stained and the various organ systems can be reconstructed. I focused on learning SEM and thin section histology methods during my stay at the University of Tokyo under Dr. Takenori Sasaki.

7. Research implementation and results under the program

Title of your research plan:

Morphological adaptation in deep sea molluscs: a phylogenetic approach

Description of the research activities:

I gained experience in several research skills that will be imperative for completing my dissertation research. I collected specimens by dredging the ocean bottom and collecting samples from the shore at the Misato Marine Biological Station on Sagami Bay. I also dissected small specimens and prepared their radulae (teeth) for SEM observation. I prepared various kinds of tissue for SEM and thin sectioning and now have a catalogue of images for reference when identifying tissue types and organs in specimens. I practiced serial sectioning techniques on patellogastropod limpet specimens, stained the sections, and practiced identifying tissues and organs observable in the sections. I practiced reconstructing the internal anatomy of Pyropelta ryukensis from sections previously made by Dr. Sasaki. I will apply these skills to lepetelloidean specimens once I return to Berkeley and through them I will obtain the morphological data necessary to examine the evolutionary history of this group and how they have adapted to their respective environments.

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

I enjoyed both the research and cultural experiences from living in Japan immensely. I was lucky to have many opportunities to experience the culture here including: a sumo tournament in Nagoya, Gion Matsuri in Kyoto, the temples and sights of Kyoto, island life and SCUBA diving from Okinawa's Zamami Island, and the daily dose of culture that comes from living in Tokyo and having the freedom to explore it's varied districts.

RESEARCH REPORT

1. Name: Andrew Kae （ID No.: SP11030）

2. Current affiliation: University of Massachusetts Amherst

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Osaka Prefecture University

5. Host researcher: Dr. Koichi Kise

6. Description of your current research

I work in character recognition. This is the task of recognizing the text in a scan of a printed medium such as a book or magazine and converting the text into a machine-readable format. Current approaches to this task work well under ideal conditions such as noise-free documents. However, I am analyzing a set of historical newspaper documents written in the late 1800s, early 1900s which is difficult for current approaches because the documents are so old and degraded. It is important to obtain good recognition accuracy on such a dataset in order to make this information more accessible for search and organization.

Many current approaches rely on matching stored character models with the characters in a target document. However, for historical data, the characters in the documents may differ significantly from the stored models or may otherwise be a poor match to known models due to the inherent degradation in the image. I deal with this problem by learning *document-specific* character models from the document itself. This type of character model is adapted to the font and noise level present in the document, and thus can provide a better character model than a stored model for the historical data.

My approach assumes we are given a noisy translation for a target document. I then learn to identify parts of the translation which I believe are correctly recognized with high confidence, which is called the *clean list* for the document. I then build document-specific character models from this clean list in order to recognize the rest of the document.

This kind of approach has weaknesses. First, the clean list that does not cover all possible character classes and second, this approach relies on the given character segmentation and cannot re-segment the characters. I address the first weakness in my Summer research.

7. Research implementation and results under the program

Title of your research plan:

Adapting Document-Specific Models for Optical Character Recognition

Description of the research activities:

I am extending my previous work (explained earlier) in document-specific modeling. In particular, I am working to expand the coverage of my character models to include all character classes, not just characters that appear in the clean list. My goal is to bring in outside font information and adapt these font models to the noise level in the document. These adapted font models can then act as substitutes for character classes which do not appear in the clean list.

For example, in the clean list for a document, let's say I do not have any instance of the letter "b". And so, I find a similar looking "b" from my font library and then adapt the font instance of "b" to look more like it came from the target document. In addition to building an adapted model of a font character, I can use the adapted model to sample many additional instances of characters such as "b". This will help improve classification accuracy because we will have many samples for each character class.

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

I was very fortunate that my host researcher was able to arrange visits for me to other universities. I met with many researchers and students and learned not just about their work, but also the culture of academic research in Japan. I am thankful to have these opportunities.

RESEARCH REPORT

1. Name: Nicole Kelley （ID No.: SP11031）

2. Current affiliation: University of California, Santa Cruz

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Hokkaido University

5. Host researcher: Dr. Yukihiro Takahashi

6. Description of your current research

I currently study high-energy radiation associated with lightning. These include terrestrial gamma-ray flashes (TGFs), x-ray glows, and stepped leaders. TGFs are short bursts of gamma-rays lasting on the order of a few milliseconds that have been observed in thunderstorms. The correlation between TGFs and lightning is still poorly understood. My time in Japan was spent comparing TGF data from the Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI), a NASA satellite to lightning detection networks built by the group at Hokkaido University. I used the times and location of the TGF to search for the parent lightning's radio signature in the Asian VLF (very low frequency) Observation Network (AVON) and Global ELF (extremely low frequency) Observation Network (GEON). Lightning emits an EMF signal peaking in the radio that is propagated worldwide due to the Earth-ionosphere waveguide. The AVON network's range is from about 3 kHz to 30 kHz. These waves attenuate over shorter distances and are more sensitive to smaller lightning events, such as IC (inter-cloud) discharges. The GEON network is sensitive to events under 3 kHz and is more adept to finding larger events, such as CG (cloud to ground) lightning, but from anywhere in the world. My goal of the summer was to find as much lightning as possible to categorize what type of lightning is most associated with TGFs and find if there are patterns in the charge moment change of TGF parent lightning.

This summer I worked with students at Hokkaido University to find both ELF and VLF data that matched the RHESSI times of TGFs. Unfortunately, the AVON network did not have any available data during the time TGFs occurred in its detectable region. I then found the list of files that I needed from the GEON network. This changed my research goals to only studying the charge moment change of CG parent lightning.

This summer I also opened communication between the groups at Hokkaido University and the University of California, Santa Cruz for future collaboration with an International Balloon experiment. This would be to study high energy radiation involved with relativistic electron precipitation from the Earth's radiation belts at the North Pole.

7. Research implementation and results under the program

Title of your research plan:

Designing a Gamma-Ray Detector to fly on an International Balloon Experiment and Using VLF and ELF Networks to Characterize Lightning Associated with TGFs

Description of the research activities:

It took me several days to accumulate all the GEON data I needed off the various DVD-Ram disk drives. Once I had a complete collection of data, I wrote a program to search for +/- 50 ms of the TGF time for a lightning strike. This time window accounts for speed of light propagation from the RHESSI satellite footprint to the GEON detectors and allows for longer lightning events.
Searching for the radio emission from lightning in the GEON data was a four-step process. First, manmade EMF noise was filtered out of the data. Then, I corrected for clock drift. The instrument software has a bug where the data can be shifted by up to four seconds. After, I filtered the low frequency component of Schumann resonances. These are due radio waves resonating in the earth-ionosphere waveguide and can make it difficult to see the initial lightning signature. The final step was finding the variance of the background signal and searching for events that were two-sigma above background. My future work will involve finding the charge moment change of the lightning sferics that matched to a TGF.

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

This was a wonderful program where I not only got to visit the beautiful country of Japan, travel around Sapporo and Hokkaido on the weekends and after work, and eat tons of new, interesting food, but I got to work with and befriend many amazing people. The students and professors at Hokkaido University were very welcoming and helpful and set the example of how we should all treat international guests.

9. Advisor's remarks (if any):

Nicole Kelley has done the work energetically and earnestly through out her stay in Sapporo. She challenged to learn the scientific importance of ELF/VLF sferics in TGF studies and succeeded in mastering how to handle the ELF dataset obtained by GEON in a short period, though she was not familiar with magnetic/electric filed variations caused by lightning discharge. Also we made fruitful discussions on the development of TGF sensors which will be used in a balloon observation campaign led by Japanese universities near future and the analysis of another type of gamma-ray events, called surge, observed by US aircraft campaign from the point of view of ELF measurement.

RESEARCH REPORT

1. Name: Min Kim （ID No.: SP11032）

2. Current affiliation: UC Berkeley

3. Research fields and specialties:

Biological Sciences, Agricultural Sciences

4. Host institution: Tokyo Metropolitan University

5. Host researcher: Takashi Okamoto

6. Description of your current research

Genetic and molecular studies, primarily in Arabidopsis, have shown that epigenetic regulation via DNA methylation plays an essential role in endosperm development. Gene imprinting, the differentially expression of the same allele in a prent-of-origin specific manner, is suggested to influence seed size and quality. Recently, we generated comprehensive single-nucleotide maps of cytosine methylation and gene expression profiles in rice endosperm and embryo. In this study, we have identified a number of candidate imprinting genes in endosperm. However, the mechanism by which these genes are selectively expressed in rice endosperm is still elusive. I hypothesize that the loss of DNA methylation either in gametes or after fertilization is responsible for their gene expression. To test my hypothesis, I performed rice gamete isolation in the Okamoto lab at Tokyo Metropolitan University. The genomic DNA from these isolated cells will be sodium bisulfite treated and sequenced to generate the map of DNA methylation at single-nucleotide resolution.

7. Research implementation and results under the program

Title of your research plan:

Epigenetic Regulation of Gene Expression in Rice Endosperm

Description of the research activities:

During two months, I performed isolation of rice gametes. First three weeks, I learned isolation of egg and sperm cells. The ovaries were harvested from flowers before anthesis and placed in 370mM mannitol solution. A transverse cut was made with a razor blade that opens the ovary and its internal ovule. The egg cell was isolated under a dissecting microscope by gently pressing on the basal end of the ovary with a glass needle. The released egg cell was transferred into a mannitol droplet with a manual microinjector. I was able to collect about 40 egg cells per day. For sperm cells, about 500 anthers were crushed in 15% sucrose solution to release sperm cells. The sperm cell containing 15% sucrose solution was filtered twice through a 20um and a 10um nylon mesh. The filtered solution was centrifuged in a percoll gradient to separate the sperm cells. The sperm enriched layer was collected and the sperm cells were collected manually with a microinjector. Through this method, I was able to collected 150 sperm cells per day. After the third week, I optimized the central cell isolation technique. An ovule was isolated from an ovary and a vertical cut was made along the antipodal side of an ovule. This ovule was treated with enzymes that digest cell walls for 20 minutes. Central cells were mechanically released from the treated ovules using a thin glass needle and harvested. This technique allowed me to harvest 5 central cells per day on average.

In order to perform the bisulfite conversion, 200 egg and sperm cells and 50 central cells are required. During the two month of stay, I harvested 230 egg cells, over 400 sperm cells, and 65 central cells. These cells will be sent to UC Berkeley for further experiment.

RESEARCH REPORT

1. Name: Robin Kim （ID No.: SP11033）

2. Current affiliation: University of Illinois at Urbana Champaign

3. Research fields and specialties:

Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Prof. Tomonori Nagayama

6. Description of your current research

My current research at the University of Illinois at Urbana Champaign focuses on structural health monitoring (SHM) using wireless smart sensor technology. Public concerns on wireless smart sensors network (WSSN) have increased recently with the help of innovative sensor technology and also with the strong merits over wired sensor networks. WSSN are easy to implement, cost-effective and has on-board computation ability. One of the issues facing with WSSN is synchronizing the network. Currently, the time synchronizing method that has been mostly used and proposed is to utilize CPU time. However, using PC clocks in particular is inaccurate due to various effects on crystal tolerances such as calibration and temperature. The effects results the network time drift of many mille-seconds. To cure this problem, I am researching to provide a cost-effective and more accurate way to synchronize the network. Global positioning system (GPS) is known to have satellite time synchronization every second and provides an accuracy of 15 nano-seconds. My efforts are focused on building a frame work to interpret GPS signal and extract only the useful information and merge the time data to the acceleration data.

7. Research implementation and results under the program

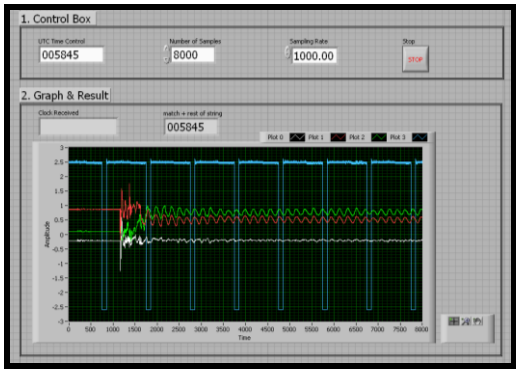
Title of your research plan:

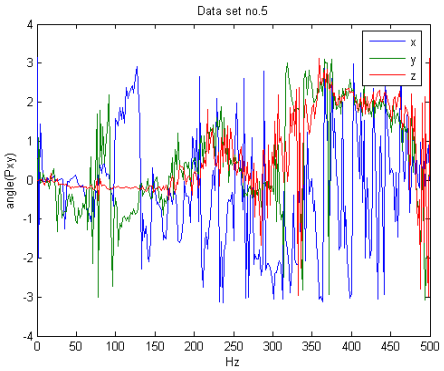
Time synchronization between the Imote2 and GPS sensor board

Description of the research activities:

As a researcher at the University of Tokyo, I was tasked with building a framework to merge time signal and information from a GPS device and tri-axial acceleration data from a wired accelerometer. Devices / tools given were: LabVIEW; software tool that controls sub devices, NI USB 6009; a data acquisition system, Ublox system; a GPS receiver with 15 nano-second accuracy, and SD 2422, a tri-axial (wired) accelerometer. After getting familiar with LabVIEW, my concern was to separately collect the GPS time signal and pulse signal from a GPS receiver. Virtual Instrument Software Architecture (VISA) was introduced to control the time information. VISA runs for a USB port, reads GPS signal and

searches/separates strings with UTC time and reports every second. At a designated time, NI USB 6009 device (DAQ) is initiated and starts collecting data with a specified data point and a sampling rate. 4 analog ports are opened in DAQ, 3 ports for acceleration data (x, y and z axis) and a port for pulse signal from GPS receiver. The pulse signal which concurrently collected with acceleration data guides the points where UTC time ticks. Collected analog inputs can be exported as a graph or text file for post processing. Main challenge came from the demanding requirement on time synchronization accuracy. To reduce any possible delay from the program, optimizing the code was required. This frame work provides synchronization error using two GPS network as good as 64μs. The error is known for the device limitation. After going back to US, collaboration with Prof. Nagayama and his group will still be maintained to expand the work for wireless networks.





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

I would like to thank Prof. Nagayama and his lab members for their helpful feedbacks on my research. Research at the University of Tokyo was very enjoyable. I also thank JSPS and NSF for the opportunity.

9. Advisor's remarks (if any):

Robin Kim developed a Labview-based program which can be directly used in field measurements using wired sensors as well as be extended to wireless sensor networks. Her contribution on this research is significant. Also, she was able to solve, by herself, problems encountered during the research. Her progress was quicker than I initially thought.

RESEARCH REPORT

1. Name: David Paul Kowalski （ID No.: SP11034）

2. Current affiliation: Drexel University, Philadelphia, Pennsylvania, USA

3. Research fields and specialties:

Engineering Sciences, Biological Sciences

4. Host institution: National Institute of Neuroscience at the National Center of Neurology and Psychiatry

5. Host researcher: Dr. Kazuhiko Seki

6. Description of your current research

My research in my home laboratory involves the purported locomotor central pattern generator (CPG) in the lumbar spinal cord. Specifically, I am measuring the modulation of the sciatic and tibial afferent-stimulated reflex during treadmill walking over time following injury in the completely transected (thoracic) cat. The sciatic-stimulated soleus H-reflex is of interest because it is indicative of a very short reflex pathway within the spinal cord and very short latency effects, while the effects of the tibial-stimulated reflex are much longer-acting, 70ms for the tibial reflex versus 6-9ms monosynaptic response for the soleus H-reflex. In these experiments, bipolar EMG electrodes are implanted in several muscles in each hind limb, and nerve cuffs placed around the sciatic and tibial nerves.

I compare these results with data recorded during acute spinal mapping experiments in the sub-chronic thoracic-transected cat using the same muscle and nerve implants. The spinal cord in the lumbar area is exposed and multisite electrodes are inserted in several segments in succession. During the acute experiments, air-stepping is elicited using one or more drugs in combination with manual stimulation of the perineal region. Following a sufficient number of trials to establish a baseline locomotor rhythm in both the EMG recordings and the neural data, electrical stimulation is applied to either the sciatic or tibial nerve in such a way to sample the response of the system over the step cycle. Spike time data is analyzed using peri-stimulus time histograms, while local field potentials are analyzed using coherence measures, both within the cord and with the EMGs, in order to determine if the stimulation evokes long-standing changes in the CPG and how those changes are mediated to elicit the measured changes in motor output.

7. Research implementation and results under the program

Title of your research plan:

Modularity in forelimb motor output and cervical interneuronal firing

Description of the research activities:

We measured the force output at the wrist elicited by intraspinal microstimulation in the Japanese Macaque monkey while simultaneously recording muscle activity using chronically implanted electrodes. Force measurements were recorded as the arm was moved throughout its normal range of motion lateral to the body. We found that stimulating different sites in the cervical spinal cord (C5-7) evoked different force fields which sometimes contained an equilibrium point or line, rather than being uniformly directed as would be the case for direct recruitment of motor pools. We also found that varying the level of stimulation evoked different output fields for the same stimulation site. Simultaneously stimulating two sites led to a non-linear or winner-take-all response. In some cases, stimulation at one site inhibited the ability of the second site to evoke movement even after stimulation of the first site had ceased, evidence that a long-term pattern of interneuonal activity was being evoked. Finally, we found that different sets of muscles were activated in set combinations.

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

The homestay experience as part of the orientation was a great opportunity to enjoy everyday Japanese life as part of a family. Both I and my host family had a great time and learned a lot from each other. My laboratory experience was very collaborative, with many lab members helping each other during experiments. We all went together on a camping trip as well – hiking and going to the beach and an onsen. I also had the chance to make Philly Cheesesteak sandwiches for the entire lab, which were well received.

9. Advisor's remarks (if any):

David and our laboratory share a scientific interest as to the function of the spinal cord for controlling movement. In a limited period of time, he established new experimental method that will lead to new discoveries of primate spinal function. Besides his research activity, he also interacted well with the members of our laboratory and brought us some new cultural understanding. I believe that the JSPS Summer Program is a superior program that stimulates both the fellow and the host laboratory.

RESEARCH REPORT

1. Name: Theodore Kramer （ID No.: SP11035）

2. Current affiliation: Columbia University, Department of Applied Physics and Applied Mathematics, Ph.D. Candidate

3. Research fields and specialties:

Mathematical and Physical Sciences, Engineering Sciences

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

5. Host researcher: Dr. Takashi Nakanishi

6. Description of your current research

My current research focuses on the mechanical, optical, and electrical properties of composite materials composed of inorganic nanocrystal (NC) and organic polymers. The unique optical/electronic properties of NCs are combined with polymers to create composite materials that exhibit useful properties. One project utilizes electrophortic deposition of NCs to create NC/polymer composites that are highly photoluminscent and mechanically robust. A second project utilizes inorganic nanocrysals in conjuction with organic semiconducting polymers to create composite materials that are well-suited to photovoltaic (PV) applications. The composite PV material is able to harness energy from a wide range of the solar spectrum, is mechanically flexible, and has the potential for economical mass production.

7. Research implementation and results under the program

Title of your research plan:
Investigation of Solvent-free Nanocrystal-Fullerene Composite Liquids

Description of the research activities:

In the course of this project we have researched the electronic and optical properties of solvent-free fullerene/nanocrystal liquid composites. Materials of this type could be valuable in future applications such as low-cost photovoltaic devices and flexible emissive displays.

The primary goal of this project was to demonstrate and characterize energy transfer between inorganic cadmium selenide (CdSe) NCs and room-temperature liquid fullerenes (RTLF) molecules in a solvent-free liquid composite. We first sought to confirm that our system exhibits charge transfer while in solution, similar to previous studies. Using chlorobenzene as a solvent we monitored charge transfer between CdSe and RTLF using steady-state absorption and fluorescence measurements. Dramatic quenching of photoluminescence from the CdSe in the

prescence of RTLF indicated energy was transferred between CdSe NCs and RTLF molecules. Similar measurements conducted on composite solvent-free samples also confirmed charge transfer between CdSe NCs and the RTLF phase.

Time-resolved spectroscopy techniques were used to characterize the dynamics of the charge transfer process in solvent-free samples on a quartz substrate. Transient absorption spectroscopy measurements of the solvent-free materials showed evidence of positively charged CdSe NCs and negatively charged RTLF molecules. These species were found to persist for up to one millisecond, indicating a relatively stable charge-transfer state. Time-resolved fluorescence measurements were made in order to characterize the time scales on which energy transfer occurs. For CdSe NC/RTLFs in solution (chlorobenzene) charge transfer appears to occur on a nanosecond timescale. For solvent-free samples charge transfer is much more rapid; occurring in less than 100 picoseconds. Time-resolved microwave conductivity measurements showed that the charge transfer state does not lead to mobile charge carriers. We suspect that the solvent-free CdSe/RTLF composite lacks long-range conduction pathways, resulting in spatially confined charge carriers. A photovoltaic device was also fabricated but demonstrated very poor performance, likely due to low carrier mobility.

However, photo-current measurements in an electrolyte solution provide further evidence of photo-active behavior in solvent-free composite samples. The composite CdSe NC/RTLF material exhibited photocurrents up to 500 times that of the pure RTLF material. When illuminated with 480 nm light, which is not strongly absorbed by the RTLF, photocurrent was independent of fullerene content, indicating that the CdSe NCs are the primary source of photocurrent in the composite material.

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

It was great to work in a Japanese research lab. In addition to learning new experimental techniques I learned about important aspects of Japanese culture and professional etiquette. A trip I made to Osaka University allowed me to see a new part of Japan and meet with other researchers who are conducting high-quality research in the same field as myself.

9. Advisor’s remarks (if any):

Within only two months, Mr. Kramer has made a great effort to two different sciences in our room temperature fluid fullerene material and his optical active nanocrystals, using many different opto-electronic analytical techniques. Our progress would be meaningful to be appeared as a publication report in a public scientific journal soon.

RESEARCH REPORT

1. Name: Erik Larson （ID No.: SP11036）

2. Current affiliation: University of Colorado

3. Research fields and specialties:

Interdisciplinary and Frontier Sciences

4. Host institution: University of Tokyo

5. Host researcher: Dr. Seiji Sugita

6. Description of your current research

At the University of Colorado I develop and run the Titan Community Atmospheres Model, a global circulation model similar to those used to predict climate change on Earth. This model was converted to be applicable to Titan, a moon of Saturn, by the Jet Propulsion Laboratory. Specifically, I model the physical properties of the high altitude organic aerosols produced in the atmosphere. I am interested in the aerosol size, number density, global distribution, production rate, and optical properties. These aerosols affect the heating rates, temperature, and circulation of the atmosphere. They are responsible for a net cooling of the atmosphere due to an antigreenhouse effect. This same effect is seen on earth after large volcanic eruptions. Understanding how aerosols drive planetary climates is an interesting problem and relevant to our current climatic change situation.

By running the model over several different sets of parameter space, we have identified a self consistent set of aerosol properties. We find that the organic aerosols are best described as fractal aggregates, similar to a snowflake. These aerosols coagulate to almost a micron in size as they fall toward the surface of Titan. These aerosols are highly absorbing in the UV and blue wavelengths and less so in the red and IR. The aerosol distribution displays seasonal cycles based on the global circulation, which they help drive. These aerosols heat the tropics and cool the poles leading to enhanced zonal winds. We compare with ground based telescope and satellite data to validate and constrain the model.

7. Research implementation and results under the program

Title of your research plan:

After some discussion with my host researchers, we decided to alter my research plan. The topic, Titan's atmosphere is the same, but the details and focus are different. A new, better title would be: "Tholin sensitivity to atmospheric methane abundance and the climatic implications".

Description of the research activities:

The first part of my summer was spent in the laboratory creating an organic substance similar to that which is formed high in Titan's atmosphere. We created these samples by flowing different nitrogen to methane gas ratios at low pressure through a tube with an electrical current through it. This current broke chemical bonds in the nitrogen and methane molecules. We let the ensuing organic chemistry products accumulate on sample disks. The samples were sent to the Horiba corporation for analysis. The optical properties (scattering and absorbing) and sample thickness were returned.

The second part of my summer was spent analyzing the data and using it as inputs into a numerical model of Titan's atmosphere. The sample thickness is proportional to the production rate of organic aerosols in Titan's atmosphere, and the optical properties of these aerosols is an important inputs into climate models. I wrote a small program based on the work of Lorenz et al. (1999) to calculate the surface temperature of Titan based on the atmospheric methane abundance. The results of our laboratory work were important inputs into this model.

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

I was very fortunate to have a wide variety of cultural experiences. I was able to volunteer for disaster cleanup in Ishinomaki. I hiked up Mt. Fuji through the night to see the sun rise from the top. I saw some amazing fireworks and sent a lantern down the river for the Obon festival, just to name a few.

RESEARCH REPORT

1. Name: Annie H. Liu （ID No.: SP11037）

2. Current affiliation: California Institute of Technology

3. Research fields and specialties:

Mathematical and Physical Sciences

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

5. Host researcher: Professor James Mori

6. Description of your current research

Effective earthquake early warning (EEW) system is crucial in earthquake-frequent countries such as Japan. While it's critical to quickly send out alarms of potential large shakings, it is equally important to minimize occurrences of false warnings. False warnings typically result from incorrect estimates of event parameters (e.g. epicenter location, event origin time), which directly lead to erroneous estimate of event magnitude. In the following 50 days after the March 11th Tohoku earthquake, there have been over 70 warnings issued by Japan Meteorological Agency to the general public. Among those, 17 (25%) were false alarms of actual detected intensity less than 2. The reason behind the abnormally high false alarm rate was inherent in the current EEW design. The current EEW system can't handle detection and parameter estimation of multiple simultaneous events, which are common during the high seismic activity period after a major earthquake. In the scenario when two or more small events occur about the same time but distances apart, the system generates erroneous estimates based on the incorrect assumption that there is only one event.

One possible solution to this problem is to exploit the spatial and temporal correlations of sensor readings. Seismic waves travel in a certain manner that has been well characterized by seismologists. Combining the physical model of seismic wave progression and a probabilistic model of the sensor measurements, the problem naturally falls into the realm of Bayesian parameter estimation with multi-target tracking. With this framework, it is possible to distinguish and separate out the influence of simultaneous events, and therefore generate better estimates of multiple events. To illustrate this better, consider two stations A and B that both detect abnormally large shaking. Given the speed of wave, the distance between A and B, and existing events, one can compute the probability that both stations detect the same event. Furthermore, this probabilistic approach can be integrated into the current EEW system, which is purely parametric, to improve estimation accuracy.

7. Research implementation and results under the program

Title of your research plan:

Detection and parameter estimation of simultaneous seismic events by exploiting the temporal and spatial correlations of sensor readings using a Particle Filter multi-target tracking approach.

Description of the research activities:

With the help of my mentor, I have access to the seismic data from the 1,000 stations in Japan for the 1.5-month period after the March 11th earthquake, when false alarms were most frequent. The first half of the program was spent on familiarizing myself with the current implementation of EEW system and the data organization, while reading up all relevant materials. The implementation of the algorithm described happened in the second half. The algorithm is a variation of Particle Filter for multi-targets tracking, which operates on mass sampling in the parameter space, i.e. 3-axis epicenter location, magnitude, origin time. To avoid computation overload, only the first moment of the distribution (i.e. mean) is propagated to the next to the next time step. The algorithm is tested against a 5-minute segment of data, during which the EEW system gave out false warnings, and is able to identify and separate out 3 independent events occurred during that period with relatively accurate estimates of epicenter and magnitude.

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

The University campus is far outside the city, so during the week I mostly stayed in the lab, but on the weekends I tried to explore as much as possible of Japan which included several mini trips to nearby cities. This arrangement turned out to be a pretty good balance for me. Outside of the JSPS friends, I also joined several outings with my research group that included Ukai by the river, movie, shrine visits, and hanabi viewing which I truly appreciated. Overall my experience in Japan was beyond excellent.

9. Advisor's remarks (if any):

It will require more fine-tuning of the algorithm and more testing to validate this new approach to seismic event detection and estimation. My mentor has agreed to let me take all the data back to the States and I plan to continue working on this project till it's ready for publishing.

RESEARCH REPORT

1. Name: Jennifer Lubbeck （ID No.: SP11038）

2. Current affiliation: JILA at the University of Colorado, Boulder

3. Research fields and specialties:

Mathematical and Physical Sciences, Chemistry

4. Host institution: RIKEN, Advanced Science Institute

5. Host researcher: Tahei Tahara

6. Description of your current research

Fluorescent proteins (FPs) have enabled researchers to explore cellular dynamics with unprecedented spatiotemporal resolution. Unfortunately, compared to fluorescent dyes, all FPs, especially red FPs (RFPs), suffer from accelerated but temporary conversion to a dark state. Dark-state conversion limits photon output and the utility of FPs in many imaging applications. Mutations to the chromophore pocket are known to alter the tendency of RFPs to dark state convert by affecting the rigidity of both the chromophore and the chromophore pocket. While flexibility of the chromophore and its pocket are known to positively correlate with dark-state formation, few studies have methodically evaluated the effects of mutational changes across a family of RFPs on chromophore and pocket flexibility. This project makes use of ultrafast spectroscopy techniques (specifically: time-resolved fluorescence upconversion spectroscopy, anisotropy and time correlated single photon counting) to determine the flexibility of the chromophore and chromophore pocket for a series of RFP mutants. Flexibility is then correlated to specific point mutations in order to determine a given residue's effect on dark-state formation. Collectively, this data will clarify how given mutations to a chromophore pocket correlate to changes in dark-state formation and inform future attempts to engineer a brighter RFP through dark-state suppression.

7. Research implementation and results under the program

Title of your research plan:

Ultrafast Excited State Dynamics of Red Fluorescent Proteins

Description of the research activities:

During my stay in the Tahara-Lab at RIKEN I utilized spectroscopy techniques such as time-resolved fluorescence upconversion, time-resolved fluorescence anisotropy, streak-camera, and steady state fluorescence to perform a time-resolved spectral reconstruction of three different red fluorescent proteins. Using this data I was able to assess the flexibility of the chromophore and the chromophore pocket located within the beta barrel. I also attended a conference in Sapporo, Hokkaido which detailed the cutting-edge physical chemistry being performed currently throughout Japan. This gave me a wonderful overview my field as it exists in Japan.

RESEARCH REPORT

1. Name: John Joseph Lyons （ID No.: SP11039）

2. Current affiliation: Michigan Technological University

3. Research fields and specialties:

Physical Sciences

4. Host institution: Earthquake Research Institute, University of Tokyo

5. Host researcher: Dr. Minoru Takeo and Dr. Mie Ichihara

6. Description of your current research

Our summer research was focused on developing a better understanding of a seismic and infrasound signal that is commonly recorded at active volcanoes – harmonic tremor. Specifically, we are interested in how some volcanic plumbing systems are able to generate harmonic tremor within the volcano (seismic) that is also radiated into the atmosphere (infrasound). Past field studies conducted independently at Fuego volcano, Guatemala and Kirishima volcano, Japan show interesting changes in signal characteristic depending on whether the volcano is producing tremor just within the conduit or both in the conduit and in the atmosphere, and these data provided mush of the motivation for this work.

In order to study these phenomena, we constructed a model volcanic conduit closed to the atmosphere and attached to a compressed air source. We built a simple device that oscillates when pressurized gas flows over a membrane, and inserted it into the conduit. Two pressure sensors are also located upstream and downstream from the oscillating membrane within the conduit. The signal (gas stream) is then injected into a viscoelastic fluid that we mixed from a gel with known mechanical properties (hair gel) and water, simulating a magmatic fluid. Around the ‘magma’ chamber we positioned an array of broadband microphones to record the signal emitted into the atmosphere from the oscillating pressure signal erupting through the viscoelastic fluid. All the pressure signals were recorded simultaneously on a time-synched datalogger along with high-speed and normal digital video of the ‘eruptions’ (experiments). Upon completion of our final experiments, we will compare similar features occurring in the real and synthetic data and draw conclusions about what experimental conditions produced signals most similar to the real data. This will allow us to infer possible conditions within the volcanic conduit and vent system and gain a better understanding about the physical significance of harmonic tremor in erupting volcanoes. These results will be presented to a panel of our peers at the 2011 Fall American Geophysical Conference (Authors: John J Lyons, Mie Ichihara, Jonathan M Lees, Gregory P Waite, Title: Investigating the tremor source process at Fuego

volcano, Guatemala through bench-scale analogue modeling) and the Volcanological Society of Japan 2011 Fall Meeting (Authors: Mie Ichihara and John Lyons, Title: Laboratory modeling for generation of harmonic tremor in the ground and in the air).

7. Research implementation and results under the program

Title of your research plan:

Synthesizing volcanic music: Comparing natural and synthetic signals to constrain the physics of harmonic tremor at Fuego volcano, Guatemala

Description of the research activities:

We designed and built this system basically from the ground-up, and several iterations of the experiment were tried before we settled on the final model design. Extensive testing of different sensors, conduit configurations, fluid reservoirs, and oscillating membrane design occupied the first weeks. The responses of all the sensors used in recording the experiment were tested in order to produce robust results. The viscosity and bubble content of the viscoelastic fluid was also carefully controlled, and we used the same viscous gel (hair gel) with known material properties throughout the experiment. Viscosity of the fluid was varied for different experiments by adding known amounts of water to the fluid, and nearly bubble-free fluid conditions were obtained by placing the fluid in a vacuum chamber. In addition to the experimental design and procedure, several new software packages and instrument controls were learned in order to run experiments safely and efficiently.

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

My advisors at ERI introduced me to many Japanese scientists from our field working at other universities, and I was invited to give a seminar at Tohoku University on my ongoing research. In addition, we visited several active volcanoes and I was able to learn about the monitoring systems and sensors used by different agencies, as well as attending a conference on open vent volcanic activity at Sakurajima volcano. Ichihara-san also invited me to an Obon celebration where we cooked traditional Kansai-style sukiyaki, amongst many other cultural exchanges.

RESEARCH REPORT

1. Name: Sarah L Lyons （ID No.: SP11040）

2. Current affiliation: University of Maryland College Park

3. Research fields and specialties:

Social Sciences

4. Host institution: University of Tokyo

5. Host researcher: Dr. Susumu Yamaguchi

6. Description of your current research

A stigma is some kind of "mark" that discounts an individual's identity due to some personal characteristic or group membership (Goffman, 1963). Stigmatization can be manifested in terms of negative attitudes toward a stigmatized person or group, as well as behaviorally through discrimination or social distance. Importantly, a stigma develops through societal consensus regarding what constitutes a devalued identity (Jones, 1984). However, little is known about the factors that lead individuals or groups to become stigmatized across cultures. Most stigma research concerns particular identities (e.g., homosexuality) in limited cultural contexts. More global theories are needed to understand how certain aspects of culture facilitate stigmatization of people who are "different" in some way.

This research seeks to investigate the ways in which stigmatization differs across cultures. We look to cultural tightness-looseness as a framework for understanding why stigma develops differentially across societies (Gelfand et al., 2011). Cultural tightness-looseness is the extent to which social norms are maintained and enforced in a society. Tighter societies (e.g., Japan) emphasize the importance of following rules in order to maintain social order, whereas looser societies (e.g., the United States) are more tolerant of deviation from norms.

We predicted that individuals who are "different" in some way would present a threat to social order in tight societies, thus justifying stigmatization. We also predicted that public and private situations would moderate the extent to which stigma is expressed in tight and loose societies.

7. Research implementation and results under the program

Title of your research plan:

The Cultural Origins of Stigma

Description of the research activities:

Because this research will be conducted in multiple countries, we performed focus group interviews at the University of Tokyo (N=18) to learn more about what kinds of people are stigmatized in Japan, the reasons these people become stigmatized, how stigma is manifested behaviorally, and how people react differently in public and private situations. These interviews are in the process of being translated and reviewed by teams of cultural experts. We also distributed an online survey asking similar questions in a more anonymous environment with a non-student sample from various regions of Japan.

At Hokkaido University, we have begun to run lab studies assessing implicit attitudes toward stigmatized others using the Implicit Association Test (IAT; Nosek, Banaji & Greenwald, 2006). We are piloting the IAT stimuli as well as our public-private manipulation and other survey measures in order to make sure that the materials work as intended across cultural samples.

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

The feedback I received from colleagues at Hokkaido University was invaluable in shaping the future directions of this research project. In a field like cultural psychology, it is important to incorporate feedback from teams of cultural experts at every stage of the research process. It wouldn't have been possible to receive such feedback without the opportunity to work collaboratively in a face-to-face lab setting.

RESEARCH REPORT

1. Name: Elizabeth A. Marks （ID No.: SP11041）

2. Current affiliation: Rice University

3. Research fields and specialties:

Social Sciences

4. Host institution: ICU

5. Host researcher: Sean Malarney

6. Description of your current research

This week, I head to Aomori with a small team including a producer, assistant producer, cameraman, and television "caster" (presenter). I am currently conducting fieldwork for my dissertation at one television production company in Tokyo, and one of the major commercial television networks. I have also received permission to pursue fieldwork next year in another of the commercial stations, as well as maintain my current field sites. And I have permission to conduct interviews with the staffs of two more production companies. Lately, I go every day to the offices of one of the major commercial television companies (I am not using names, for now, until I can work out confidentiality parameters), and work among the staff of the highest rated morning information program in Japan. This has taken me to Chiba to watch rice be tested for radioactivity, to the brightly colored program set, to the space-ship like control rooms where television is actually broadcast, and to the grime covered offices where producers and assistant producers sleep, script, make endless phone calls, do research, and screen video. I have already sat in on more meetings than I can count, hearing daily revisions to story ideas and proposals for future spots. I stayed overnight for a full 26-hour shift with a young producer, and in my most sleep deprived state at 5AM, met the famous casters of the program I have been studying. In response to one of my updates, my advisor commented: "I was pretty sure you'd have a successful research summer. But you've exceeded my inflated expectations too."

I hesitate to describe my current estimation of television in Japan, as it is presently in flux. I began the summer with a highly critical position on its staunch visuality and seemingly empty content. I have not yet determined how to reconcile this with the extremely bright and artistic individuals with whom I have spent the summer engaging. Those in television, at least in jobs with major production companies and commercial networks are among the best-educated, socioeconomically elite members of society. At present, I do not know how to talk about Japanese television accurately, which is why I will return next year.

7. Research implementation and results under the program

I came here this summer to secure permission for my yearlong dissertation fieldwork, to commence in June of 2012, (funding permitting). Thus, I began immediately in June to send formal letters of inquiry in Japanese to the major television stations and production companies around Tokyo. This mostly required finding a printer and heading to the post office, but also faxing, and occasionally finding email addresses to try. While this strategy was successful in the case of production companies, none of the major commercial television companies replied to these inquiries. My access to these came serendipitously, the first breakthrough resulting from the kind assistance of some acquaintances I had, one of whom turned out to know a TV section director. After two anxious meetings, (conducted in Japanese as they all were this summer), I was granted permission to carry out fieldwork in their offices and studios, and even given my own work schedule. The second breakthrough came when it turned out that the language practice buddy I had acquired–the student of a man I'd randomly had dinner with after a Tokyo anthropology conference–had family friends high up at another of the major television companies. What I learned from this was that no opportunity should be forfeited to meet people, when one is conducting anthropological research. I never knew whom or what circumstances would advance my project, so I tried everything.

Title of your research plan:

Television after Information: Japanese jouhou bangumi and the crisis of public communication

Description of the research activities: (See #6)

This summer's research activities resembled the routine of an investigative reporter. I initially spent long days pursuing leads and contacts, and orienting myself to the media landscape in Japan. As I began to have important meetings this summer, my process shifted to being one of performing both linguistic and scholarly competency. I then shifted again into the role of "reporter of reporters", and have maintained this routine, following TV producers around in their daily routines, observing as they create stories.

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

I actually wound up enrolling in a Japanese class, which met in two sessions each week. This took a sizeable chunk of my money, but it was worth it to learn more business vocabulary. I have realized that I will need to work hard this year back in the U.S. to improve my Japanese, as the business meetings and fieldwork I conducted solely in Japanese were difficult. Although I could continue my research at my current level of Japanese comprehension, I would rather improve more. So, I will be taking Japanese again in the U.S., and I have hired a private tutor as well.

RESEARCH REPORT

1. Name: William McLamb （ID No.: SP11042）

2. Current affiliation: Florida Institute of Technology, Department of Biological Sciences

3. Research fields and specialties:

Biological Sciences

4. Host institution: Okazaki Institute for Integrative Bioscience, National Institute for Physiological Sciences, Okazaki, JAPAN

5. Host researcher Makoto Tominaga, M.D., Ph.D.

6. Description of your current research

My doctoral research examines the thermosensitive pit organs of pit vipers, pythons and boas. The pit organ is a specialized sensory structure that enhances the predatory success and habitat utilization of these reptilian predators, providing a supersensory ability to detect and respond to environmental stimuli. Evolutionarily conserved cation channels of the Transient Receptor Potential (TRP) protein family act as polymodal sensors in diverse species, and can be activated by thermal, mechanical and chemical stimuli. There is evidence for a role of TRPs in mediating behavioral thermoregulation in crocodiles, and thermosensitive TRPA1 has been found in the snake trigeminal ganglion, which is known to innervate the pit organ. However, TRPs and their transduction mechanisms have not been characterized inthe reptile's peripheral sensory tissues, where these animals directly interface with, and respond to, the world around them. The aim of my research is to identify the peripheral cells and tissues involved in pit organ thermosensation, and to characterize the role of TRPs in regulating thermal targeting behaviors in snakes.

7. Research implementation and results under the program

Title of your research plan:

Feeling the heat and under pressure: Characterization of TRP ion channels as environmental sensors in predatory reptiles

Description of the research activities:

To define the ecological and evolutionary significance of TRP ion channels in reptiles, my JSPS-sponsored research included physiological and pharmacological characterization of TRP ion channels in the green anole, Anoliscarolinensis, using molecular cloning, DNA sequencing, and voltage clamp electrophysiology. The green anole is an ideal reptilian model, with a completely sequenced genome, which provides a strong foundation for continued research in additional reptile species. My research activities in the lab of Dr. Makoto Tominaga at the Okazaki Institute for Integrative Bioscience (OIIB) included the successful cloning and sequencing of a novel TRP ion channel in the green anole, and the initial steps for complete physiological characterization of this ion channel. My summer research also included preliminary steps toward identification of another novel TRP ion channel in snakes. This project will increase our understanding of complex reptilian sensory behavior, including prey detection, predatoravoidance and thermoregulatory site selection, and provide insight into the evolution and functional utility of TRP ion channels in novel sensory systems. Additionally, this work will support research on the effects of environmental change on predatory success, and will contribute to the goals for continued management and conservation of the ecological resources that support these reptilian predators.

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

This was an outstanding opportunity for me, allowing extensive international scientific collaboration, and providing me with exposure to daily life and work in Japan. In addition to visiting historical sites in Kamakura and Okazaki, I enjoyed watching the spectacular fireworks festival in Okazaki, and watching the Chunichi Dragons playing baseball in the Nagoya Dome.

9. Advisor's remarks (if any):

William McLamb has a successful experience with the cloning of a thermosensitive TRP channel of green anole in the short stay in Okazaki. He worked hard and we could do a lot of fruitful discussion for the current and future studies. I really appreciate the program's support for this collaboration and internship.

RESEARCH REPORT

1. Name: Adam J. Mellott （ID No.: SP11043）

2. Current affiliation: University of Kansas

3. Research fields and specialties:

Engineering Sciences

4. Host institution: University of Tokushima

5. Host researcher: Prof. Eiji Tanaka, D.D.S., Ph.D. and Prof. Sumihare Noji, D.Sc.

6. Description of your current research

The primary objective of my research was to evaluate and compare the advantages and disadvantages of using three popular short interfering RNA (siRNA) delivery methods for knocking down luciferase gene expression in B16-F10-*luc*-G5 melanoma cells. B16-F10-*luc*-G5 melanoma cells have been engineered to permanently express the enzyme, luciferase, which is responsible for luminescence or a "glowing" effect that can be quantified using a luminometer. My project focused on comparing Atelocollagen, Nucleofection™, and Lipofectamine 2000™ to assess how each technique affected cell viability, luciferase gene expression, and protein expression on B16-F10-*luc*-G5 melanoma cells.

7. Research implementation and results under the program

To implement my research design, I cultured and plated B16-F10-*luc*-G5 melanoma cells in 96 well-plates. Most of my time was spent culturing cells and optimizing transfection methods. For my project, I transfected B16-F10-*luc*-G5 melanoma cells with either luciferase siRNA (treatment) or scrambled siRNA (positive control) using one of three methods: Atelocollagen, Nucleofection™, or Lipofectamine 2000™. Cells were plated at a density of 5,519 cells per well, and transfected at an siRNA concentration of 20 pmol per well. A subset of cells was reserved as a negative control, and received no treatment. Viability data were collected 24 hours post transfection, and gene expression and protein expression data were collected 24, 48, and 96 hours post transfection. All experiments were run in triplicate. My findings showed that the Lipofectamine 2000™ delivery method had the least cytotoxic effect of the three treatments. However, the delivery of luciferase siRNA via Atelocollagen exhibited the greatest gene knockdown of luciferase at all three time points. Luciferase siRNA delivered via Nucleofection™ exhibited the second greatest gene knockdown, at all three time points, and Lipofectamine 2000™ exhibited virtually no gene knockdown. The reduction in magnitude of gene knockdown decreased over four days in all three transfection methods.

Title of your research plan:

Evaluation of Delivery of siRNA via Nucleofection™ and via Atelocollagen to B16-F10-*luc*-G5 Melanoma Cells

Description of the research activities: While in Japan, Prof. Noji gave me the opportunity to build a brand new lab exclusively for my research project. Furthermore, during the interim of waiting on supplies and equipment to arrive, I traveled to Kyoto University where I had the opportunity to meet with Prof. Tabata, whom is one of the top scientist in the field of biomaterials research. Prof. Tabata kindly invited me back to give a presentation about my work to his lab and colleagues after the end of the JSPS Summer Program. In addition, Prof. Noji arranged an appointment for me with Dr. Koyanagi, a post-doctoral fellow working at the Center for induced pluripotent stem cell (iPS) Research and Application (CIRA) at Kyoto University. Dr. Koyanagi gave me a V.I.P. tour of CIRA, and I was most impressed. Prof. Tanaka also was very kind, and gave me the autonomy to use his lab for my research, while I waited on equipment to arrive at my lab, and Prof. Tanaka introduced me to many of his colleagues so I could build up my own network of contacts. For the remainder of my time, I cultured cells, optimized transfection protocols, ran biochemical assays, reviewed articles, and helped colleagues with English grammar while they helped me with the Japanese language.

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

While in Japan, I had the wonderful opportunity to visit Matsuyama, where I got to tour Matsuyama Castle and bathe at Dogo Onsen. I traveled to Kyoto and visited Golden Temple, the Imperial Palace, Nijo Castle, and Heian Jingu. My friends taught me how to cook Japanese food including: takoyaki, okonomiyaki, shabu-shabu, and how to barbeque food Japanese style. In addition, I had the opportunity to pay my respects at the Memorial Peace Garden in Hiroshima, and I was able to watch some seasonal fireworks with friends in Osaka. Lastly, I got to dance with friends and colleagues in the Awa Odori Festival before I departed Tokushima. I have had a most excellent time in Japan.

9. Advisor's remarks (if any):

AJ Mellott, very gentle and nice guy, has much interests to Japanese culture and during his stay in Japan, came in touch with the spirit of Japan. He also made many friends who will support him in future. With respect to the research, his work achieved will gain great international attention. I am very confident about his talents and commitment to research, and feel very strongly that he will proceed with more contributions for years to come.

RESEARCH REPORT

1. Name: Andrea Murphy （ID No.: SP11044）

2. Current affiliation: University of North Carolina at Charlotte

3. Research fields and specialties:

Biological Sciences

4. Host institution: Hiroshima University

5. Host researcher: Dr. Takemasa Sakaguchi

6. Description of your current research

Order *Mononegavirales* includes many important human, animal, and plant viruses that share structurally similar negative-sense RNA genomes with similar strategies for viral genome replication, transcription, and posttranscriptional modifications of viral mRNAs. The large (L) polymerase protein is conserved among all *Mononegavirales*, and this multifunctional protein in complex with the viral phosphoprotein (P) is responsible for viral genome replication, transcription, mRNA 5'capping, cap methylation, and 3' polyadenylation. For all members of *Mononegavirales*, the L protein has six highly conserved regions ("domains" I-VI) that have been postulated to constitute the specific enzymatic activities of this multifunctional protein. These individual domains remain poorly defined and there is no structural data available for any portion of the L protein. In our lab we use several molecular, biochemical and cell culture approaches to study domain VI of the L protein using a prototypic member of *Mononegavirales*, Sendai virus (SeV, a paramyxovirus). Previous studies with vesicular stomatitis virus (VSV, a rhabdovirus), another prototypic member of *Mononegavirales* that is distantly related to SeV, have shown that domain VI of the L protein plays a role in cap methylation of viral mRNAs. Similarly to eukaryotic mRNA, viral mRNA requires a 5'cap structure for mRNA stability and this cap must be methylated for efficient mRNA translation into viral proteins. In my recently published studies, I targeted by site-directed mutagenesis highly conserved amino acids (aa) spanning the entire domain VI of the SeV L protein and showed that domain VI plays an important role in SeV cap methylation.

7. Research implementation and results under the program

Title of your research plan:

Role of viral mRNA cap methylation in host antiviral responses against paramyxoviruses

Description of the research activities:

Eukaryotic mRNA requires a 5'cap structure for mRNA stability and this cap must be methylated for efficient mRNA translation. Methylation occurs at the guanine-N7

position (Cap0) and the 2'O-ribose of the 5'penultimate nucleotide residue (Cap1). It has been well established that methylation of the 5' cap at the guanine-N7 position is absolutely required for efficient translation, but significance of methylation at the 2'O-ribose has remained unclear. Recent studies have demonstrated that the presence or absence of 2'O-ribose methylation has an evolutionary basis and plays a role in distinguishing self from non-self mRNA. Therefore several viruses have evolved strategies for ensuring that their viral mRNAs are capped and methylated, mimicking host mRNAs and evading antiviral responses. Two separate research groups demonstrated that lack of 2'O-ribose methylation in positive strand RNA viruses led to increased immune responses in host cells thus indicating the importance of methylation at this position of the mRNA cap structure. My research has led to the creation and characterization of several cap methylation defective SeV mutants (prototypic negative strand RNA virus). The relationship between 2'O-ribose cap methylation and host immune responses in negative strand RNA viruses has not been explored. To evaluate the significance of 2'O-ribose cap methylation in SeV infection, primary mouse embryonic fibroblasts (MEFs), wild-type (wt) as well as several cell types that are deficient in immune components important for antiviral responses against RNA viruses, were used. I hypothesized that antiviral immune responses will be greater in wt MEFs infected with SeV mutants lacking 2'O-ribose methylation. Following infection of MEFs, I analyzed viral protein expression levels, the number of infectious virus particles budding from the cells, and induction of immune response stimulated genes as a downstream indicator of recognition of SeV. Interestingly, I did not observe any increased immune responses to SeV mutants lacking 2'O-ribose methylation in wt MEFs. However, in MEFs lacking the viral RNA sensor, RIG-I, viral protein expression was equivalent for all mutant viruses and the wt virus which indicates that RIG-I plays a role in detecting viral RNA lacking 2'O-ribose methylation. Future experiments will investigate further the importance of RIG-I in the recognition of SeV mRNA lacking 2'O-ribose methylation.

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 time in Japan thanks to members of my lab and also the many great individuals I met at the Hiroshima International Center! With my lab I went to a Hiroshima Carp baseball game and I also attended a BBQ held in a traditional Japanese home. I went on an excursion to the mountains of Kure where I went to a taiko drum performance and afterward we learned the highly specialized process of making calligraphy brushes. I participated in tea ceremony wearing a traditional yukata. I traveled outside of Hiroshima city to a Kagura Village where I learned the history of Kagura and got to watch two performances. I met a wonderful Japanese couple at the International Center and every weekend they took me to beautiful shrines and temples in and around Hiroshima. I would not have known how to travel to these locations without the help of my Japanese friends. And of course I frequented and enjoyed many Japanese restaurants in Hiroshima city!

RESEARCH REPORT

1. Name: Ilia Nikiforov （ID No.: SP11045）

2. Current affiliation: University of Minnesota – Twin Cities

3. Research fields and specialties:

Mathematical and Physical Sciences, Engineering Sciences

4. Host institution: National Institute for Materials Science Namiki-site

5. Host researcher: Prof. Dmitri Golberg

6. Description of your current research

I study computational nanotechnology. I perform and analyze atomistic simulations of nanostructures to determine their properties. So far I've been majorly involved in three projects. My master's thesis project was on the bending of carbon nanotubes. Using the objective method which allows for rotational symmetry, I simulated smoothly bent carbon nanotubes. I showed that the objective method agrees with previous studies and uncovered a new wavelike rippling mode in multi-wall carbon nanotubes. The new wavelike rippling mode was found to retain a linear bending response, albeit at a lower stiffness, in contrast to the buckling of single-wall carbon nanotubes which results in a near-zero stiffness. Recently, experimental results were published which are in quantitative agreement with this study. The second project was the adaptation of the discrete element method (DEM) to treat nanotubes. The data from my master's thesis study was used to parameterize carbon nanotubes as an elastic cylinder. I assisted in developing the interactions between nanotubes in the DEM model, as well as running simulations using DEM. Finally, my current project is a study of dislocations in silicon nanowires.

7. Research implementation and results under the program

Title of your research plan:

Mechanical Behavior of BN Nanoribbons: Combined Theoretical/Experimental Approach

Description of the research activities:

My host laboratory has the unique capability to directly bend nanostructures. We decided to apply this technique to boron-nitride nanoribbons (BNNRs) as well as simulating BNNRs under bending in order to compare the experimental and theoretical results. I explored the possibility of electronic structure change in BNNRs under bending, but found none. However, the mechanical behavior was still an interesting topic. To examine if the BNNR would kink or bend smoothly under load, I developed a new method to simulate a localized kink between two straight regions. I performed preliminary simulations and showed that a two-layer nanoribbon is likely to bend smoothly. I plan to continue collaborating with Prof. Golberg's group. The bending experiments still need to be performed. I showed that current classical interatomic potentials do not accurately model the inter-layer behavior of BNNRs, and plan to develop a potential that will. Quantum-mechanical tight-binding simulations will also be performed to confirm these results.

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

I highly enjoyed my home stay, where I got to experience a sento, as well as visit several landmarks such as Odawara castle. My host family was wonderful. I also enjoyed climbing Mt. Tsukuba, visiting Tokyo and I plan to visit Nikko with Prof. Golberg on Saturday.

RESEARCH REPORT

1. Name: Elizabeth A. Nowadnick （ID No.: SP11046）

2. Current affiliation: Stanford University

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: RIKEN Advanced Science Institute

5. Host researcher: Naoto Nagaosa

6. Description of your current research

My research is in the field of condensed matter physics, which is the study of the physics of materials. In particular, I study the properties of strongly correlated electron materials. The properties of many common materials, such as metals, can be understood using theories that assume the material's electrons do not interact with each other. In contrast, significant Coulomb interactions ("strong correlations") between electrons' charges must be accounted for in order to understand the properties of strongly correlated electron materials. These strongly correlated materials often display quite exotic behaviors, including high-temperature superconductivity (conduction of electrical current with zero resistance below a critical transition temperature).

I am studying the interplay between the electron-electron and electron-phonon interactions in strongly correlated materials. The atoms in a solid are arranged in a regular crystal structure, but at nonzero temperatures, they will vibrate about their equilibrium positions. These wavelike vibrations can then be quantized and treated as particles, phonons, just as light waves can be quantized and treated as particle-like photons. There is experimental evidence for a significant interaction between electrons and phonons in strongly correlated materials, however, there is not yet a complete theoretical description.

Because analytical solutions to the problem of many interacting electrons and phonons are lacking, in my research I perform numerical simulations to study this problem. In particular, I use quantum Monte Carlo simulations to study how the strength of the electron-phonon interaction influences the behavior of materials.

7. Research implementation and results under the program

Title of your research plan:

Quantum Monte Carlo studies of the electron-phonon interaction in strongly correlated electron materials

Description of the research activities:

During my summer research I performed determinant quantum Monte Carlo (QMC) simulations of the Hubbard-Holstein model, the simplest model that treats both the electron-phonon and the electron-electron interactions in strongly correlated materials on an equal footing. I also learned the technique of stochastic optimization analytic continuation which is needed to compare the results of QMC simulations to experiments. This is because finite temperature QMC simulations are done in "imaginary time;" analytic continuation is the procedure that converts the imaginary time results to real time results that can be related to experiments. We set up a collaboration for a longer term project that will involve combining my QMC results with the results of other numerical methods to help elucidate the effect of electron-phonon coupling on strongly correlated materials.

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

I had many opportunities to experience Japanese culture including travel (to Kyoto, Nikko, Matsumoto, and climbing Mt. Fuji), attending kabuki theatre, and enjoying Japanese food with both lab mates and JSPS program friends

RESEARCH REPORT

1. Name: Kevin G. Nyberg （ID No.: SP11047）

2. Current affiliation: University of Maryland, College Park

3. Research fields and specialties:

Biological Sciences

4. Host institution: National Institute of Nature Sciences

5. Host researcher: Dr. Satoru Kobayashi and Dr. Yuji Kageyama

6. Description of your current research

The biological role of RNA is classically thought to be that of an informational conduit between DNA storage and active, functional proteins. Exceptions to this have been known for years – e.g. the structural transfer RNAs and ribosomal RNAs and catalytic self-splicing introns. More recently, however, advances in DNA sequencing technologies have shown that a far larger proportion of the eukaryotic genome is transcribed than previously thought. Many of these transcribed sequences show no evidence of protein-coding ability, and their functions remain unknown. My current work focuses on the identification, evolution, and function of non-protein coding RNAs in the fruit fly genus *Drosophila*. In order to better understand how to analyze the expression and function of these genes, I spent the summer working with Dr. Yuji Kageyama, who has spent more than a decade analyzing different types of non-protein coding RNAs.

7. Research implementation and results under the program

Title of your research plan: Expression and functional analysis of two non-coding RNAs in *Drosophila* nervous system development

Description of the research activities:

This summer, I studied the expression and function of two non-protein coding RNAs, MRE31 and MRE32, in the nervous system of the fruit fly *Drosophila melanogaster*. I characterized MRE31 expression in the central and peripheral nervous system during embryonic development using in situ hybridizations. MRE32 previously has been shown to be expressed exclusively in the central nervous system, and loss of this gene causes a delay in the emergence of the adult fly from the pupa. Microarray analysis has shown that a large number of genes have altered expression levels in MRE32 mutants. Using three different methods - in situ

hybridization, Northern blot analysis, and quantitative real-time PCR - I was able to confirm expression level changes of several of these putative MRE32 targets.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I was encouraged by my sensei to travel extensively and learn about Japanese culture. I experienced the traditional visiting the Itsukushima-jinja in Miyajima, attending the sumo tournament in Nagoya, taking part in a tea ceremony at Kennin-ji in Kyoto, and spending a night in a gassho-style house in the rural Shirakawa-go. I saw the historical in the Peace Museum in Hiroshima and the hometown of Tokugawa Ieyasu in Okazaki. I took in the modern and unique in a maid café in Akihabara, the Sony building in Ginza, and the nightlife in Shinjuku. And though a bit cliché for gaijin, I capped my Japanese travels with a climb up Fujisan to watch the sun rise.

9. Advisor's remarks (if any): Mr. Nyberg shows us his enthusiasm in our laboratory and obtained good evidences to show functionality of non-coding RNA, which we have been pursuing in the last months. We also thank him for his aggressive attitude to science and versatility for experiments, which makes his participation stimulus to my research group. I sincerely say that this program is very fruitful in the view of scientific and cultural exchange between the two nations, and hope that JSPS continuously supports it in the future.

RESEARCH REPORT

1. Name: Alexander O'Connor （ID No.: SP11048）

2. Current affiliation: University of California - Berkeley

3. Research fields and specialties:

Social Sciences

4. Host institution: Hitotsubashi University - ICS

5. Host researcher: Satoshi Akutsu, Ph.D

6. Description of your current research

The lay theories – the conceptions we have of how something works - we hold of various attributes and traits *do* influence our perceptions of our self and even our own behaviors. Such work originated in the study of intelligence. A personal belief that intelligence is fixed and unchangeable leads to deficient coping of negative feedback in relevant domains (e.g., in academic, school settings).

Lay theories toward creativity should similarly influence people's perceptions of their own creativity, their motivation to labor through the creative process, and their ability to cope with and incorporate feedback acquired during their own creative endeavors. Such processes are particularly important for creativity, as researchers have noted the importance that listening to alternative explanations, incorporating feedback, and altering or even discarding original ideas has in the creative process. We suspect people who view creativity as fixed (entity theorists) are less likely to engage in a lengthy creative process, as they are less open to the critical feedback and potential "microfailures" systemic to the creative process. *Incremental* theorists, who instead believe that traits and attributes are subject to change and can be increased through effort, should be more accepting of feedback and more willing to endure the entire creative process.

As part of a larger cross-cultural study, we suspect that cultural influences partly lead people to prefer one lay theory over the other. A collectivistic mindset (generally preferred in East Asia), with its focus on context and less of an emphasis on individual and static traits, may lead East Asians to adopt more incremental theories of creativity. If true, highlighting these particular concepts may stimulate motivations to be creative in all cultures, and interestingly may be easier to stimulate in collectivistic settings and cultures.

7. Research implementation and results under the program

Title of your research plan:

Culture, Creativity, and Essentialism

Description of the research activities:

We had participants complete survey measures designed to assess their theory toward creativity which includes items such as, “You have a certain amount of creativity and you really can’t do much to change it.”

Participants then completed a series of measures assessing their self-perceived creativity, motivations to be creative, their self-reported creativity as measured by a Creative Achievement survey, a measure of creativity – the Unusual Uses Task, which has participants come up with as many uses they can of ordinary objects (e.g., a brick, toilet paper), and finally various cultural variable measures. Unfortunately, the Japanese data is still being collected and analyzed. However, in my time in Japan I have analyzed our American data, which supports our hypothesis that a fixed/entity view of creativity is associated with less creativity.

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

I had a wonderful in Tokyo and Japan and am talking with my host researcher to determine if it is possible to return in the near future. Also, after having conducted research in China and Japan, I have observed more nuanced differences between East Asian cultures. As a cross-cultural psychologist, we often generalized amongst East Asian (i.e., Japan, China, Korea) and Western (i.e., US, Canada, Western Europe) cultures. While such generalizations are helpful when researching broad cultural variables like individualism, for many other variables such groupings of East Asian or Western countries would be inaccurate. My time here allowed me to experience some of those differences.

RESEARCH REPORT

1. Name: Daniel Robbins （ID No.: SP11049）

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

3. Research fields and specialties:

Chemistry

4. Host institution: Kyoto University

5. Host researcher: Prof. Michinori Suginome

6. Description of your current research

My graduate research has focused on two approaches for reaction discovery and development: one targeted to specific reactions and methods in organic synthesis and one to develop a system for reaction discovery with a small experimental footprint. I have developed several synthetic methods for selective functionalization of arenes and heteroarenes using C-H activation. These methods include the first general method for *meta*-selective alkylation of arenes with allylic and benzylic electrophiles, a simple and general method for the Suzuki-Miyaura coupling of the typically unstable 2-heteroaryl and polyfluorophenyl aryl boronates, and the first method for the selective functionalization of the 7-position of indole. All of this chemistry has centered around the use of Ir-catalysts for the C-H activation, and my work has encompassed methodology development, expedient synthesis of a natural product, as well as mechanistic studies of catalytic intermediates. These methods have addressed unmet challenges in organic synthesis and we have applied these methods to the synthesis of useful target structures.

I have also designed, developed and implemented a conceptually novel system to utilize high-throughput screening to discover new catalysts and new synthetic reactions. I have used this catalyst discovery system to identify new catalysts for alkyne hydroamination and alkyne hydroarylation based upon earth-abundant transition metals. These provide low-cost and versatile catalysts for useful organic transformations. In addition, the development and demonstration of this system to discover new catalysts and new chemical reactions represents a conceptually new approach for catalyst discovery based on high-throughput screening and streamlined analysis strategy. This allows for the examination of a many catalyst and substrate combinations simultaneously and will surely lead to the discovery of other useful catalysts in the future.

Both of these areas and study and the progress and developments that have been made will open new avenues of chemical reactivity and increase the efficiency with which complex molecules are assembled.

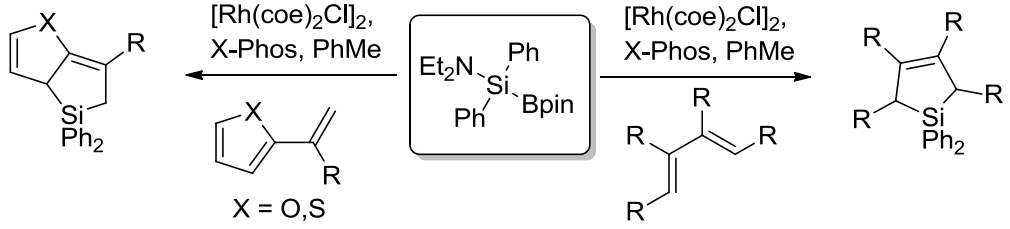
7. Research implementation and results under the program

Title of your research plan:

New Rhodium Catalysts for Generation of Silylene from Aminosilaboranes: [4+1] Cycloaddition with Dienes and Vinylheteroarenes

Description of the research activities:

New methods for the synthesis of organosilicon compounds have the potential to have a significant impact in organic synthesis. Organosilicon compounds have a wide range of potential utility, including as stable organometallic reagents for cross-coupling or further functionalization, or as the foundation of useful organic materials. For example, functionalized siloles have found utility as organic optical materials for a variety of applications, including pH sensing, explosive detection, and biological sensing. Despite their utility, methods for the synthesis of siloles with a broad range of functionality are limited, so new methods for the synthesis of siloles and new silole derivatives are very useful. To address this challenge, I have developed novel rhodium catalysts for the generation of metal silylene species from dialkylamino-substituted silaboranes and studied their reactivity in [4+1] cycloaddition reactions to provide a new route to potentially useful organosilicon compounds. I have identified the combination of a Rh(I) precatalyst with the bulky, electron-rich biarylmonophosphine X-Phos as a suitable catalyst for the generation of a rhodium-silylene intermediate. The silylene intermediate is formed by oxidative addition of the Si-B bond, followed by elimination of aminoborane to generate the silylene. Subsequent [4+1] cycloaddition could then occur with dienes or vinylheteroarenes to form new organosilicon compounds. The cycloadducts with the vinylheteroarenes represent a unique class of structures that would provide a promising lead structure for the development of new functional organic materials.



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

Living in Japan was a new, eye-opening experience for me. This summer was my first experience living in a country other than the United States, and to come to a place like Japan where daily life is very different from in the US, was a tremendous experience. Experiencing life in Japan, both inside and outside of the laboratory, was a great learning experience. In addition, the relationships that I have established with the students and faculty in my laboratory and in other laboratories at Kyoto University will certainly foster future scientific exchanges.

RESEARCH REPORT

1. Name: Sarah A Seiter （ID No.: SP11050）

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

3. Research fields and specialties:

Biological Sciences

4. Host institution: Kyoto University – Graduate Faculty of Agriculture

5. Host researcher: Dr. Naota Ohsaki

6. Description of your current research

Description of research: Temperature and seasonality play central roles in the ecology and evolution of all organisms, particularly ectotherms. Populations from different parts of a species' range can experience radically different thermal environments, food resources, and natural enemies. Many studies have documented adaptive divergence among geographic populations in physiology, body size, immune responses, life history, phenotypic plasticity and related traits. Invasive species are a unique opportunity to study how quickly populations and to what degree populations can diverge from their ancestors, because the date at which they were introduced into their new habitat is often known. I have been studying geographic divergence in the invasive cabbage white butterfly (Pieris rapae). P. rapae is native to Europe, was accidentally introduced to North America in the 1860, and rapidly colonized much of North America by 1900. As a result, geographic populations in North have diverged within the past 150 years, and reaction norms for growth rate, development time and immune function differ in the Northern and Southern populations. P. rapae was introduced to Japan during the Edo period, about 300 years ago, and comparing the North American and Japanese populations can offer us two "snapshots" of evolution after an invasion. These ongoing studies represent an important component of my PhD research on thermal adaptation and rapid evolution in invasive species.

Description of the research activities: I conducted experiments on butterflies from two geographically distinct populations of Pieris rapae, one near Sapporo, and one from Kyoto. These field sites were selected for comparison with two of our U.S. field sites(Nova Scotia, Canada and North Carolina) because of their similar climate. I reared the butterflies at two temperatures (20 C and 26.7 C) and measured growth, development, and immune performance in both populations. During my first week in Kyoto, I collected butterflies in local gardens and along the Kamogawa, and harvested their eggs. Animals from Hokkaido were shipped during week three by a collaborator (Dr. Shingo Tanaka). JSPS discretionary funds were used to ship them to the lab. I then reared the laboratory born offspring of the wild caught females in temperature controlled growth chambers using a standard protocol developed by my laboratory in the U.S. I randomly selected a subset of individuals and measured their immune function during fifth instar (the final developmental stage). I weighed the remaining butterflies when they became pupa, and again when they matured as adults.

Development time was slower in the Japanese population than in the U.S. population, and consequently the experiment is not yet completed. To collect the remaining data, two of my colleagues (both graduate students in the Laboratory of Insect Ecology) will weigh and measure the remaining few animals after I finish and ship the samples to the U.S. Data

will be collected using an online Google spreadsheet so all parties involved in the project will have real time access to the data set and can readily communicate. Samples will be returned to the U.S. using pre-paid shipping labels purchased by the University of North Carolina.

7. Research implementation and results under the program

Title of your research plan:

Rapid Adaptation to Climate in an Invasive Butterfly

Description of the research activities:

Our results indicate that the P. rapae population in Kyoto differs significantly in body size at both temperatures from the population near Sapporo. At present no animals from the Sapporo cold temperature treatment have matured to pupation yet, so no inferences can be made about the body size of Sapporo animals 20 C. The Sapporo population reared at 26.7 C had a significantly smaller body mass than the Kyoto population at either 26.7 C and 20 C (ANOVA, df=2, F=8.0842, p=0.0054)

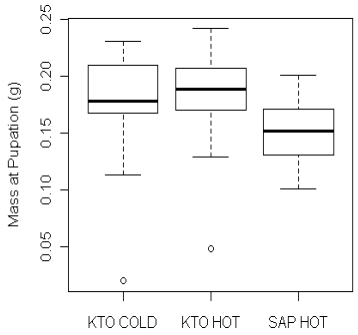


Figure 1: Body Mass at pupation for the Kyoto and Sapporo *P. rapae* populations. The box plot shows the Kyoto population two temperatures 26.7 C (Hot) and 20 C (Cold), and the Sapporo population at 26.7 C. The Kyoto population does not differ significantly in body mass between temperature treatments. The Sapporo population is significantly smaller than the other two treatments at the 26.7. At present, the experiment is not complete and we do not have data on the body size of the Sapporo animals at 20 C.

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

Working in the Laboratory of Insect Ecology offered me unparalleled opportunities to collaborate and interact with Japanese researchers. My lab mates were incredibly helpful and welcoming and always included me in social activities. In particular, Noriyuki Suzuki was very helpful in helping me prepare some supplies for my experiments before I arrived. I also enjoyed meeting with Dr. Shintaro Oku, who has developed some interesting models of the effects of temperature increase on growth and development in insects. Additionally, I was able to observe firsthand the barriers to publication and professional development facing scientists who are not native English speakers. In working with my Japanese colleagues, I found that although their experiments were excellent, and their ideas novel, English communication skills often prevented them from disseminating those ideas. Two lab members asked me for assistance in preparing manuscripts for publication, and another colleague asked for my help in preparing a presentation, and I really enjoyed working with them on those projects. I'm very interested in ways of improving communication with Japanese scientists, as I have come to realize that North American and European scientists are missing out on opportunities for research and collaboration. Additionally, I really enjoyed the time spent with the other JSPS fellows. Several of the fellows based in Kyoto had complimentary research interests. In particular, Melissa Whittaker, another butterfly researcher who was based in the Ogushi laboratory of insect ecology was an excellent source of ideas, and we have been discussing collaboration opportunities in the U.S. I also learned a great deal from Annabel Ballard, an anthropology student who studies the culture of science with a specific focus on insect researchers. Annabel assisted me on writing a blog post for my blog on butterfly research, about the emerging field of ethnoentomology (the study of cultural differences in insect use).

RESEARCH REPORT

1. Name: Matan Shelomi （ID No.: SP11051）

2. Current affiliation: University of California, Davis, CA

3. Research fields and specialties:

Biological Sciences

4. Host institution: National Institute of Agrobiological Sciences, Tsukuba

5. Host researcher: Watanabe, Hirofumi

6. Description of your current research

I am studying the digestive systems of the Phasmatodea. I wish to determine how this understudied, fully-herbivorous order of insects manages to survive and thrive given their limited diets. Walking stick guts are thin and straight, lacking any room for diverticulae or enlargements, further constraining their ability to digest food. I hypothesize that the phasmid gut has evolved ways to break down cellulose, which is a large portion of their leafy diet. I am analyzing the gut in three ways: microbiologically (to find symbionts), chemically (to find endogenous enzymes), and histologically (to describe the gut anatomy).

7. Research implementation and results under the program

Title of your research plan:

Endogenous and Microbial Cellulases of the Stick Insects (Phasmatodea)

Description of the research activities:

Preserved tissue of walking sticks (phasmids) reared in my lab at UC Davis was mailed to Japan. These insects, as well as live specimens of the Japanese species Entoria okinawaensis reared here at NIAS, were used in the following analysis. To determine the presence of cellulase (an enzyme that breaks down cellulose, the main component of plant cell walls), proteins were extracted from the dissected insect guts and separated using chromatography. The extracts were tested for cellulase activity by mixing them with a cellulose solution and an indicator that changes color when a certain enzyme product is detected. Extracts that changed color were further purified, and separated on an electrophoresis gel (which separates proteins based on their size). When only a single, cellulolytic protein was visible on the gel, the protein was transferred from the gel to a special membrane that was then sent to an outside organization for partial amino acid sequencing. In addition, primers coding for

termite cellulase genes were used on fresh E. okinawaensis tissue to see if similar genes were in the phasmids. These genes were sequenced and phasmid-specific primers were designed.

The results of my work indicate that walking sticks all have cellulases in their gut, which are made by the insects themselves, as opposed to a microbial symbiont. Three novel proteins and a whole gene sequence for a fourth were discovered. The proteins so far closely resemble termite or roach enzymes, which is a surprising find as walking sticks most closely related to grasshoppers. My findings have important implications not only for the insects' evolutionary histories, but also for the biofuel industry, where novel cellulases are needed. Comparing the genes and proteins to the insects' evolutionary trees will help shed light on the origins of these genes.

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

Sites I visited included the Diabotsus at Kamakura, Nihon-ji (Chiba), Ushiku (Ibaraki), and Nara; the Tokyo Tower; the Meiji-jingu shrine; Harajuku, Shinjuku, and Akihabara districts; Mt Tsukuba; Sensoji Temple; the various shrines and temples at Kyoto, Nara, and Nikko; Himeji castle; Tsukiji fish market; Kiuchi Brewery; the Hiroshima Peace Memorial Ceremony on Aug 6; and Kozushima and Miyajima Islands. Other cultural experiences I had included eating a wide variety of traditional or famous Japanese foods, attending a tea ceremony, visiting two families in addition to my homestay family, observing a Shinto ground-breaking ceremony, bathing in a sento, riding the shinkansen, and karaoke. Museums I visited include the Tokyo National Museum, National Museum of Nature and Science in Ueno, Tsukuba Expo, Ibaraki Art Museum, and Yokohama's Ramen Museum.

RESEARCH REPORT

1. Name: Glenn Skawski （ID No.: SP11052）

2. Current affiliation: Clemson University

3. Research fields and specialties:
Interdisciplinary and Frontier Sciences

4. Host institution: University of Tokyo

5. Host researcher: Dr. Tomochika Tokunaga

6. Description of your current research

Oil, natural gas, heat, and water can be recovered from subsurface formations and CO2 can be stored there, so improving the understanding of storage characteristics in porous or fractured materials has wide ranging applications in underground laboratories or other settings. Pumping water from a well and measuring the pressure change with time is one method used to characterize aquifers. Storativity is a common parameter that describes volume of water released from storage per unit decline in head per unit area, but it weakly affects the pressure signal during pumping. This is a non-uniqueness problem wherein different storativity values can produce the same pressure signals. A hydromechanical well test involves measuring fracture displacement during pumping, and can solve the non-uniqueness issue because its signal depends on the storativity of the aquifer. Another considerable problem is if the fractures are dipping then the displacements observed will be an underestimate of the actual displacement. Including the transverse components of displacement promises to markedly reduce the non-uniqueness of interpretations when dipping fractures occur in the subsurface With this in mind, we have developed a device to measure the deformation of boreholes in three dimensions in order to improve understanding of how storage changes occur during pumping from a well. The device uses two anchors that grip the borehole wall and are separated by a rigid rod and a flexible coupling. Strain caused by relative displacement of the anchors is concentrated in the flexible coupling, and a suite of fiber bragg grating strain gauges is mounted on the coupling to measure how it flexes. Those data are then used to calculate the deformation in three orthogonal directions (including the borehole axis) as the borehole deforms in response to changes in water pressure. A prototype device, which we call a 3DX (3D extensometer), was developed to be used in an open borehole with diameters between 86 mm (3.4 inches) and 99 mm (3.9 inches) in diameter.

7. Research implementation and results under the program

Title of your research plan:

Development of a 3D FBG extensometer for hydromechanical well testing

Description of the research activities:

The device was first tested at a site underlain by fractured granite in Tsukuba, Japan, where pumping tests were performed in two open boreholes with the 3DX deployed at various depths and positions, and different fracture densities. Drawdown ranged between approximately 4 meters and 10 m during constant-rate pumping tests, and was accompanied by both axial and transverse displacements on the order of microns. The average values of the fiber optic gauges during pump tests showed axial compression during pumping and extension during recovery. The axial displacement signal is similar in magnitude and pattern to signals obtained at other sites using a uniaxial extensometer. Both the new and previous signals indicate tenths of a micron of displacement occur per meter of drawdown, for example, and indicate that displacement is a hysteretic function of head in the wellbore. These similarities partly validate the response of the new device. Although average compression followed by extension was observed transverse displacement was interpreted when a gauge measured opposing signals to the average response. This was seen during most of the well tests indicating dipping fractures. The results are encouraging because of the 3DX's ability to respond to these fracture displacements including the transverse component of displacement and moreover, the 3D displacement sensor is relatively simple so it could be readily deployed in a variety of applications.

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

I visited Nagano and the onsen monkeys at the Jigokundani Monkey Park. In Kyoto I visited many temples in the Higashiyama area and spent a day in the Arashiyama area. I was able to climb Mt. Fuji and Mt Mitake, as well as do some hiking in the Nikko area. One of my favorite trips was taking a boat to Kozushima Island, where I did some camping, hiking, and snorkeling. Another fun trip was visiting Minakami and trying canyoning for the first time, and being so close to Tokyo I visited the city often. On a professional level, I attended a workshop on the use of fiber optics in the geoscience field, and I visited the underground Mizunami research laboratory. As part of a US Japan collaboration I helped set up a tilt measurement system in a WWII underground bunker. The research required help from people outside of the University of Tokyo, so it was rewarding to work with professionals from companies, universities, and research institutes. I was also given the opportunity to present the research at various stages throughout the summer to students, professors, researchers, and companies that helped with the research.

RESEARCH REPORT

1. Name: Tiffany Suekama （ID No.: SP11053）

2. Current affiliation: The University of Kansas

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Hokkaido University

5. Host researcher: Dr. Jian Ping Gong

6. Description of your current research

Developing high strength biocompatible and biodegradable materials with the capability for cell encapsulation is particularly important in tissue engineering (TE) applications, especially cartilage. Specifically, my research examines tough interpenetrating network (IPN) hydrogels of agarose and poly(ethylene glycol) diacrylate (PEG-DA), and methacrylated chondroitin sulfate (MCS), PEG-DA and acrylamide (AAm). Hydrogels are water-swollen, three-dimensional, cross linked polymer networks. Although hydrogels are widely used as TE scaffolds, their mechanical properties are relatively poor: they are soft (low modulus) and fracture easily. In contrast, biological structures such as the extracellular matrix are highly ordered, complex materials with excellent toughness (energy per unit volume that a material can absorb before failure). Mimicking these tissues with synthetic hydrogels would advance TE for repair of damaged or diseased tissues. To date, multicomponent TE hydrogels synthesized at the University of Kansas have been tested under compression. The limitations of this method for measurement of failure properties include inability to reach strains over 100% and variability caused by sensitivity to sample defects. At Hokkaido University, pioneering work has been done on the synthesis of double-network (DN) hydrogels and the measurement of their toughness by tear tests and the study of their fracture properties under tension. The strategy of this project has been to focus on using tear and tensile tests to measure the mechanical properties, specifically fracture properties, of the hydrogels in order to improve these properties since the compression tests currently in use in our lab are inadequate because compressions of over 90% strain are questionable.

7. Research implementation and results under the program

Title of your research plan:

Understanding Fracture Properties of Cell Encapsulated Interpenetrating Networks

Description of the research activities:

This project has examined DN hydrogels of poly(ethylene glycol) diacrylate (PEG-DA) and agarose, and different combinations of methacrylated chondroitin sulfate (MCS), PEG-DA and acrylamide (AAm). In this project I have learned how to synthesize agarose/PEG-DA and MCS-PEG-DA/PAAm hydrogels with minimal oxygen inhibition. Basic characterizations (swelling tests) on the hydrogels have been done. I have learn how to use the gel cutting device: SDAP-100N Dumbbell Co, Ltd. Gong's cutting device is in particularly helpful in reducing crack initiation that leads to premature failure. Mechanical properties of these gels have done including: tearing tests using Tensilon RTC-1150A, Orientic Co. The data is currently being analyzed and compared with previous work. In the end, I have learned the methodology so I can adapt to be able to do these projects at KU.

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

Besides the scientific research performed, I have be able to gain many cultural experiences such as participating in the traditional dress and tea ceremony, going to festivals, beer gardens, baby showers, church, temples, food gatherings and many day to day activities. The culture is completely different from America and has been very enjoyable!

The research experience and the cultural experience have been so great for me that I would like to come back to Japan in the very near future.

RESEARCH REPORT

1. Name: TAKAMITSU TANAKA （ID No.: SP11054）

2. Current affiliation: Max Planck Institute for Astrophysics (Germany)

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Shin Mineshige, Dr. Kimitake Hayasaki

6. Description of your current research

Supermassive black holes (SMBHs) are ubiquitous astrophysical objects with masses of millions or billions times that of the Sun. Observational evidence indicates that these monsters inhabit the centers of most or all galaxies. When large quantities of gas falls ("accretes") onto a SMBH, the gas heats up and becomes extremely luminous —often outshining all of the stars in its galaxy. These phenomena are called active galactic nuclei (AGN) and are extremely important tools for studying extragalactic astronomy, fundamental astrophysical fluid dynamics, general relativity and cosmology.

Because large galaxies are formed through the collisions of smaller galaxies throughout the observable Universe, it follows that many recently formed galaxies will have two or more SMBHs. Double SMBHs are believed to form compact binary systems whose orbital separations shrink as they interact with surrounding gas and stars. At sufficiently compact separations, such a binary emits copious amounts of gravitational waves (GWs) —ripples in the spacetime fabric that will be detectable by future detection experiments— to shrink even faster, and finally merge to form a single SMBH. The indirect detection of GWs resulted in the 1993 Nobel Prize in Physics, and direct detection of GWs would be a momentous scientific achievement.

An arguably even more important scientific opportunity lies in the possibility that merging SMBH binaries also have a characteristic light signature, such as a "blip" in AGN light. Because a leading hypothesis poses that AGNs are triggered by collisions and near-encounters of galaxies, it is plausible that many merging SMBH binaries are also undergoing an AGN phase. Concomitant studies of such systems with both GW detectors and conventional telescopes could have an unprecedented scientific yield; this is due to the fact that light and GWs carry different and complementary pieces of information.

The importance of studying light signatures of merging SMBH binaries has only emerged in the last decade; this is a truly nascent field with much work to be done. I have recently published several analytic (i.e., "pencil-and-paper") models of such light

signatures, but studying the luminous gas using numerical (i.e., computer) simulations can address questions and possibilities that are intractable with analytic methods. The objective of my research is to learn to use a numerical code to calculate the behavior of astrophysical fluids, and to apply this code to accretion flows onto merging SMBH binaries. Equipped with both analytic and numerical tools, I will be better equipped to advance this new and exciting topic in astrophysics.

7. Research implementation and results under the program

Title of your research plan:

Numerical Simulations of the Afterglow of Supermassive Black Hole Coalescence

Description of the research activities:

Learning and using a computer code to calculate astrophysical gas dynamics, and applying this code to study the behavior of gas accretion disks around a supermassive black hole binary. Preliminary work included test runs and comparisons of code results to my previously published analytic results.

Discussion of astrophysical scenarios, observable consequences, etc.

Future work can now proceed, even after I leave Japan. The goal is to submit a short paper on our results in the next several months.

I presented recent and present work in Japan and at a conference in China:

- Invited seminar and invited colloquium at Kyoto University
- Invited seminar and invited colloquium at Hokkaido University
- Invited seminar at the Insititute for the Physics and Mathematics of the Universe (IPMU) at University of Tokyo
- Contributed talk at workshop in Lijiang, China: *Gravitational Wave Astrophysics, Binary Supermassive Black Holes, and Galaxy Mergers*

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

I found the rigid requirements for paperwork and procedure extremely frustrating. At times, the quality of my scientific work and professional activities suffered as a result of the JSPS program rules.

Overall, I enjoyed my time in Japan, and I would consider living and working here in the future.

RESEARCH REPORT

1. Name: Maureen Tang （ID No.: SP11055）

2. Current affiliation: University of California, Berkeley

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Kyoto University, Katsura Campus

5. Host researcher: Professor Takeshi ABE

6. Description of your current research

Lithium-ion batteries are a promising option for electric vehicles because of their high energy and power density. However, the high cost and relatively short lifetimes of lithium-ion batteries have so far prevented their widespread use in vehicles. One reason for the limited lifetime of a lithium-ion battery is the solid-electrolyte-interphase, or SEI. The SEI is a passivating film that forms on the graphite anode during the first few charge cycles. The electrolytes in lithium-ion batteries are thermodynamically unstable at the potential of graphite. This means that a battery without an SEI, or with a "bad" SEI, continuously grows and consumes electrolyte. The growth of the SEI means that less lithium is available for energy storage.

Although the SEI has been studied for many years, scientists still do not understand how it prevents electrolyte reduction, or what parameters are necessary for the formation of a 'good' SEI. Because it is sensitive to air, moisture, and impurities, the SEI is very difficult to characterize using traditional techniques. Because formation involves many competing chemical reactions, the ability of traditional electrochemical techniques to describe the film is also limited. My research project is the development of a new method that characterizes the SEI using redox shuttles. By comparing the kinetics of a redox shuttle in the presence and absence of the SEI, I use the shuttle as an electrochemical probe to determine the mechanism by which the SEI prevents reaction. The results of this method contribute to understanding an important failure mechanism in lithium-ion batteries.

My work in Berkeley studies the SEI that is formed on glassy carbon, which is a model surface. During the JSPS Summer Program, I used my method to study the SEI formed on highly-oriented-pyrolytic graphite (HOPG), which is more like the conditions found in an actual battery.

7. Research implementation and results under the program

Title of your research plan:

Effect of Graphite Orientation on Solid-Electrolyte-Interphase Formation and Characterization

Description of the research activities:

Previous work has shown that the SEI differs in composition and morphology on the edge and basal orientations of graphite. Our objective this summer was to compare the effect of edge-to-basal plane ratio on the formation kinetics and electrochemical properties of the SEI. The relative fraction of edge and basal planes was calculated by measuring the double-layer capacitance of HOPG in 1.0 M KCl. The formation kinetics were studied using chronoamperometry (CA) and cyclic voltammetry (CV). The electrochemical properties of the SEI were studied by CV and electrochemical impedance spectroscopy (EIS) of ferrocene.

Our results show that, as expected, current due to both lithium intercalation and SEI formation increases with the fraction of edge planes. After SEI formation in $LiClO_4$-based electrolyte, the edge plane permits slightly more electron transfer to ferrocene, but the reaction rate is too small to measure ferrocene EIS accurately on either orientation. Attempts to form the SEI incompletely by running CV scans to progressively lower voltages show that water contamination produces a more passivating SEI. Comparison of formation CVs for $LiPF_6$- and $LiClO_4$-based electrolytes shows that the degree of passivation is very different for the two electrolytes. Furthermore, ferrocene kinetics are faster on the basal than the edge plane in $LiPF_6$ electrolyte, even though the edge plane exhibits higher reactivity towards SEI formation. More work is required to explain the difference between the graphite orientations and the two electrolytes.

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

Working in the Abe Laboratory was an excellent experience. Throughout the summer, I gained a much greater appreciation for international scientists who must conduct research and communicate results in English, even though it is not their native language. Living in Kyoto provided excellent opportunities to experience Japanese culture. I especially enjoyed seeing Japanese fireworks and festivals.

RESEARCH REPORT

1. Name: David W. Taylor （ID No.: SP11056）

2. Current affiliation: Yale University School of Medicine

3. Research fields and specialties:

Biological Sciences

4. Host institution: Okazaki Institute for Integrative Bioscience

5. Host researcher: Dr. Kazuyoshi Murata

6. Description of your current research

Dicer plays a central role in RNA interference pathways by cleaving longer double stranded RNA (dsRNA) precursors into small regulatory RNAs. Although Dicer processes both pre-miRNAs and pre-siRNAs *in vitro*, high-throughput RNA sequencing data suggests that Dicer primarily processes pre-miRNAs in human cells. We are studying the structural basis for human Dicer's substrate preference. Using cryo-electron microscopy, we are solving the structures of human Dicer bound to a pre-miRNA, pre-let7, and a pre-siRNA duplex. Our initial results show that pre-let7 assumes a bent conformation and induces a structural change in the enzyme that may ensure catalytically productive substrate recognition. Our discovery implicates the structure of the RNA substrate in conferring its recognition and processing by human Dicer. We are also investigating the mechanism of RISC-loading in human cells. The RISC-loading complex is a macromolecular machine composed of Dicer, TAR-RNA binding protein (TRBP), and Argonaute2 (AGO2), which functions to unwind the Dicer product and incorporate the guide strand into AGO2 (the core of the RISC) for target silencing. Using single particle EM, we recently showed that the RLC Dicer's N-terminal DExH/D domain, located in a short 'base branch', interacts with TRBP, whereas its C-terminal catalytic domains in the main body are proximal to AGO2. A model generated by docking the available atomic structures of Dicer and Argonaute homologs into the RLC reconstruction suggests a mechanism for siRNA transfer from Dicer to AGO2.

7. Research implementation and results under the program

Title of your research plan:

Analyzing macromolecular complexes using Zernike phase-contrast cryo-electron microscopy (ZPC-cryoEM)

Description of the research activities:

Using both conventional cryo-electron microscopy (cryo-EM) and the recently implemented technique of Zernike phase-contrast cryo-EM (ZPC-cryoEM), we determined the structures of virus-like particles from two different classes of caliciviruses at nanometer resolution. Our results show that the major difference between these two viruses is the outer spikes on the surface of the capsid We hypothesize that these structural differences play an important role in determining the degree of infectivity. Additionally, we have made substantial progress in the structural determination of human Dicer. Using the in-column energy filter on the microscope, individual human Dicer particles were easily identifiable. The conventional cryo-EM structure of the enzyme is remarkably similar to the structure obtained using ZPC-cryoEM.

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

I visited Kyoto, Nagoya, Okazaki, Kanayama, and Tokyo. At these locations, I visited the major historical and cultural sites offered. I went backpacking and climbing on Mt. Takao and saw a great view of Mt. Fuji. My host researcher, his son, and I climbed to the summit of Mt. Fuji. Overall, my stay in Japan was an incredible experience.

RESEARCH REPORT

1. Name: Philip Thomas （ID No.: SP11057）

2. Current affiliation: University of Massachusetts Amherst

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Okinawa Institute of Science and Technology

5. Host researcher: Prof. Kenji Doya

6. Description of your current research

Markov decision processes (MDPs) are a common formulation of control tasks where a controller must map the state of a system to an action. Given an MDP, one can search for an optimal policy, or controller. However, finding such an optimal controller becomes exceedingly difficult as the dimension of the action increases (e.g. the number of motors that must be simultaneously controlled). Intuitively, this occurs because the set of possible controllers, through which we are searching for an optimal one, grows exponentially with action dimension.

My research focuses on methods for tackling control problems with high-dimensional actions.

7. Research implementation and results under the program

Title of your research plan:

Functional Electrical Stimulation Control of a Human Arm

Description of the research activities:

In our current work, we derive inspiration from how animals learn, especially on motor control tasks. These problems have high-dimensional action spaces, because animals must select real-valued stimulation levels for each muscle during a movement. Humans, for example, have over 100 muscle elements in a single arm. Animals maintain a set of modular primitives, each of which results in a pattern of activation over all muscles. These modular primitives have been studied in depth by researchers including Ferdenando Musa-Ivaldi and Emilio Bizzi. Animals need only select an activation level for each modular primitive. Hence, the action dimension is

reduced from that of the true actions down to the number of modular primitives.

We call artificial modular primitives motor primitives, and derive a gradient based method (ascending the gradient of the MDP's objective function, taken with respect to the motor primitives) for autonomously deriving locally optimal motor primitives for a problem. Given these motor primitives, subsequent problems and adaptation to changing dynamics both become easier. We test our method on a biomechanically accurate model of planar movement of a human arm. The model contains 6 muscles (6-dimensional actions), which we artificially inflate to 18 muscles. Rather than selecting 18 real-valued numbers as an action, the controller need only select 4 real-valued activation levels for 4 autonomously generated motor primitives. As expected, we observed a significant increase in learning speed when using the motor primitives.

The primary drawback of motor primitives is that, for a single problem, they typically slow down learning. Intuitively, this occurs because solving a problem is easier than solving a problem and finding motor primitives. However, this additional cost is countered by improved performance on all subsequent problems. So, motor primitives are only of practical if an agent is faced with multiple similar tasks.

RESEARCH REPORT

1. Name: Kyle Thompson （ID No.: SP11058）

2. Current affiliation: University of Florida

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Osaka City University

5. Host researcher: Professor Tohru Hata

6. Description of your current research

My research at the University of Florida concentrates on understanding of the decay of homogenous isotropic quantum turbulence in superfluid helium 4. My group has developed a superconducting actuator, which uses the Meissner effect to levitate a niobium cylinder at milikelvin temperatures. A mesh grid attached to the actuator is towed through the fluid creating turbulence. After the turbulence has been created we monitor the temperature as a function of time to gain insight into the mechanisms of energy transfer in the viscous free helium 4.

7. Research implementation and results under the program

Title of your research plan:

Detection of Excitations from a Turbulent Region in Liquid Helium Using Miniature Tuning Forks

Description of the research activities:

The proposed project for my EAPSI fellowship at Osaka City University was to construct, test, and operate a low temperature experimental cell, designed for the detection of quantized vortex rings and phonon emission from a turbulent fluid region. The turbulence in this scenario would be generated by an oscillating superconducting wire driven by an ac magnetic field. The excitations emitted from the wire are measured as damping on one of 4 quartz tuning forks being driven on resonance. This work is a natural extension to the science already being conducted by the Hata research group which I will be joining at the university (citations).

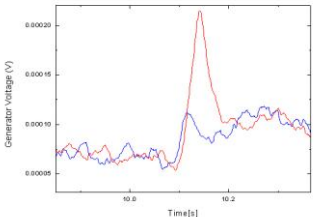


Fig. 1: Typical generator data. Data trace a shows a laminar regime before the transition to turbulence and trace b shows a set where the laminar flow is absent.

The project consists of three phases; first is cell preparation, followed by acquisition of data, and concluded with the analysis of the data. Rather than progress in the natural order, I saw a need to peruse studies on data analysis techniques as well as cell construction from the start. This is because the analysis techniques used for the study are also relevant to work that is currently being conducted. However, with a very limited time to work I was forced to prioritize one project above the other. Both projects probed interesting questions but, the data analysis was more pressing and received more of my effort.

I will begin this review with a quick reflection the experimental cell I constructed then describe the data analysis work. I constructed a copper cell which mounts on the sintered heat exchanger on the Osaka City dilution refrigerator. This cell was designed by a masters student in the lab and houses the vibrating wire experiment from my proposal. Electrical tests were preformed on the cell at both room temperature and 4.2 K. Mounting and running of the experiment will be done after I depart, but we plan to still be in communication.

The bulk of my time and effort have been spent on development of a mathematical routine to determine the time of flight of vortex (TOF) rings as measured by an oscillating NbTi wire. A TOF measurement for this experiment is in actuality two separate measurements; one which

indicates when turbulence is generated on a generating wire and a separate measurement which pin points the time of detection for a traveling vortex ring. The difference of these two measurements provides the TOF information for a given event. Turbulence is a statistical phenomenon and many measurements must be conducted to achieve an adequate picture of the physics involved. The analysis for this work up until the present has been conducted by hand, in an excruciatingly time intensive process. The data sets themselves all contain in excess of 15,000 individual data points, which must be averaged, fit to a line, and inspected before a TOF can be determined. This process not only takes time, but it also limits the number of events the lab is able to analyze for each energy and temperature.

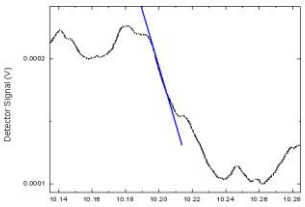


Fig. 2: Typical detector data. A line is shown fit to the slope of the transition. The detection time is calculated as the location of the divergence of the trace data from the fit line.

The analysis process is repetitive which makes it perfect for a computer run mathematical routine. I have written a routine and tested it on data previously analyzed by the group. Two routines are required, because the process of turbulence generation and vortex ring detection are different. Both generation and detection data are the root square sum of the in phase and quadrature signal of a lock-in amplifier set to the resonant frequency of an oscillating wire. The output is recorded digitally as a change in voltage by a labview routine. Both signals resemble a Heaviside step-function where the generator steps up and the detector signal steps down.
The signals each have subtleties which need to be accounted for when extracting the TOF data. The generator data, Fig. 1, needs careful analysis because the step is not always of the same form. When turbulence is generated at low temperatures it is possible for the wire to laminarly oscillate in the fluid for a time before it begins to generate vorticity. This can be seen as a peak in one trace. It is also possible for the wire emerge directly from its rest state into turbulence, bypassing the laminar flow. This is shown in the other trace. These two scenarios need to be analyzed separately without having to manually open the files. This is done by calculating both the “peak” and the “mean" voltage for each data set. When the “peak” height is greater than 3 times the standard deviation of the data plus the mean height it is assumed that there is a laminar flow. Those data sets export the time associated with the peak voltage while the remaining sets are treated as if there is no super-critical laminar regime and the exported time is when the trace surpasses the mean voltage.

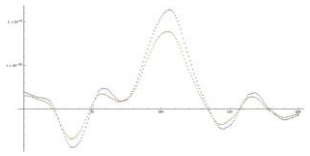


Fig. 3: Typical correlation data. For the computed data the transition time is calculated as maximum correlation between the fit function and the raw data.

The detector data sets have a different set of complications. In these the onset of a detection signal is more vague than the clear step for the generator sets. Previously when these data were analyzed by hand, a line was fit to the step of the data and where the data diverged from the fit, turbulence was considered detected. This is shown in Fig. 2. Computationally this is done by creating many fitting function forms and calculating their correlations to the detector data as the fits move through time. One such form is shown in the inset of Fig. 2. Once all of the correlations are calculated the 5 best fitting function's transition times are recorded and averaged to produce “the” detection time. A typical correlation function is shown in Fig. 3.
By recording TOF data for various different temperatures, generator wire velocities, and vortex ring flight distances we can gain insight into the properties of quantum turbulence generated in an isolated region. When the non-detection time is plotted on the same axis as the probability of a detected event, the data closely follow a single exponential decay curve. From the single exponential form, we infer that the process creating the rings is Poissonian. Therefore each detection is considered an independent event. The fit to the non-detection time plot provides information about the distribution of the size of vortex rings emitted from the turbulent cloud! With further study and analysis we will examine the changing dynamics of the turbulent cloud as temperature and creation energy is varied to understand the fundamental physics involved.

RESEARCH REPORT

1. Name: Francis Wham （ID No.: SP11059）

2. Current affiliation: Pennsylvania State University

3. Research fields and specialties:

Biological Sciences

4. Host institution: University of the Ryukyus

5. Host researcher: James Davis Reimer, Ph.D

6. Description of your current research

My research has been primary focused in molecular genetics of corals and their symbionts. I am generally interested in the process of genetic structuring and speciation in the marine environment. My current research employs neutral genetic markers and coalescent based simulation to delineate populations and species of *Symbiodinium.*

7. Research implementation and results under the program

Title of your research plan:

Delimiting Sympatric species of Symbiodinium with concordant multilocus genetic data

Description of the research activities:

Zooxanthellate zoanthid colonies of the species *Zoanthus sansibaricus* (Cnidaria: Anthozoa: Hexacorallia) are present both in the intertidal zone and at depths greater than 7 meters at Manza along the coast of Okinawa, Japan. In this study a molecular analyses of 6 polymorphic microsatellites were used to examin the species identity and genetic structure of *Zoanthus sansibaricus* and its symbionts. Transects from 0 to 35 meter depths at Manza indicated that the shallow and deep populations of Z. *sansibaricus* were discontinuous in their distribution, with few or no Z. *sansibaricus* colonies found at depths 2 to 7 meters. Examination of *Symbiodinium* (=zooxanthellae) types within Z. *sansibaricus* colonies by phylogenetic analyses of *Symbiodinium* ITS-rDNA by DGGE, Pbsa minicircle and 6 polymorphic microsatellites showed clear differences between the two populations. All shallow colonies possessed a clade C Symbiodinium with several also harboring a clade A Symbiodinium. All deep colonies harbored a different clade C Symbiodinium from the shallow colonies. From this study, it is clear that the zoanthid Z. *sansibaricus*

has some flexibility in its symbiosis with *Symbiodinium*, allowing the species to adapt and colonize different depths in the subtropical coral reef environment of Okinawa.

Hundreds of ribosomal transcribed spacer sequences (ITS1 and ITS2) distinguish a large diversity of *Symbiodinium* with distinct ecological and biogeographical distributions, yet formal species assignments remain a subject of controversy. Here we employed a multi-locus approach to test the hypothesis that two *Symbiodinium* with distinct depth distributions, yet similar ITS sequences, are separate species. Eight nuclear microsatellite loci and sequence differences in the psbA chloroplast gene were evaluated under the null hypothesis of panmictic mating within species. We found that geographically separate populations of *Symbiodinium* of the same depth distribution were more similar genetically to each other than sympatric populations analyzed across depth. By extrapolating from this example, there are 100's of morphologically cryptic yet genetically divergent *Symbiodinium* spp. awaiting description. These data further substantiate a growing awareness that these microbial eukaryotes are considerably more diverse than current assessments indicate. The modernization of protocols for validating new species is long overdue.

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

I was able to help several students in their current research as well as enable the Reimer lab to begin using population genetic markers. I also gave an invited lecture to the biology department in the area of my research.

RESEARCH REPORT

1. Name: David J. Wheatcroft （ID No.: SP11060）

2. Current affiliation: Committee on Evolutionary Biology University of Chicago

3. Research fields and specialties:

Biological Sciences

4. Host institution: Rikkyo University

5. Host researcher: Professor Keisuke Ueda

6. Description of your current research

Many animals produce alarm calls when they are threatened by predators or other threats. Some animals produce very different sounding alarm calls for different types of threats. For example, a bird might use call type A when it sees hawks and call type B when it sees a snake. Such context-specific signals are thought to evolve because they allow animals to convey more detailed information to others, which facilitates context-appropriate responses. For example, when others hear call type A, they know both that a hawk is present and that they must make an appropriate escape behavior. However, it is not known how such context-specific calls evolve. For example, how do two or more alarm calls with distinct sounds evolve and how by what process do they become associated with distinct types of threats? I am evaluating these questions in an avian alarm call system used by multiple species in a genus of songbirds, the Old World Leaf Warblers (Phylloscopidae).

The *Phylloscopus* produce a species-specific alarm call when they observe most threats, such as hawks, owls, or crows. However, when and only when they encounter cuckoos—birds that represent a unique type of threat to breeding songbirds because they lay eggs in songbirds' nests which drastically reduce their breeding success—each species in the genus studied thus far uses a special type of alarm call: a harsh call that is common across species. I am investigating both the evolutionary history of this call type by comparing its usage across multiple species as well as the function of this call both by constructing mathematical models of its possible function and evolution and through field experiments. My work will be one of the first phylogenetic (i.e. cross-species) analyses of alarm calls and will provide important insights into the evolution of context-specific alarm calls.

7. Research implementation and results under the program

Title of your research plan: The evolution of context-specific vocalizations in songbirds

Description of the research activities:

My previous research was conducted in India. In Japan, I conducted fieldwork at three sites—Miyakejima, Mt. Fuji, and near Sapporo—to study the usage of cuckoo-specific alarm calls in Japanese warblers. I was able to study the responses of three species: one *Phylloscopus* warbler and two closely related species. I am now analyzing the results to prepare them for publication.

Additionally, I met with TAKASU Fugo, a mathematical modeler at Nara Women's University, and started to work on a model of alarm call evolution in the *Phylloscopus*. I met with HAMAO Shoji, a researcher at the National Museum of Science and Nature, to compare my results with his very similar fieldwork on a species of warbler in Japan. I collaborated with students in my host laboratory to develop and review/commentary paper about the evolution of context-specific calls—both to review what is known and to suggest future research. We currently have a first draft completed.

RESEARCH REPORT

1. Name: Melissa Whitaker （ID No.: SP11061）

2. Current affiliation: University of California, Davis

3. Research fields and specialties:

Biological Sciences

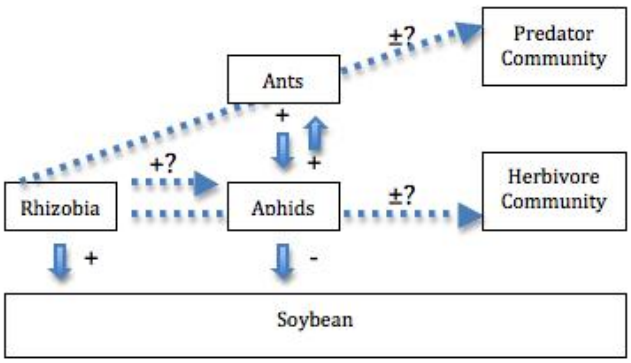
4. Host institution: Kyoto University

5. Host researcher: Dr. Takayuki Ohgushi

6. Description of your current research

Species interactions in general, and positive species interactions (i.e. mutualisms) in particular, are important forces shaping populations and community dynamics in nature. The vast majority of species interactions are not tight, pairwise associations between species, but rather diffuse networks of potentially interacting partners, often involving multiple mutualists. Despite this, most studies to date have used a pairwise approach to studying species interactions. This project aims to explore the effects of a plant-microbe mutualism on ant-aphid mutualism and arthropod abundance, providing a novel study of the effects of a "foundational mutualism" on higher order processes across multiple trophic levels.

This study will use a well-described experimental system of soybean (*Glycine max*) strains to examine the direct and indirect impacts of belowground interactions on aboveground interactions. Two soybean strains will be used: a nodulating strain (R+), the nodules of which are colonized by several nutrient-fixing bacteria (*Rhyzobium fredii*, *Bradyrhizobium japonicum*, and *B. elkani*); and a non-nodulating strain (R-) which does not harbor any nutrient-fixing microbes. These strains will be used to address two main questions: 1) How do rhizobia affect ant-aphid mutualisms? and 2) How do rhizobia affect arthropod community structure? Hypotheses were formulated and tested based on the following assumptions and questions about indirect and direct effects in this system:



7. Research implementation and results under the program

Title of your research plan:
Positive species interactions and interaction webs: effects of plant-rhizobia mutualism on ant-aphid mutualism and arthropod community structure

Description of the research activities:

For this project I grew 90 nodulating (R+) and 90 non-nodulating (R-) soybean plants and inoculated 60 plants of each strain with aphids, leaving the remaining 30 as controls. Plants were covered with fine mesh to prevent other insects from accessing plants or aphids, and aphid abundance was counted weekly on each plant. The following plant traits were measured both before and 2 weeks after aphid inoculation: % leaf carbon, % leaf nitrogen, % leaf phenolics, and plant size. Honeydew collection devices were installed on plants receiving the aphid treatment and after 24 hours they were removed and analyzed for amino acid and sugar content of the collected aphid honeydew. Plants were then moved to an experimental field where several ant nests were located and the mesh was removed to allow access by other insects. The plants that had been inoculated with aphids were then divided into 2 treatments: aphids with ants, and aphids without ants. For the latter, ants were excluded from plants by painting the plant stem with Sticky Tanglefoot, a sticky barrier to terrestrial arthropods. Control plants remained aphid-free and any aphids found on them were removed. Surveys were conducted weekly to measure the abundance of aphids, ants, and herbivorous and predacious arthropods on each plant. Afterward, plants were removed from their pots in order to measure total plant biomass, % herbivory, and leaf chemicals.

Some of the lab analyses for this project will be completed after my departure from Japan, and so the results from this experiment are as yet uncertain.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): I had many terrific cultural experiences in Japan. In Kyoto I visited temples and attended some of the summer festival events. I attended a sumo wrestling event in Nagoya, visited Nara to see the sacred deer and Daibutsu, went sightseeing in Tokyo and Yukosuka with my host family, and traveled to Osaka for a walking tour and to see the city views from the world's largest Ferris wheel. One of the most powerful experiences of all was traveling to Hiroshima for the 66th anniversary of the atomic bomb, where I visited the peace museum and attended the annual peace ceremony and lantern ceremony. I have also arranged to stay after the program dates and plan to explore Tokyo and climb Mt. Fuji—very excited!

RESEARCH REPORT

1. Name: Evan Wilson （ID No.: SP11062）

2. Current affiliation: North Carolina State University

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Osaka University

5. Host researcher: Dr. Masato Okado

6. Description of your current research

We have studied the behavior of the cellular automaton associated with the crystal base of the affine algebra G_2^(1). A cellular automaton is a dynamical system in which the dependent values assigned to a space lattice take discrete values and whose time evolution is given by a deterministic rule. Soliton cellular automata (SCA) are a kind of cellular automata which possess features analogous to solitons in non-linear integrable partial differential equations. In our case, the dynamical variables are elements of the perfect G_2^(1)-crystal B_l, which is a combinatorial object related to the representation theory of quantum groups. The time evolution is given by iterating the combinatorial R matrix, which is a unique crystal isomorphism from the product of two crystals to the product taken in the opposite order. We computed this for all elements of B_L times B_1. Using this, we found which initial states correspond to “one-soliton” solutions, i.e. right traveling waves with speed equal to their length. We found that these can be identified with elements of the much simpler affine algebra A_1^(1)-crystal B_3L. When two solitons collide, we found that the solitons separate back into two solitons of the same lengths as the original ones, but with some phase shift. We proved that the resulting two soliton state is given by the combinatorial R matrix for the corresponding A_1^(1)-crystal elements and the phase shift is given by the value of the energy function on these elements. These have well-known and very simple formulas. As a consequence of these formulas, we observed that the G_1^(1) and D_4^(3) SCAs possess the unusual behavior (for SCAs) in which the longer soliton may have negative phase shift as a result of collision while the shorter one has positive phase shift.

7. Research implementation and results under the program

Title of your research plan:

Soliton Cellular Automaton Associated with G_2^(1) crystal base.

Description of the research activities:

Before the start of the fellowship, we computed the R matrix for the highest weight elements of B_L times B_1, which would allow us to theoretically compute it for arbitrary elements.

When the fellowship started, we wrote a program in Mathematica to compute the R matrix and the time evolution of the system and used it to make a conjecture of the scattering of solitons after colliding.

We also computed the R matrix explicitly for all elements of B_L times B_1, which allowed us to prove our conjecture about soliton scattering.

We are currently finishing writing up our results in a paper, which we hope to publish in the Journal of Mathematical Physics.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): During my stay in Japan, I visited many important historical and cultural sites including Osaka castle, Kinkaku-ji in Kyoto, Meiji jinku shrine in Tokyo, the Hiroshima peace memorial, and others. I worked on learning Japanese and received some lessons from a tutor at Osaka University. I also met many well-known mathematicians in the area in which I am working.

9. Advisor's remarks (if any):

Although the length of stay was not long, the student almost finished writing a scientific paper almost for himself just by asking me a few questions. His stay was also significant also for me.

RESEARCH REPORT

1. Name: Daniel Yurovsky （ID No.: SP11064）

2. Current affiliation: Indiana University

3. Research fields and specialties:

Interdisciplinary and Frontier Sciences (Cognitive Science)

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

5. Host researcher: Dr. Shohei Hidaka

6. Description of your current research

Human infants are incredible learning machines. In just a few short years they acquire a skill that most of us cannot learn over our entire adult lifetimes: native fluency in a new language. I try to understand how the cognitive processes available to young infants, along with the input they receive from their learning environments, allows them to bootstrap themselves into language.

This work proceeds along two major lines. First, in order to understand their basic learning mechanisms, and how they may differ from those of adults, we study infants perceptual and cognitive systems in well-controlled lab experiments. In these studies, infants eye movements are tracked as they watch videos containing cross-modal regularities (e.g. a novel word consistently labels some objects but not others). From the pattern of eye movements we see, we can begin to infer how the infants brains are processing the incoming signals in order to discover these consistent patterns. Evidence has begun to accumulate that the learning mechanisms infants use to pick out statistical regularities in 5 minute lab experiments may scale to the complexities in natural language.

The second line of work consists of understanding the information available in language input to young children. Of course infants do not learn language in a vacuum, but rather do so through interaction and observation of other conversational partners and the environments in which language use occurs. Decades of research have convincingly demonstrated that speech directed to infants differs in significant ways from speech directed to adults. Sentences are simplified, prosody modulation is exaggerated, and important information is highlighted. But language is not a closed system; one of its powers is to connect to properties of the physical and social world. Thus, I record natural parent-child interactions from a camera positioned on the child's forehead. From this view, we can begin to understand how infants learn to connect the sounds they are hearing with observable properties of their worlds.

7. Research implementation and results under the program

Title of your research plan:

Linking learning to looking in real-time: Bayesian nonparametrics for eye-movements.

Description of the research activities:

In order to understand the remarkable language learning abilities of young infants, we must study them on the cusp of this remarkable achievement. Consequently, we are forced to measure learning in pre-verbal infants indirectly: by observing their eye movements. Thus we are in the difficult position of making a simultaneous inference about both the learning mechanisms available to young infants, and function which links these mechanisms to observable patterns in their gaze record. Current statistical lack the power to study individual differences, or to make quantitative predictions.

My collaborators and I have developed a statistical modeling framework which addresses both of these shortcomings. Using a type of hierarchical Bayesian model called a Dirichlet process mixture model, we have produced a rigorous, theoretically sound technique for linking observed eye movements directly to formal mathematical models of cognitive processes.

RESEARCH REPORT

1. Name: Robert Citron （ID No.: SP11066）

2. Current affiliation: University of Colorado at Boulder

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Dr. Shigeru Ida

6. Description of your current research

My current research involves the geophysics of Mars. I examine the effects of external and internal processes on the interior and surface of Mars. Specifically, I have been examining the possibility that mantle convection produced lineations in the crustal magnetic signature of Mars. Many of these effects are relevant to the Mars crustal dichotomy, a difference in the crustal thickness between the northern and southern hemispheres of Mars. I am investigating if a giant impact or mantle convection could have produced the Mars dichotomy and associated surface features.

7. Research implementation and results under the program

Title of your research plan:

Simulations of the Formation of Martian Moons Following a Giant Impact

Description of the research activities:

I investigated the formation of Mars' moons Phobos and Deimos from a giant impact. I conducted simulations of a giant impact of similar scale to the impact suggested for the formation of the Mars crustal dichotomy. Impact simulations were conducted using a Smoothed Particle Hydrodynamics code provided by Dr. Hidenori Genda. Simulations were conducted for a variety of impact parameters in order to construct scaling relations applicable to a wide range of Mars moon formation scenarios. The results from this study will serve as initial conditions for N-body codes.

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

The best part of my stay was interacting with my lab mates and other Japanese students.

RESEARCH REPORT

1. Name: Diane G. Youker （ID No.: SP11067）

2. Current affiliation: State University of New York at Buffalo

3. Research fields and specialties:

Interdisciplinary and Frontier Sciences

4. Host institution: University of Tsukuba

5. Host researcher: Dr. Yasuaki Masumoto

6. Description of your current research

The application of quantum dots (QDs) in photovoltaic cells to enhance their conversion efficiencies is a promising and increasingly active field of research. Such cells are termed “future generation” or “third-generation” solar cells. One approach to enhance efficiency in QD-based PV cells compared to conventional bulk semiconductor-based PV is to create multiple charge carriers from one high energy photon, through a process called multiple exciton generation (MEG). The observation of MEG in QDs has been reported to be highly efficient. However, the efficient extraction of multiple carriers once they have been generated is still under debate. The transfer of multiple carriers from QDs to a TiO_2 acceptor has very recently been reported through photoelectrochemical analysis. While this groundbreaking report demonstrates that collecting multiple carriers following MEG is possible, the dynamics and injection yields of the electron transfer reaction are still unknown. A fundamental understanding of the electron transfer process is crucial for implementation of QD MEG into “third-generation” solar cells.

I proposed to use femtosecond time-resolved spectroscopy to characterize injection of multiple electrons from photoexcited PbS QDs to TiO_2 nanoparticles following excitation by high-energy photons. I first characterize transient spectral signatures of MEG in PbS QDs alone and calculate the number of excitons per QD. I then use bifunctional molecules to link PbS QDs to TiO_2 nanoparticles within assemblies dispersed in organic solvents. The injection of multiple electrons from the PbS-MPA-TiO_2 assemblies will be correlated with decreased lifetime of the multiexcitons and the appearance of a transient spectral signature attributed to electrons in TiO_2. Through this spectroscopic analysis, I will be able to draw conclusions about dynamics and injection of electron transfer.

7. Research implementation and results under the program

Title of your research plan:

Spectroscopic Characterization of Electron Transfer Following Multiexciton Generation

Description of the research activities: Three different sized PbS QDs were synthesized with a diameter of 2.8, 3.6 and 4.3 nm. Mixed suspensions of PbS and mercaptopropionic acid (MPA) were prepared. MPA is a bifunctional linker and tethers the PbS QD to TiO_2 nanoparticles (NPs). The addition of MPA alone to the PbS QD quenched the photoluminescence of the 4.3 nm PbS and increased the photoluminescence of 3.6 nm PbS. We attribute this difference to a hole trapping mechanism that is favorable for the 4.6 nm PbS but not for 3.6 nm PbS.

We then evaluated the photoluminescence decay dynamics on the nanosecond timescale using time-correlated single photon counting measurements to ascertain electron injection if any occurs from PbS QDs to TiO_2 NPs for each size QD. We found that the larger 4.6 nm PbS QD did not show any evidence of electron injection, whereas the smaller 3.6 nm PbS QD showed dynamic photoluminescence quenching attributable to electron injection into TiO_2. We concluded that the conduction band edge of the 4.6 nm PbS lies positive to that of TiO_2 acceptor states making electron injection thermodynamically unfavorable. We believe that the conduction band edge of 3.6 nm PbS QD lies negative to TiO_2 acceptor states creating a driving force for charge transfer that is absent in the 4.6 nm QD. We also conclude that electron injection occurs on both the nanosecond and picosecond timescale.

After successfully establishing the presence of electron injection in the 3.6 nm sample we are now using femtosecond transient absorbance spectroscopy to evaluate the presence MEG in the PbS QDs. Our research collaboration is ongoing and we continue to take data. My research fellowship has not only been successful in research but also through this interdisciplinary collaboration I have acquired new insight and perspective to research challenges I face.

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

9. Advisor's remarks (if any): Ms Youker grew PbS quantum dots and observed photoluminescence decay of them by means of time-correlated single photon counting. She successfully observed the charge transfer from PbS quantum dots to TiO_2 nanoparticles depending on the size of the dots. She observed the transient absorption in the femto-pico-second time domain. She worked hard and collaborated with my students friendly during her stay. I was much pleased at having a chance to work with her in this summer.

RESEARCH REPORT

1. Name: Christopher L Buckley （ID No.: SP11101）

2. Current affiliation: CCNR, Informatics, University of Sussex, Falmer, UK

3. Research fields and specialties:

Biological Sciences

4. Host institution: RIKEN Brain Science Institute

5. Host researcher: Dr. Taro Toyoizumi

6. Description of your current research

Exposing the insects to odour evokes rich dynamic rate patterning in the their antennal lobes (AL's). The exact shape of the dynamics is odour specific and thus it is believed that the identity of odours is not only distributed across neurons within the AL but through time in the complex response patterns of these cells.

In my recent work developed a framework to describe these dynamics. I accomplished by first developing a quantitative, multi-scale reduction of a biologically plausible conductance based model of the AL. I did this by systemically separating the slow and fast timescale of the AL dynamics and constructing an analytical description of this system across different levels of description. Utilising this reduction I was able to determine what kind of formal nonlinear mathematical object could describe the dynamics of the AL. I found that the experimentally observed dynamics where well described by stimulus specific displacements of a single, globally stable fixed point. This framework is consistent with the data on coding of odour identity described in the literature, which is invariant to both stimulus duration and stimulus intensity.

7. Research implementation and results under the program

Title of your research plan:

Examining the nature of olfactory pattern clarification in dynamic neural networks.

Description of the research activities:

After a long discussion between myself, Dr. Tara Toyoizumi and members of Dr Hokto Kazama laboratory, who work on olfactory system in drosophila, we decided to examine the mechanisms of olfactory odour representation.

Recent experimental work has shown that the response of the olfactory system

exhibit sharp transitions between discrete states as the ratio of chemical that comprise input odour is slowly morphed between two pure odours. In contrast, at first sight, the the dynamical framework I have recently developed seems to predict that the olfactory system would exhibit smooth transition between odour representations. Through a combination of simulation modeling and analytical work we were able to determine a biologically plausible mechanism that could account for the sharp transitions observed in experiment. Furthermore, we were able to make several novel experimental prediction which we hope will be ultimately tested by Dr Kazama's lab. We currently preparing a theoretical paper to describe this work.

During my stay I also presented some of these ideas to two labs outside of the BSI. First Dr Takashin Ikegami at the Department of General Systems Studies at the university of Tokyo. Second, to Kanzaki-Takahashi Laboratory, Research Center for Advanced Science and Technology and experimental lab focusing on invertebrate olfaction again at the the University of Tokyo.

RESEARCH REPORT

1. Name: Jamie M. Cameron （ID No.: SP11102）

2. Current affiliation: University of Glasgow

3. Research fields and specialties:

Chemistry

4. Host institution: University of Tsukuba

5. Host researcher: Professor Hiroki Oshio

6. Description of your current research

My current research at the University of Glasgow involves the synthesis and characterisation of a series of novel inorganic clusters known as polyoxometalates (POMs) which can exhibit a wide range of fascinating chemical and physical properties. Specifically, our aim is the isolation of new POM clusters incorporating paramagnetic metal ions which are expected to have interesting magnetic and electronic properties. Additionally, by targeting the synthesis of a sub-set of POM clusters – polyoxovanadates – it is hoped that we will be able to 'tune' the associated magnetic/electronic behaviour via controlled addition or subtraction of electrons from the POM framework through the inherent redox chemistry of the vanadium ions present within.

Recently, we had been able to isolate a series of lanthanide-substituted polyoxovanadate species ($(TBA)_2[Ln(V_{12}O_{32}(Cl))(H_2O)_2(CH_3CN)_2]$, *Ln* = Pr, Eu, Gd, Tb, Dy, Er, Ho) in our lab in Glasgow, and it was hoped that these clusters might display interesting properties which we hoped to explore in conjunction with the Oshio group in Japan.

7. Research implementation and results under the program

Title of your research plan:

Characterisation of a Series of Lanthanide-substituted Polyoxovanadates

Description of the research activities:

At the outset of this project, the goals of our research could be broken down into three distinct aims following successful preparation of the clusters in Japan; i) full characterisation of the magnetic behaviour, ii) analysis of the electrochemistry associated with the POM cage, and iii) exploration of the possibility to photoreduce the POM cluster.

i) Magnetic Properties:

Due to specific nature of the lanthanide ions in these clusters, it was hoped that one or more of the different analogues might display interesting magnetic behaviour – specifically, we intended to investigate whether any of the species exhibited so-called 'slow-relaxation'

dynamics. Whilst working in the Oshio group, we were able to run 'SQUID' measurements on all five compounds of interest (Ln = Gd, Tb, Dy, Er and Ho). Although we encountered several difficulties in acquiring accurate results, we were ultimately able to confirm that none of the five clusters displayed slow-relaxation phenomena. We do however believe that there is still much scope for further work and we hope to continue exploring this concept in collaboration with the Oshio group.

ii) Electrochemical Properties:

The electrochemistry associated with the POM cage was also explored thoroughly over the course of the project and yielded some promising results. As synthesised, the cluster exists in a fully-oxidised state, that is to say that all of the metal ions present are in their highest available oxidation state (i.e. have the fewest electrons possible). By using cyclic voltammetry (CV), coulometry and differential pulse voltammetry (DPV) we were able to identify and confirm a reversible, six electron redox process associated with the POM cage.

iii) Photoreduction and UV-spectroscopy:

Based on the observation that bright orange crystals of these species will turn green if left in direct sunlight over a period of several days (indicative of the reduction of vanadium), we decided to attempt to analyse this process using UV spectroscopy. In addition we also believed it would be useful to perform electro-UV to go in conjunction with the electrochemistry results we obtained. These experiments are still currently in-progress and as such we have no firm results to report as yet however initial results appear promising.

In summary, I believe the work conducted over the course of the 2011 Summer Programme can help to shape the direction of my research over the coming academic year and hope it can go on to form the basis of a lasting and fruitful collaboration between our two groups. I immensely enjoyed my time in Japan and I'm confident that the knowledge and experience I have gained whilst in Tsukuba will assist me greatly over the remainder of my PhD studies.

RESEARCH REPORT

1. Name: Gareth Haslam （ID No.: SP11103）

2. Current affiliation: Dept. of Materials Science, University of Cambridge, UK

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Dept. of Complexity Science and Engineering, University of Tokyo, Kashiwa Campus, Chiba, Japan

5. Host researcher: Prof. Takashi Mizokawa

6. Description of your current research

Hydrogen fuel cells, particularly polymer electrolyte membrane fuel cell (PEMFC), are a technology that is often discussed as a possible low-carbon, alternative power source for vehicles. Fuel cells convert hydrogen to electrical energy by a direct electrochemical process which avoids the harmful emission of greenhouse gases such as CO_2 which are the product of fossil fuel combustion in traditional engines. Currently, fuel cells are economically unattractive when compared to traditional engines. This is partly due to the high cost of the electrocatalyst which is a critical component for enhancing the anodic hydrogen oxidation and cathodic oxygen reduction reactions necessary for generating electrical current. At present, platinum is used as both the anode and cathode electrocatalyst as it is extremely active towards both reactions and is immune or highly passive at the potentials and acidic pH used in the PEMFC. Development of non-platinum alternative electrocatalysts made from more cheaply available materials is thus desirable if clean and efficient fuel cells are to be a viable, widespread technology. However, unlike Pt, any non-noble material must demonstrate passivity against corrosion, as well as sufficient electrocatalysis.

My research has involved the development of two quite different potential fuel cell anode electrocatalysts: thin films of nickel-carbon (Ni-C), and tungsten carbide powder. Nickel, which is electrocatalytically active towards the hydrogen, is easily corroded in the acid fuel cell. However, by co-depositing nickel with carbon using magnetron sputtering it is possible to produce a material that is both electrocatalytically active and passive against corrosion. Carbon on its own does not electro-oxidise H_2 but it is resistant to corrosion. The origin and extent of these unusual properties has been investigated using a range of characterization techniques such as energy-dispersive x-ray spectroscopy (EDX), x-ray photoemission spectroscopy (XPS), transmission electron microscopy (TEM), and electrochemical methods such as potentiostatic polarization in sulfuric acid under either argon or H_2. This has led to the conclusion that the carbon forms encapsulating shells

around the nickel that protects the nickel from dissolution but still allows electrocatalysis.

Tungsten carbide (WC) is a more widely studied material for the hydrogen reaction. During my research I have investigated methods for producing the material in smaller particle size in order to increase the surface area available for electro-oxidation. This involved the development of an unusual technique involving microwave heating. Attempts to improve the activity further by doping the WC with Ni-C were also attempted.

7. Research implementation and results under the program

Title of your research plan:

Surface spectroscopy of transition-metal composites for novel energy devices.

Description of the research activities:

Using experimental x-ray photoemission spectroscopic data obtained from a range of nickel-carbon samples with compositions ranging between 13 – 100 at.% Ni we attempted to identify the chemical composition and oxidation state of the two components at the near surface (1 – 10 nm). We were able to identify a change in binding energy in the Ni region of the spectra as a result of introducing the carbon into the material. We then focused on the data obtained from the 55 at.% Ni sample after the surface had been etched to reveal the underlying structure. This provided a clear spectrum with which we could fit a model spectrum. To obtain the model data we used cluster model calculations to measure the charge transfer that results from the presence of carbon. The model spectrum was able to accurately fit the experimental data and indicates that the charge transfer from C to Ni is substantial. This has interesting implications for the fundamental study of such systems and may also be of use for understanding the electrochemical properties previously observed. We hope to publish the results in a forthcoming letter.

I also spent 2 days at the Hiroshima Synchrotron Radiation facilty (HiSOR) where I was able to observe and learn about the possibilities of high-energy x-ray spectroscopy.

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

University of Tokyo, Dept of Complexity Science: seminar on non-noble electrocatalysis
United Nations University – IAS: workshop on science policy for reducing CO_2
Toshiba R&D: seminar on electrocatalysis synthesis
Visits to Miyajima Shrine, Asakusa lantern festival, Tokyo fireworks festival, and volunteering in tsunami clean-up in Ishinomaki.

RESEARCH REPORT

1. Name: Peter Hughes （ID No.: SP11104）

2. Current affiliation: School of Built and Natural Environment, University of Central Lancashire, Preston. United Kingdom.

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Graduate School of Engineering, Fukui University, Fukui, Japan

5. Host researcher: Professor Shin-ichiro Suye

6. Description of your current research

The aim of this research is to advance the understanding of how concrete surfaces and coatings respond in the marine environment. Due to the fact that macro synthetic fibres were used in the mix in the case study, up to this point no other work has covered this area. Phase 1 has assessed physical characteristics of the marine concrete used in the case study and has included the analysis of the factors affecting the biofouling process, and concrete biorecetivity. A generalized relationship between surface energy and the relative amount of bioadhesion has also been established. Bacterial adhesion is less on hydrophobic surfaces with a low surface energy and is easier to clean because of weaker binding at the interface. The surface energy of marine fibre concrete samples is determined for the first time and samples with TiO2 coatings are examined. A clear objective of this study is to measure the impact of existing, aggressive cleaning practises on the wear of concrete surfaces. Surface roughness measurements have been taken at casting stage and again measured at 3 years; in this period they doubled. Analysing surface roughness of concrete revetment armour has been undertaken over a three year period and assessing deterioration is ongoing throughout this research. Studying the effect of concrete surface energy and roughness has lead to a better understanding; enabling a coherent study of concrete colonisation in phase two. Surface energy measurements were established for coated and uncoated concrete. Together this will enable an original Biofouling Defence Strategy (BDS) to be presented. Phase two this study describes the fouling of concrete surfaces by algae under controlled laboratory and site conditions. An incubating chamber was designed for testing the effects of different concrete compositions on algae colonisation and fouling. Algal strains belonging to the genera Ulva Intestinalis were cultured directly from visibly fouled concrete revetment armour and used individually and in a mix to inoculate mortar tiles varying in cement composition, supplementary cementitious material additions, water-to-cement ratio, and surface roughness. A strong positive relationship was observed between tile water-tocement ratio and the amount of biofouling. In addition, coatings containing photocatalytic titanium dioxide and exposed to artificial sunlight strongly inhibited fungal colonisation and fouling. Results indicate that the fouling of concrete surfaces by algae can be influenced by variations in concrete composition and available nutrients.

7. Research implementation and results under the program

Title of your research plan:

Development and culture of extremophiles using nanofibre scaffolds. Extremophiles favour extremely special environments, such as high temperature, pH levels lower than 3, and organic solvents. They have different biological chemistry from common bacteria, such as a heat-resistant enzyme and special metabolism. They are not only biological concerns for research, but also are much expected to be applied as environmental depuration and to industrial processes.

Description of the research activities:

This research developed various polymer nanofibres for extremophiles that enabled to culture and breed them. Extremophiles have been isolatable and culturable with adhesive nanofibre scaffolds. Application to environmental materials and industrial usage could be achievable. In addition, basic knowledge has been increased on the relationship between the fibre properties, fibre thickness and molphologies, and the successful bacterial adhesion and growth created a new research area of the control of bacterial behaviours with various material surfaces. Several site visits to concrete sea defences (Algae colonisation sites) on the west coast have been beneficial and informative. Algae samples have been collected, observed by microscopy and identified.

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

Japanese language training at the orientation was very useful. The poster presentation was a great success. Home-stay was a wonderful experience with a marvellous, and generous couple. I visited several local Temples and the remains of Fukui Castle, at Fukui Art Museum (designed by Kisho Kurokawa) the work of Hiroatsu Takata, a sculptor who spent his youth in Fukui and the wartime period in France, was enjoyed; I found H. Kannide butterflies artwork colourful and interesting. I Went to Tea Ceremony Museum and have enjoyed reading 'The Book of Tea', by Tenshin Okakura during my stay (statue in Fukui). I found captivating the Taro Kusakabe and William Elliot Griffis story (statue in Fukui) and enjoyed Fukui City History Museum. Visiting Eiheji Temple, in the mountains, one of Japan’s holiest temples, was very calming and beautiful. Mikuni on the Echizen coast, gave me fascinating views of the special rock formations. Tojimbo features magnificent pillar-shaped rocks created by sea erosion. Extending for about 1 km, it commands an impressive view, standing against the raging waves of the Sea of Japan. Tojinbo tower allowed me to observe this special place and by boat trip; also swam at Sunset beach; visiting the concrete sea defences. I was honoured to present my work to The Society of Biotechnology, Japan, at Nagoya University. I spent an enjoyable day at the Rembrandt Exhibition at Nagoya City Art Museum and made several drawings of Nagoya Castle on original Japanese paper. At Obama History Museum, I was impressed with the relevance of early Japanese pottery at a Lecture by Peter Jordan from Aberdeen University. I also purchased several chopsticks from this renowned region of Wakasa Provence, Fukui Prefecture. My trip to Kanagawa Academy of Science and Technology to visit the Photcatalyst Museum was a highlight to my Japanese Fellowship. I was unexpectedly greeted by Taketoshi Murakami, the director of museum. He guided me through the exhibitions and made several demonstrations of Professor Fujishima's pioneering work. My time at Fukui University under the supervision of Professor Shin-ichiro has been memorable and of great value to my PhD studies.

9. Advisor’s remarks (if any):

Mr. Peter Hughes has been active in the biochemical and material science studies for 2 months at University of Fukui. His activities have been of enormous value to our laboratory work and international friendships to my students in the Laboratory. He joined our nanofiber and microbial technology projects. So I was aware that he had great experience in our research field. His activities have aroused much importance for all students in my Laboratory. In addition, he is also interested in Japanese culture, especially temples, and castles. I hope he will promote friendship between Japan and UK.

RESEARCH REPORT

1. Name: Christopher Mcmonagle （ID No.: SP11105）

2. Current affiliation: University of Cambridge

3. Research fields and specialties:

Biological Sciences

4. Host institution: Kyushu University

5. Host researcher: Prof Suminori Kono

6. Description of your current research

In Cambridge I work on the aetiology of type 2 diabetes and metabolic syndrome, particularly the contribution of lifestyle factors such as physical activity and diet. For my research I utilize data from several epidemiological studies based in Cambridge and other parts of the UK.

In Kyushu using data collected from the Fukouka Cohort I examined aspects of the role of antioxidants in protecting against the development of type 2 diabetes, an area of particular interest to researchers in Kyushu University.

7. Research implementation and results under the program

Title of your research plan:

Effect Modification of bilirubin and coffee consumption on the association between gamma-glutamyltransferase (GGT) and type 2 diabetes in middle aged and elderly Japanese.

Description of the research activities:

Gamma-glutamyltransferase (GGT) has been shown to be an important predictor of type 2 diabetes and also represents a marker of oxidative stress. To further investigate this relationship we examined the potential role of bilirubin, a potent endogenous antioxidant, and coffee, a major source of exogenous antioxidants in populations such as Japan where coffee consumption is widespread, as effect modifiers of the relationship between GGT and type 2 diabetes.

We found that high levels of GGT were associated with increased risk of developing type 2 diabetes, while bilirubin concentrations were strongly and inversely associated with risk of type 2 diabetes, with coffee consumption weakly and inversely associated with risk of type 2 diabetes in women, but not in men. However, we did not find that coffee consumption or bilirubin concentrations modified the association between GGT levels and type 2 diabetes – e.g. that those people with high GGT levels, but with low levels of bilirubin concentration or low coffee consumption were not at significantly higher risk of developing type 2 diabetes, than those individuals with high levels of GGT but also high bilirubin concentration and coffee consumption.

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

An extremely enjoyable stay in Fukuoka – a very pleasant city – with Japanese food a particular highlight.

RESEARCH REPORT

1. Name: David Payne （ID No.: SP11106）

2. Current affiliation: University of Southampton, U.K.

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Tokyo University of Agriculture and Technology (TUAT), Tokyo

5. Host researcher: Professor Toshiyuki Sameshima

6. Description of your current research

I am currently studying for a PhD at the University of Southampton, focusing on the development and enhancement of light trapping within thin film solar cells. My main area of research concerns the use of metallic nanoparticles to improve light trapping within thin film solar cells via plasmonic effects, allowing for more efficient, thinner and therefore cheaper devices. I have also carried out extensive research on the more conventional approach of using textured interfaces for enhanced light trapping. The majority of my work involves optical experimentation as well as finite difference time domain based simulations of optical effects. In particular I experimentally measure the wavelengths and angles of light scattered as it passes through a material with either a textured interface or an array of metal nanoparticles. I then confirm these results by simulating the same situation using commercial FDTD simulation software. This allows me to validate both the simulation and the experimental procedure. The overall aim of my work is to increase the efficiency of thin film solar cells and I am now in a position to start fabricating and simulating full thin film solar cell devices with optimized light scattering enhancement.

7. Research implementation and results under the program

Title of your research plan:

Optimization of the Surface Passivation Layer for Novel Metal-Insulator-Semiconductor Solar Cells

Description of the research activities:

My Research in Japan was based on the novel metal-insulator-semiconductor (MIS) solar cell developed at TUAT. This is a unique solar cell that does not require several of the complex fabrication steps used to make many other solar cell designs. One of the crucial properties of an MIS solar cell is the thickness and quality of the oxide (insulator) between the metal and the semiconductor. This should ideally be a uniform, around 1.5 nm thick layer which passivates the silicon surface well. My work in Japan was to help optimize this oxide layer. We attempted to do this by fabricating several samples with ultra thin oxide layers. We then applied a high pressure vapor heat treatment in order to increase the quality of the oxide layers. Different temperatures were used so results could be compared and an optimal process temperature confirmed. The work resulted in the fabrication of several working 1 cm x 1 cm solar cells. The efficiency of each of the solar cells was measured and a large distribution in solar cell quality was found, with the best device having an efficiency of 4.45%. This was lower than expected and was likely due to the oxide layer being too thick. However the data gathered from the numerous measurements carried out at each stage of device fabrication has proven to be very useful in identifying crucial trends. It has also been useful for me to gain firsthand experience of this sort of device fabrication. I will now take the solar cells back to my home university where I will carry out further measurements such as AFM.

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

I have found my time in Japan to be extremely interesting and useful, not only from a research perspective but also in terms of learning about Japanese culture and work philosophy. I have found that the only slight barrier has been the issue of language as only a few people in my lab are fluent in English and my Japanese is very basic. This has encouraged me to continue studying the Japanese language in the future and I hope to return to Japan someday with significantly improved language skills.

RESEARCH REPORT

1. Name: Robert James Simpkins （ID No.: SP11108）

2. Current affiliation: The School of Oriental and African Studies (SOAS)

3. Research fields and specialties:

Social Sciences

4. Host institution: Waseda University

5. Host researcher: Julian Worrall, Koichi Iwabuchi

6. Description of your current research

As important historical locales and dominant nodes in the city, Tokyo's train stations are prime examples of places that have developed into complex social realms, from public transport hubs to commercial focal points, and which exist today as centres of communication in their own right. Although social research has been conducted in a wide range of urban settings in Tokyo, there remains a lack of detailed accounts of people's activities in and around these pivotal parts of the metropolis. Consequently, I propose to undertake a careful ethnographic study of one of these major rail nodes and its immediate surroundings in order to understand the ways in which commuters, Tokyo residents and urban planners, among others, use and interpret train station spaces today.

7. Research implementation and results under the program

Title of your research plan:

An Investigative Study of the Changing Uses and Meanings of 'Public Space' Surrounding and Railway Node in Central Tokyo.

Description of the research activities:

After completing an historical review of major rail nodes within the first two weeks with my host professor, we selected six stations at which to draft out research possibilities and methodologies for a long-term study, due to commence next year. On the Monday of each week I visited a new railway complex and began to record the spatial aspects of the station from the platform to the exit plazas and surrounding environments. On top of this layout I have been mapping out human activities and movement through a process of detailed observation at different times of the day, spending on average six hours at the fieldsite for each visit. Although limited by my language skills at this stage, I have also been approaching commuters, railway

employees, commercial staff and groups or individuals in order to understand the role played by railway infrastructure from their perspective of everyday life. At the end of each week I have been presenting my research to a work group at Waseda University in order to consolidate my notes and review the potential of each fieldsite for detailed study. In my final week I am attempting to organize a meeting with senior JR (Japan Rail) staff in order to discuss the potential of including a company viewpoint in the eventual ethnographic study. Now that the Summer of research is at an end, I plan to conclude the period by writing a fieldsite proposal document and finalising the selection of the station for next year's full-time research.

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

Various trips and sight-seeing, the highlight of which was climbing Mt Fuji.

9. Advisor's remarks (if any):

Robert Simpkins's presence in my laboratory at Waseda University has been of great mutual benefit. His research on the socio-spatial aspects of train stations in Tokyo from an anthropological perspective extends and invigorates a line of research into the constitution of public space in modern urban Japan dating back to my doctoral studies in architectural and urban history. Other students in the lab have also benefited from Robert's sharp and illuminating contributions to our weekly research seminar.

This experience has demonstrated the exceptional value of interdisciplinary and cross-cultural exchange on topics of common interest. It has expanded intellectual horizons on both sides, and laid the foundation for an ongoing research collaboration as Robert deepens his fieldwork as a MEXT-supported scholar from 2012, a prospect I greatly look forward to.

[Dr Julian Worrall, Waseda Institute for Advanced Study, Waseda University]

RESEARCH REPORT

1. Name: David A. Smith （ID No.: SP11109）

2. Current affiliation: University of Bristol

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: University of Kyoto

5. Host researcher: Prof. Hiroshi Sugiyama

6. Description of your current research

My current research interests are into the interaction, control and manipulation of carbon nanotubes in solution by weakly focused optical fields. At the University of Bristol we are developing techniques to sort and manipulate single-walled carbon nanotubes dispersed in aqueous solutions. Ultimately, such techniques will be used as a scalable method to selectively separate single walled carbon nanotubes of a particular chirality from a mixed solution. An efficient and scalable system for the chiral sorting of carbon nanotubes is required to enable the next generation of high speed transistors that are capable of operating at terahertz frequencies.

To sort single walled carbon nanotubes a technique is required that is inherently based upon their intrinsic optoelectronic properties. We are creating device in which dispersed carbon nanotubes are confined to a constrained volume under the influence of an intense but weakly focused optical field. The device is implemented within a photonic force microscope that enables the laterally study carbon nanotube translation & rotation under various optical conditions. In parallel to these laboratory experiments, equipment and experimental design is driven and refined by computer simulations of the system.

The success of the optical sorting techniques we are developing depends on a number of factors; not least, the preparation of good quality carbon nanotube dispersions. To this end, I have developed and investigated a range of techniques which use self-assembly chemistry to coat hydrophobic carbon nanotubes in either detergent molecules or fluorescent lipids. However, it has been shown that, typically, only 5-10% of single walled carbon nanotubes in a solution can be dispersed using these methods. DNA has been shown to disperse carbon nanotubes with efficiencies approaching 40% and more recently advanced DNA-carbon nanotube devices have been demonstrated. For these reasons I am very interest in DNA-carbon nanotube interactions and nano-constructs.

7. Research implementation and results under the program

Title of your research plan:

Laser induced temperature jumps in DNA linked carbon nanotubes: a route towards swimming in low Reynold's number environments

Description of the research activities:

The purpose of this project was to investigate methods for fabricating the world's first artificial nanoswimmer, (known as the 'Purcell Swimmer'), which has been proposed theoretically since 1972 but has so far eluded experimental realization. By attaching hairpin DNA strands between the end terminals of multiwalled carbon nanotubes and gold nanoparticles (see Figure 1A) the aim was to create artificial DNA hinges. DNA hinges would 'melt' when heated by a tracking laser before recombining when cooled, resulting in an oscillatory fashion.

Multiwalled carbon nanotubes (Diameter 10nm Length: 1-2um - Tokyo Chemical Industry) were oxidized in strong acids (96%-Sulphuric Acid:67%-Nitric Acid 3:1) for 24 hours before being extracted by repeated centrifugation and washing in H2O. The carbon nanotube precipitate was then resuspended in H2O and neutralized with NaOH.

The resulting carbon nanotubes were highly reactive at the end terminals as required but were also reactive at defect sites along the carbon nanotubes' sidewalls. To prevent binding to the sidewalls of the carbon nanotubes DNA strands consisting of 20 thymine nucleobases (poly-T henceforth) were added to the solution. Pi-pi stacking of nucleobases results in strong binding of DNA to the sidewalls of carbon nanotubes (see Figure 1B).

The poly-T encapsulation was further aided by ultrasonic treatment. Without ultrasonic treatment AFM results showed poor poly-T coverage and longer carbon nanotubes (Figure 1C). With ultrasonic treatment the carbon nanotubes were shorter but displayed complete poly-T coverage (Figure 1D).

Experiments to connect the hair-pin DNA strands were then conducted. The encapsulated carbon nanotubes were treated with SOCl2 before being reacted with thio-lated DNA strands in toluene. The addition of 5-nm gold quantum dots completed the synthesis but subsequent AFM imaging failed to identify the desired nano-constructs. The synthesis is ongoing and will be continued at the University of Bristol.

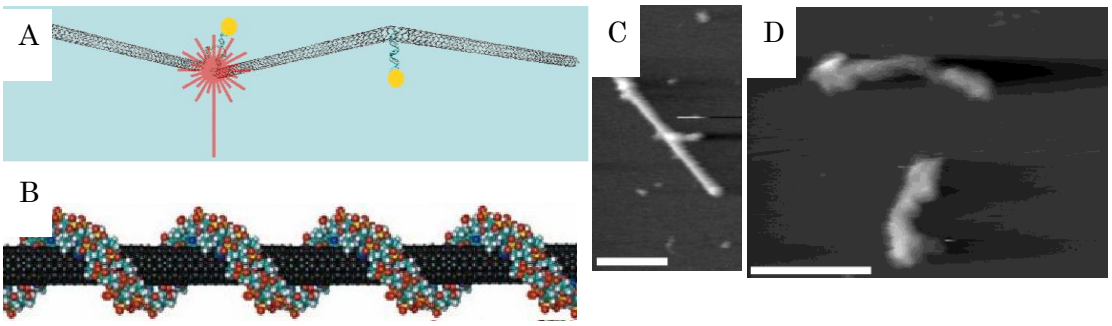


Figure 1: A – Schematic of possible nanoswimmer B - Schematic showing DNA wrapping of carbon nanotubes. C – AFM image of carbon nanotube wrapped in DNA at 2 locations D – AFM image of carbon nanotubes fully encased in poly-T DNA (C & D scale bars are 100nm)

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

Professor Sugiyama's research group was extremely welcoming and very helpful. I attended many events and activities with the group including; a welcome meal, a welcome party, the Naniwa Yodo river fireworks festival and a departing meal. Further to this Kyoto was resident to 14 other JSPS summer fellows in 2011 resulting in an excellent international, interdisciplinary social environment. Along with other JSPS fellows I visited all the major tourist sites of Kyoto. My favorite attraction within Kyoto was Kiyomizu-dera. Being the festival season I also witnessed a lot of processions and celebrations. Gion-Matsuri was particularly impressive. I took some occasional weekend day trips outside of Kyoto the most enjoyable of which was my visit to Nara. I would recommend this to anyone who has the opportunity. Further to this I have extended my stay so that I can travel in Japan for 17 days after the closing ceremony and therefore hope to obtain a wider appreciation of Japanese culture.

9. Advisor's remarks (if any):

It has been very enjoyable for David to work with us this summer. All members of our group have really appreciated his time with us and we will miss him dearly.

RESEARCH REPORT

1. Name: Peter Tollan （ID No.: SP11110）

2. Current affiliation: Department of Earth Science, Durham University, United Kingdom

3. Research fields and specialties:

Mathematical and Physical Sciences

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

5. Host researcher: Dr Alex Nichols

6. Description of your current research

My research concerns investigating how continental crust is formed in convergent plate margins (subduction zones). In such a tectonic environment, subducting oceanic crust heats up as it descends into the Earth. This causes a number of chemical reactions to take place, which culminate in the release of a water-rich melt or fluid into the overlying mantle. This in turn lowers the melting temperature (solidus) of the mantle, causing it to melt. These 'primary' melts are relatively buoyant, allowing them to percolate upward through the mantle and enter the crust. Here they begin to crystallize and evolve, before finally either completely solidifying within the crust to form plutons, or erupting at the surface to form lava.

Typically, mantle processes are determined by studying lavas. This method though has inherent problems, as magmas after leaving the mantle change chemically and isotopically prior to eruption. Scientists using such samples have to unravel these latter processes in order to 'see' into the mantle source. I am avoiding this problem by studying the geochemistry of a number of mantle xenoliths. These are crystalline fragments of mantle which have been transported in magma to the surface and erupted out of a volcanic vent. Samples such as these are very rare, hence the dearth of studies utilizing them, so the recovered information promises unique insights into a hard-to-study natural system.

7. Research implementation and results under the program

Title of your research plan:

Water budget in subduction zones, constrained through an infrared study of nominally anhydrous minerals (NAMs)

Description of the research activities:

In order to investigate how water influences the behavior of the mantle, as detailed above, I used Fourier transform infrared spectroscopy (FTIR) to measure the water content of nominally anhydrous mantle minerals (NAMs). This technique shines infrared light through a crystal with two parallel polished sides. Hydrogen bonds absorb this light at a unique wavenumber (3000-3600 cm^{-1}), and I use this measured absorbance to calculate the concentration of hydrogen, and by association, water. The first few weeks of my stay I finished preparing samples and then began calibrating the machine to determine the most appropriate settings to use. The rest of my time involved continued measurement, calibration and finding the best method to convert measured absorbance to total water concentration. Hydrogen is not homogeneously distributed in the crystal structure, but rather the concentration varies with crystal orientation. Due to limited time and samples, I had to mathematically reconstruct the primary crystal axes using my randomly orientated crystal samples. Using this method, I found a range of water contents of ~40-80 ppm in mantle olivines. These preliminary results make my samples the 'wettest' natural arc mantle samples measured yet, and could indicate the presence of very water-rich melts/fluids within the mantle wedge. I will use these results in combination with major/trace element and radiogenic/stable isotope measurements to construct a novel picture of the reactions dictating chemical variability in my study area.

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

I've had a wonderful time in Japan. I shared a house with 6 others, 30 minutes away from my work, commuting by train and bus every day. This alone was fantastic. My spare time was spent mainly in the local area along the Keikyu train line, including frequent visits to Yokohama and Tokyo. I spent 2 days in Kyoto sightseeing, and flew to Kyushu for 3 days to visit the volcanoes of Sakurashima and Kirashima, managing to witness a sizeable eruption of Sakurashima.

RESEARCH REPORT

1. Name: Emmanuel ANGER （ID No.: SP11201）

2. Current affiliation: PhD with Jeanne CRASSOUS

3. Research fields and specialties:

Chemistry

4. Host institution:

Department of Molecular Design and engineering
Graduate School of Engineering
Nagoya University
Chikusa-ku, Nagoya 464-8603, Japan

5. Host researcher: Professor Eiji Yashima

6. Description of your current research

During these two months of research we develop a new kind of helicoidal polymer using helicene as monomer. We succeeded the synthesis of this polymer and we studied all properties (UV, CD, NMR, Raman, AFM…).

We also started a collaboration on two others subjects concerning different type of polymers that could be realized in the future using helicenes chemistry developing by Prof. Jeanne CRASSOUS in France and using Helix polymer developing in the laboratory of professor Eiji YASHIMA.

7. Research implementation and results under the program

Title of your research plan:

Synthesis and characterization of polyhelicene for chiral recognition

Description of the research activities:

The main activitiy was to synthesize and characterize polymers (Nuclear magnetic resonance, Ultra Violet Absorption, Circular Dichroism, Atomic Force Microscopy, Steric Exclusion Chromatography, Chiral and recycling HPLC, Infra Red Absorption, Vibrational Circular Dichroism…).

RESEARCH REPORT

1. Name: Lucie Gattepaille （ID No.: SP11203）

2. Current affiliation: Department of Evolitionary Biology, Uppsala University

3. Research fields and specialties:

Biological Sciences

4. Host institution: Graduate University for Advanced Studies, Hayama, Japan

5. Host researcher: Dr. Hideki Innan

6. Description of your current research

My research focuses mainly on various ways to approach the challenges raised by recombination and linkage in genetic data. Until recently, I have been working on a statistical tool for combining genetic markers together and solve the problem of linkage disequilibrium between markers (the non random association between alleles at different positions in the genome, which violates the independence assumption of most of the statistical methods for data analysis), in the context of population structure. This project being over, I have started focusing on linkage disequilibrium in general and its stochastic variation over time. Recombination plays a major role in shaping this process. With Dr Innan, we have decided to develop a statistic to detect departures of genetic variation from what is expected under neutrally evolving population (no selection, constant population size, random mating between individuals). Such test already exist for different statistics, but to our knowledge, none has ever been developed on haplotype-data, that is to say whole segments of chromosomes. In case of autosomal genetic data, such segments undergo recombination and there is no analytical model for their evolution. Thus the development of a statistical test for neutrality based on haplotype-data is a theoretical challenge. However, it is thought that haplotype-data contain more information than the markers they contain because the recombination events might be as informative about genealogy as mutation events and because they are multi-loci markers, so if a test for neutrality could be developed on haplotype-data, it could potentially be more powerful than the usual tests.

7. Research implementation and results under the program

Title of your research plan:

A neutrality test for haplotype-data

Description of the research activities:

Taking example from a famous test for neutrality developed by Pr. Fumio Tajima, called Tajima's D, our idea was to find two ways of estimating the same parameter in two different ways. The major challenge of the project is the absence of analytical model for the evolution of haplotype-data. This absence causes two problems for our approach. First, since there is no model, there is no obvious candidate for the parameter we would like to estimate in two ways to construct our test. Second, we do not know analytically the probability distribution or the expected value of the haplotype-alleles configuration observed in a given sample, hence it is difficult to predict which measurable statistic could be used for developing our test for neutrality.

During this program, most of my research work has been explorative. I simulated data under neutral model with recombination and studied different quantities observable in the data and that may be of interest, for example, the number of haplotype-alleles in the sample, or the pattern of linkage disequilibrium in the whole segment.

I also thought about a possible approximation to the effects of recombination, that would allow us to use results from the case with no recombination. This case has been studied extensively, and a major result called the Ewen's Sampling Formula could potentially be used for our purpose. I studied the validity of this approximation, but it is still unclear if it can elude the basic challenges raised by recombination.

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

This summer program has been a truly enriching experience. It allowed me to see how research can be conducted in Japan and gave me the opportunity to work with Dr Innan. On the personal level, I have been extremely pleased by my stay. I particular, it was a great idea to introduce me to a host family in the beginning of the program. I had the chance to be in Sokendai, so my host family was close and we kept meeting from time to time during my whole stay in Japan. It is a bit sad that the other fellows that are scattered everywhere in Japan didn't get the chance to keep on having a regular contact with a Japanese family, and I was wondering if it could be possible in the future to make the homestay experience, not in Hayama but in the vicinity of the fellows host institution.

RESEARCH REPORT

1. Name: Thomas Gaudisson （ID No.: SP11204）

2. Current affiliation: Department of Chemistry, Paris Diderot University, France

3. Research fields and specialties:

Chemistry

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

5. Host researcher: Dr. Kozo Shinoda

6. Description of your current research

My research is focused on production of magnetic nanoparticles exhibiting large magnetocrystalline anisotropy used in high-density storage of information. Indeed the miniaturization toward a nanoscale in size of magnetic particle materials induces a superparamagnetic behavior at room temperature, which is a drawback for magnetic recording application. Consequently, the recording unites become thermally unstable at operating temperature

I tried to prepare d and f metal transition alloys, like Europium-Cobalt and Samarium-Cobalt, using the polyol process. This process can be decomposed in two way through different route, the first, indirect (two-step) way (way 1), based on creation of an intermediary phase in first step, where the two metallic cation co-exist, and in second step this phase is heated in polyol solvent with a strong bases or not. And another, direct (one-step) way (way 2) consists to precipitate directly the nanoparticles of a metallic alloy, in presence or not of dispersant agent.

7. Research implementation and results under the program

Title of your research plan:

Structural and Microstructural Characterization of Magnetic Nanoparticles based on Metallic Alloys and Their Related Mixed Alkoxide Precursors.

Description of the research activities:

On a first hand I tried to made direct reduction of metallic precursor. The solvent was nitrogenated for approximately 1 hour. A certain quantity of PolyVinylPyrrolidone (PVP) was solved for capping agent and metallic precursor was added with always Eu:Co ratio equal at 1. I tried some different conditions in metal ion concentration and quantity of PVP. For a concentration about 1.2x10-3M and 7g of PVP, and a reaction time at boiling point about 1h or 1h30m, a black magnetic phase was obtained and it was confirmed the phase has poor cristallinity phases by X-ray diffraction measurement and Transmission Electron Microscopy (TEM) observation. Magnetism was studied with a magnetometer and we observed a behavior typical superposition of a antiferromagnetic contribution associated at the linear variation of magnetization, and a ferromagnetic contribution associated at the opening of hysteresis around H = 0.

On the other side for a concentration about 2x10-3M and 0.84g of PVP, time at boiling point equal at 1h30m, a brown powder none magnetic considered as certainly Cobalt oxide was obtained.

On a second hand I made X-ray absorption fine structure (XAFS) experiment on alkoxide phases Eu-Co already synthesized, fitting let appear a mix local structure around Europium between Europium chloride and Europium oxide but an Iron contamination is a drawback for a correct fitting.

The black powder obtained by tried direct reduction in this study contains a large amount of Cobalt comparing to Europium.

The Eu:Co ratio in final products was different and it is considered due to difference in the reaction condition.

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

9. Advisor's remarks (if any):

For the structural analysis using EXAFS measurements at Eu L3 absorption edge (6983eV), sharp absorption peak from contaminated Fe in the sample at Fe K edge (7111eV) overlapped on the Eu EXAFS spectrum is large problem even if the concentration of Fe (in case of Eu-Co samples for this study, that is 2-3 atomic %). Therefore, the discussion for local environmental structure around Eu was limited qualitatively. In order to apply the XAFS technique to analyze the local structure for this system, it is important to prevent the Fe contamination.

RESEARCH REPORT

1. Name: Philippe Humbert (ID No.: SP11205)

2. Current affiliation: University of Strasbourg, France

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Kyoto University, Research Institute for Mathematical Sciences

5. Host researcher: Pr. Kazuo Habiro

6. Description of your current research

My research interests lie in the field of quantum topology (finite type invariants of links) and quantum algebra (braided categories and their refinements).

The first part of my work was to construct a Kontsevich-like tangle-functorial invariant for links embedded in a torus cylinder. Just as the usual Kontsevich invariant is derived from the monodromy of the Knizhnik-Zamolodchikov (KZ) equation, this invariant has been obtained from a universal version of the elliptic Knizhnik-Zamolodchikov-Bernard (KZB) connection, which is a genus one analogue of the KZ equation.

Then, I have studied the category of tangles in an arbitrary surface cylinder from a combinatorial point of view. This combinatorial description leads to the definition of a G-structure over a ribbon category (where G is a fatgraph in the surface), for which the category of tangles in the surface cylinder has a universal property. This work is expected to be the first step of a combinatorial construction of an invariant of framed links in surface cylinders.

7. Research implementation and results under the program

Title of your research plan:

Finite A-type invariants of tangles in surface cylinders

Description of the research activities:

In the same way as the Kontsevich invariant has a universal property among Vassiliev finite type invariants, the constructed invariant of knots in a torus is expected to be universal among finite A-type invariants. The notion of finite A-type invariant naturally arises in the theory of claspers developped by my host researcher,

Pr. Habiro. To prove this statement, it is sufficient to show the existence of a "surgery map" from the target space of the invariant to the graded space associated to the A-filtration of tangles.

During my stay in Kyoto, I got more familiar with clasper calculus in order to understand why such a surgery map is indeed well-defined.

I have also improved the definition of a G-structure over a ribbon category (showing that G-structures are equivalent for all fatgraphs G in a fixed surface), and have tried to define G-structure over an infinitesimal symmetric category.

I have had the opportunity to give two informal talks on my current research.

I would like to express my gratitude to Pr. Kazuo Habiro for kindly hosting me at RIMS. I would also like to thank Pr. Toshitake Kohno for having given me the opportunity to visit him in Tokyo University, to give a talk there, and to meet some of his graduate students.

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

This two months stay has been a very positive experience to me. Kyoto is a wonderful city with numerous cultural assets, and it is also a very lively place.

I have particulary enjoyed summer festivals like Gion matsuri, Daimonji, Bunraku theatre, and japanese food in various restaurants and izakaya.

As I am coming to the end of my stay in Kyoto, I have the feeling that time flew by too fast... However, I am glad to realize that, after all, this stay has been long enough to experience real daily life in Japan and get used to it, and to make new friends.

Therefore, I would like to deeply thank the JSPS Summer Program organizers for making it possible, as well as my host researcher and the administrative staff of RIMS, and finally all the friendly people I have met for good time spent together.

RESEARCH REPORT

1. Name: Julien Jaravel （ID No.: SP11206）

2. Current affiliation: Institut P', Department of Physics and Mechanics of Materials, France

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Department of Mechanical Engineering, Faculty of Engineering Kyushu University (*九州大学大学院　工学研究院　機械工学部門*)

5. Host researcher: Pr. Shin Nishimura

6. Description of your current research

Rubber-like materials are used as seals in many industrial applications over a wide range of temperature and pressure and sometimes under various gas environments (seals, pumps,…) When an elastomer is placed in pressurized gas (H_2, CO_2, N_2,…), the gas penetrates and saturates the elastomer. During depressurization, damage appears in the rubber in the form of cracks, bubbles or foams. In order to understand this phenomenon, I'm studying during my PhD the coupling between mechanical loading and gas (H_2 and CO_2) pressure on the damage of rubber: The aim is to better understand the physics of the damage phenomenon and to develop a physically motivated mechanical criterion for damage. To this aim, I both perform experiments on commercial rubber to understand the fast decompression phenomenon and I'm working on a coupled mechanical-diffusion numerical simulation of the hollow sphere problem using Abaqus® and Matlab ®.

7. Research implementation and results under the program

Title of your research plan:

Fast decompression of rubber after saturation under high-pressure gas: Measurement of the hydrogen released profile by a Thermal Desorption Analysis

Description of the research activities:

During my stay I conducted a Thermal Desorption Analysis on cylinder filled with hydrogen. The goal was to saturate a cylinder of elastomer by putting him into a vessel with high hydrogen pressure. After waiting enough time to allow the gas to penetrate and saturate the cylinder, the sample is suddenly removed from the vessel so the hydrogen start getting out and a measurement of this released hydrogen is

conducted. This measurement is interesting to get information of the time of desorption and of the quantity of hydrogen that can penetrate the material.

This study has been conducted under a various range of gas pressure and results will be used to better understand results obtain during my Ph.D. at Pprime Institute.

RESEARCH REPORT

1. Name: KRIEGEL Sébastien （ID No.: SP11207）

2. Current affiliation: Laboratoire de spectroscopie vibrationnelle et électrochimie des biomolécules, Université de Strasbourg, Strasbourg, France

3. Research fields and specialties:

Chemistry, Biological Sciences

4. Host institution: CRC (Catalysis Research Center), Hokkaido University

5. Host researcher: Pr. Masatoshi Osawa

6. Description of your current research

The current research topic deals with Fourier Transform InfraRed (FTIR) spectroscopy applied to biolomolecules, especially to the first enzyme of the respiratory chain, i.e. NADH:ubiquinone oxidoreductase (Complex I). The main goal is to create a system where the Complex I is reconstituted into a lipid bilayer with properties as close as possible to the native biological membrane. This system is then studied through Surface Enhanced IR Absorption Spectroscopy (SEIRAS) in the ATR mode. Combined with electrochemistry or with the perfusion of chemicals, this technique, once operative, will be a powerful tool to investigate the behavior of the protein when brought into contact with substrates, inhibitors or potential drugs.

In order to attach the protein to the crystal used for ATR-SEIRAS, a thin gold layer is deposed on the crystal. This layer enhances the IR signal and offers the possibility to create Self Assembled Monolayers (SAM) to whom the protein can be attached. This technique is at the center of this project.

To immobilize the protein on the gold surface two processes are used here. The first involves the natural substrate of Complex I, i.e. NADH, and the second uses the affinity of a hexa-histidine tag present on the enzyme for Ni^{II}.

7. Research implementation and results under the program

Title of your research plan:

Combining SEIRAS with electrochemistry in order to probe redox reactions in Complex I immobilized on a gold surface.

Description of the research activities:

The main goal of the research activity in Japan was to create a reliable way of combining SEIRAS with electrochemistry. To achieve this, two obstacles had to be overcome. First, the deposition of the gold layer on the ATR prism had to be done in a reliable way yielding reproducible SEIRAS properties. This was done by using the electroless gold deposition technique previously developed in Pr. Osawa's laboratory. Secondly, a specifically designed electrochemical cell had to be used to probe the redox reactions occurring in the immobilized protein *via* SEIRAS. This could also be done thanks to the help of the laboratory's team. First results are promising, showing that it is possible to get a signal of the protein at different redox states, although the Complex I samples used here suffered a loss of activity due to transport conditions from France to Japan. Experiments detailing step by step immobilization of the protein were also carried out.

This technique will now be adapted at the home laboratory in Strasbourg, where fresher samples of Complex I will be used, hopefully taking this project a huge step towards its completion.

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

The techniques learned here at Hokkaido University are of tremendous interest for my project and allowed me to advance significantly in my research. Pr. Osawa and his team were very helpful and made this program a great scientific and personal experience. It also opened the way for future collaborations.

In a more general aspect, it was very interesting to immerse oneself into the Japanese culture, it even made two months feel way too short to learn and to see everything that I'd have wanted. It is definitively an incitement to come back to Japan for a longer period, and I would recommend everyone this summer program.

RESEARCH REPORT

1. Name: Alexandre ROY （ID No.: SP11208）

2. Current affiliation: Institut National des Langues et Civilisations Orientales, Paris

3. Research fields and specialties:

Humanities, Social Sciences, (Economic History)

4. Host institution: Kyushu University

5. Host researcher: MIWA Munehiro, Pr.

6. Description of your current research

My PhD is about the Economic History of modern Japan. My methodolgy is crossing a global and a local perspectives, dealing with the problem of the industrialisation by focusing on one place : the port of Moji (on the Shimonseki Straits, called Kanmon Straits in Japanese), which was the "coal station" of industrial Japan from 1890 to the 1950s.

One can assume, as it is repeated by the historiography, that Moji "has just been a frozen village" (kanson ni suginakatta in Japanese) befor the port has been opened to international trade in 1890… but in fact it has always been a strategic place, carefully considered by politics as well by economics from the Antique Ages up to the Eve of the Tokugawa Shogunate. Who controlled Moji could dominate the Straits, and decide to lock it or not, making impossible the circulation of goods and people from Central Japan to Kyushu or the Asian continent…

During the period of the "Warring States" (15-16th centuries), Moji was the key of the Oouchi Clan power, controlling the Straits, the clan was controlling the whole Trade between central Japan and the Continent. The clan of the Mooris succeeded the Oouchi and fought the Tokugawas in their ascension to the supreme power, but they were defeated at the Sekigahara Battle (1600) with the other powerful clans of western Japan. The Tokugawas hurried to deprive the Mooris of their power on the Straits by taking over Moji, letting Shimonoseki (on Honshu) into the Mooris' hands. The Tokugawa shogunate then created a new feudal domain form Moji and its area, the Kokura Domain, and gave it to a friend-like clan, the Hosokawas and from 1633 to the Ogasawaras. The Ogasawaras were a feable clan, owing everything to the Tokugawas, and endeavoured a special mission : to keep an eye on the Kyushu area –where many enemies of the Tokugawas still remained- and particularly the Mooris. The Tokugawa shogunate soon promulgated two major measures to assess its power : its monopoly on the international trade (in Nagasaki) and the destruction of all castles in western Japan, excepting one by powerful domain. Moji then lost its international trade, and its military importance, its castl being destroyed in 1615. From then, the Kokura Domain clearly ignored Moji and its surroundings, turning its back to the Straits and the Mooris, following the shogunate Order. But this policy, lasting more than two centuries, brougth big troubles. At first, the Mooris have developed Shimonoseki as a major commercial place, actually absorbing the whole Straits area under their economic power… while the Kokura Domain was doing anything to compete with them. Secondly, the average people was attracted by this dynamic, and the demographic growth in the Kokura domain was definitely concentrated on the Moji Area… while Kokura Domain was keeping on ignoring it. Soon, many Chinese (and Korean) merchants came to the Straits to smuggle, this reached such a scale that the shogunate had to order a campaign to "expulse the foreigners' boats" (1715-1723). Smuggling remained a big problem for the shogunate, the Mooris was taking advantage of this, becoming richer and richer while the Tokugawas structure of power was struggling with structural deficits. All this permitted the Mooris (Choshu Domain) to affirm their power when the Occidental Powers came in Japan, signing treaties with the shogunate (1853-58). Indeed, Choshu was eager to overthrow the Tokugawas and took advantage of the problem of the treaties signed by the shogunate. Choshu undermined politically the shogunate authority by contesting every of its decision. Wanting to overthrow the Tokugawas, to get in touch with the Occidental powers to benefit their advanced technologies and to open trade relations with them, Choshu used its power on the Straits : it provoked an open conflict by shoting at western vessels (1863), showing how much the shogunate was powerless in Western Japan, forcing the Powers to come to the Straits for a battle. The battle was a very symbolic one (1864), Choshu has surrendered quickly, eager to open negociations as soon as possible, and proposed directly the Occidental Powers to open trade relations in Shimonoseki and Moji. From this moment, the shogunate was condemned. The British saw in Choshu the political power they were looking for in Japan, being fed up with the

complications of the shogunate (which came from its powerlessness upon western Japan). Great Britain smuggled weapons to Choshu in Shimonoseki, the Kokura Domain was powerless, still ignoring the Moji position… and in 1866 Choshu swept away the shogunate forces gathered in Kokura, disembarking at Moji, a land which had been continually -as a matter of facts- a Moori's land… With the Satsuma Clan as ally, Choshu defeated without problem the Tokugawas, instoring a new regime from the end of 1867, the "Restoration of the Empire". From 1868, Choshu and Satsuma directed the government, establishing a central State with a strong industrial policy.
At first, social troubles occurred, with big-scale riots, but up to 1878, the place of Moji kept on its traditional economy, while some of the biggest merchants of the region were already trying to develop modern industry and trade, in coal. We analyse the case of Nakahara Kazoemon, whom had a lot of businesses with Moji's seamen and merchants. It appears he had failed to run coal mines in the Chikuho area (20 kms South of Moji) because both of a bad conjoncture and an incapacity to adopt a complete capitalistic-way of management (Nakahara kept on running traditionnal businesses -as heavy cash lending- while investing lot of money in mine property rights). Very contrasting were the 1880s, the decade began with a severe deflation, permitting an accumulation of capital on a center-periphery type structure. The first railway project was launched in Fukuoka, putting Moji as the terminus of the Kyushu line. The new japanese Navy was modernizing its equipment, acquiring steamers and then took advantage of Moji as a strategic place, establishing a coal station there (1879-1882). Administratively too, the village of Moji strated to grow, absorbing neighboring villages… and in 1885 a first attempt by locals to export coal from Moji to Shanghai has been realized. But without railroad to carry coal massively and without any big-scale publicity, this "first opening" just failed (1887). But the railroad project was advancing, the prefecture mobilized the State and the Capital, founding the Kyushu Railway Company in 1888, placing its central office at Moji. With the railway coming, the State projected the opening of the port to international trade, which was done in 1890.
From 1890, Moji boomed suddenly into the most strategic port in Japan, furnishing the Chikuho coal to Tokyo as well as Shanghai, Hong Kong and Singapore, becoming the first coaling station in Asia... playing the role of front-rear logistic base during the Sino-Japanese War in 1894-95 and Russo-Japanese War in 1904-05. The town became the third "city" (*shi*) in Kyushu, claiming more than 50,000 inhabitants in 1900. During this period, the Japanese Coal exports grew threshold, becoming the first coal in the whole eastern Asia, from Shanghai to Singapore. If the japanese historiography considers this expansion as the "chasing out of Asia" of the British and Australian coals, our analysis points out that in fact, the Japanese coal benefited the conjonctural concentration of these coals on specific regions. During the 1890s, the Australian coal exports have growned toward South America, while the British coal was focusing on the European market. Our analyse of the World market shows that actually, the expansion of Japanases coal has been limited too by this dynamics : it could not expanded toward India, nor Pacific North America, cause the Indian coal industry was also booming, as well as the Canadian one (in British Columbia).
At the beginning of the 20th century, Moji was the symbol of the new Japan, the "Meiji Japan", it was the industrial port by excellence, the port of the expansion of economic and military power of the Empire... very far away from the incredible situation the Tokugawa Shogunate put it into. Considering the Japanese Industrialization process from Moji helps us to understand that its ground was mainly political, or rather geopolitical, being a response to the lack of efficiency of the former central States over the territory control. We understand that the Japanese Industrialization was both a geopolicital and an economical process, with its roots in the specific situation of the Tokugawa regime.

7. Research implementation and results under the program

Title of your research plan:

The Japanese Industrialization Process in the 19th Century analyzed from the Port of Moji (Northern Kyushu)

Description of the research activities:

I have been able to read and consult all the documents referring to my research field, especially the coal issue. The documents hold by the University of Kyushu are the one I needed for my work, about the local data and issues and especially the coal issue. I have also been able to achieve the writing of some 250 pages of my dissertation, which is mostly achieved by now.

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

That was perfect.

RESEARCH REPORT

1. Name: SOHIER Till （ID No.: SP11209）

2. Current affiliation: Institut Pluridisciplinaire Hubert Curien, Strasbourg, FRANCE

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: National Institute For Radiobiological Science

5. Host researcher: Pr. Nakahiro Yasuda

6. Description of your current research

Nowadays, it is very important to detect, with high fiability, ionizing radiations. A common used protocol is to use the naturally emitted light of several materials under irradiation. A lot of methods exist to measure the fluorescence “flash” that occurs in an organic scintillator after an interaction with an ionizing radiation. However, we developed in our laboratory (Institut Pluridisciplinaire Hubert Curien) a multimodal measurement platform, which allows us to reconstruct, at a nanosecond timescale, the light emitted after an interaction with all kind of radiations (charged and uncharged radiations) at several energies (from a few keV up to several GeV). In order to improve our understanding of the primary mechanisms which occurs in the scintillator, we will lead, this summer, a measurement campaign at the National Institute of Radiological Science (NIRS). Indeed the synchrotron high energy (several GeV) accelerator, with several kinds of ions (typically He and C), allows us to get an innovative set of data in this domain.

7. Research implementation and results under the program

Title of your research plan:

An accurate luminescence measurement method to understand the energy deposition of ionizing radiations

Description of the research activities:

During the JSPS program, we lead at the NIRS a measurement campaign using several types of ionizing radiations sources. Especially high energetic (290 MeV/u) carbons, gamma rays from Cesium and Cobalt, and X-rays sources. Our goal was to confirm a certain temporal light emission effect correlated with the linear energy transfer (LET) of the incident particle. Indeed we already lead a measurement campaign at the Heavy-Ion Medical Accelerator (HIMAC) but only with helium particles. The new set of data obtained will be useful within the frame of temporal

luminescence emission theory development and track detector field through new measurement possibility. It also opened a collaboration project which could lead to an international exchange of post doctoral researchers.

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

The JSPS program offered me an unique experience to establish contact with Japanese collaborating researchers. Especially it gave me the opportunity to continue an international collaboration through common experiment campaign lead with NIRS's staff.

RESEARCH REPORT

1. Name: Thomazo Michaël （ID No.: SP11211）

2. Current affiliation: University Montpellier 2, France

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Iwate University

5. Host researcher: Ken Kaneiwa

6. Description of your current research

For a few years, an interesting problem has risen from both database and knowledge representation communities. For a long time, databases could be used to query huge sets of data, by using the so-called conjunctive queries. On the other hand, knowledge representation deals with ontologies, which are formalizations of shared conceptualizations. The traditional querying problem in this field focus on a given ontology: one is interested in deciding if an ontology is coherent, if a concept of this ontology is subsumed by another concept, and so on. What is aimed at now it to be able to query huge sets of data, while taking into account ontological knowledge. This problem is called either ontological query answering, or ontological-based data access (OBDA).

The team I am working in uses existential rules to represent ontologies. Existential rules are closed logical formulas of the form ((¥forall x ¥forall yB[x,y]) -> (¥exists z H¥[y,z])). The OBDA problem can then be recast as: given a fact F, a set of rules R, is that true that a conjunctive query Q can be derived from F and R ? Unfortunately, it can be show that this problem is not solvable by a computer (undecidability). It is thus very interesting from a theoretical point of view to determine special cases where the problem can be solved, and to study how complex is the problem in these settings, which is the topic of my Ph.D thesis.

7. Research implementation and results under the program

Title of your research plan:

Ontological-Based Data Access: Merging Appoaches

Description of the research activities:

Kaneiwa's Laboratory is working on a different formalism, called Order-Sorted Logic (OSL) for dealing with the same knowledge representation problem. While both formalisms have common features (logically founded, ability to create new individuals during the reasoning), there was a few notable differences in our knowledge about them:

- whereas numerous decidable cases are known for existential rules, only a single non trivial case was known for OSL (called 'safe knowledge base')

- OSL allows the use of meta-predicates, i.e., allows to speak not only about individuals or objects, but also about the facts that are built on them. This is a very useful feature in knowledge representation, but this was not dealt with in existential rules.

During the two months stay at Iwate University, we have shown that existential rules and OSL are very related, i.e., one can be polynomially transformed into the other. Thus, the decidable cases from existential rules can be adapted to OSL, and meta-predicates can freely be added to existential rules. Thus, pros of both formalisms can be used simultaneously. We also defined a new family of decidable classes, based on known cases but with increased assumptions in order to decrease the complexity of the reasoning problem.

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

I would like to thank the JSPS for providing this opportunity, and the people of Morioka for the warmhearted welcome I got, with a special thanks for all the go players I had the chance to be defeated by.

9. Advisor’s remarks (if any):

Using the knowledge of decidability and complexity for logical languages, the fellow has shown the formal relationship between existential rules and Order-Sorted Logic. I think that it must be helpful for our work and therefore it will lead to an interesting result in the area of Order-Sorted Logic.

RESEARCH REPORT

1. Name: VALLARD Annabel （ID No.: SP11212）

2. Current affiliation: Centre Asie du Sud-Est (CNRS / EHESS, France)

3. Research fields and specialties:

Social Sciences

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

5. Host researcher: Prof. Yoko HAYAMI

6. Description of your current research

My current research is dedicated to textile in Southeast Asia. In the region, weaving and its products are linked to a long history of practices and representations that have recently undergone considerable transformation. These changes are related to globalization and the increasingly integrated flows of capitals, human beings and goods at an international scale. From fibers to garments, a number of Southeast Asian countries have been deeply involved since the 1980's into the world of textile and apparel industry which nowadays plays a key role in their economies.

My research explores two facets of Southeast Asia textile globalized networks through a focus on : 1/ innovative fibers production and use, in particular bio-textile issued from genetic engineering and 2/ collections of ancient fabrics that populate private galleries and public museums. The purpose is to question, at every stage of these networks, the ways in which humans make these materials and textiles collections exist by giving them a presence in the physical world as well as in the symbolic sphere.

This ethnographically based project is focused on two mainland Southeast Asian countries: the Lao PDR and Thailand. The comparison is important at least for two reasons. 1/ These countries are not only large producers, consumers and exporters of handcrafted textiles, but this craft widely models the social images and imaginations of individual as well as collective. 2/ Furthermore, they share a common cultural ground, the dominant political population being Tai ethnic groups. However, during the 20th century they experienced contrasted political and socioeconomic developments, resulting in one being a constitutional monarchy, the other being a socialist republic.

Japan is a particularly interesting interface to develop this project not only because numerous Japanese collectors are dedicated to Laotian and Thai textiles, but in the field of field of agriculture, agro-forestry or fibers production, Japanese institutions maintain numerous collaborations with Southeast Asian institutions. These scientific collaborations are manifest within the framework of textiles biotechnologies.

7. Research implementation and results under the program

Title of your research plan:

Textile matters! Southeast Asia and Japan materials networks

Description of the research activities:

During my two-month stay in Japan, I initiated a double fieldwork on polymorphous innovative networks connecting Japan with Thailand and Laos – and more generally Southeast Asia – through a focus on Japanese collectors and biotechnologists.

On laboratories of silkworms' genetic engineering. I identified and contacted some laboratories working on the 'silkworm genome project' in the perspective to initiate further ethnographies on their research's aims, objectives and protocols. I get in particular in touch with colleagues from the Kyoto Technical Institute that are engaged in a long term collaboration on silk with Thai Universities.
On collections and collectors of Thai and Laotian textiles. I identified and visited some Thai and Laotian textiles collections existing in Japan starting with a search at the National Museum of Ethnology in Osaka. I also collected some contacts among private collectors based outside of Kyoto that should be visited in the future.
Part of the summer program had also been dedicated to networking with researchers working on Southeast Asia and/or textiles in and outside my host institution. The purpose was not only to get to know people working in my field, but to advertise individual and collective researches that have been in progress in my current French institution in the perspective to initiate new collaborations beyond myself.

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

My first research experience in Japan was incredibly fruitful. I have founded what promise to be long lasting collaborations and friendships. I am deeply thankful to Hayami-Sensei and all the members of my host institution for their kindness and their helpfulness in research as in entertainment. Even if Kyoto's summers are known to be hot, I enjoyed every minute being here. I especially appreciated Japanese matsuri and Bunraku performances. I definitely have to learn more Japanese for fieldworks to come. Thank you JSPS for this amazing opportunity and for the well-run and efficient organization in these difficult times for Japan.

9. Advisor's remarks (if any):

Annabel was very active in expanding network and knowledge regarding both Japanese collaboration towards silk production in Thailand, and regarding Japanese textile collections itself. She conducted a seminar at our Center in the early days of her stay. It was a rare chance for us to hear about the institutional setup of Southeast Asian studies carried out in France, and encouraged further exchange between our Center and French scholars. It was great to have her, and we hope that it will be the start of future exchange.

RESEARCH REPORT

1. Name: Hélène VU THANH （ID No.: SP11213）

2. Current affiliation: Paris IV-Sorbonne University

3. Research fields and specialties:

Humanities

4. Host institution: University of Tokyo

5. Host researcher: Professor Katsumi Fukasawa

6. Description of your current research

Pastoral and missions in Japan during the Christian century (16^{th}-17^{th} centuries)

Pastoral work in Christian missions to Japan is now the central focus of my research. It consists in studying the methods used in converting Japanese people, but also the adaptation of Catholic rites to Japanese customs during the 16^{th}-17^{th} centuries. During my stay in Tokyo, I focused on two themes in particular:

- Sacraments (marriage, confession, Eucharist) and their administration: in what measure and up to what point were sacraments adapted to Japanese culture by the missionaries? Also, missionaries often had doubts concerning sacraments, in particular about marriages between pagans and Christians: they would send reports to Goa or to Rome in which they would share their doubts and ask for theological clarifications. More generally, I am studying Liturgy, and especially burial rites. The point is to see whether the European rituals were adapted to Japan – would such adaptation help Japanese Christians to a better understanding of the doctrine? Were elements borrowed from Buddhist funeral rites?

- It is thus necessary to take into account the Japanese point of view on pastoral work and to study their way of living the Catholic faith. Meanwhile, books, printed by the Jesuits on the island of Kyushu, allowed Christians to live their faith on their own in spite of the insufficient number of missionaries. These books could be translations of European catechisms, lives of saints or spiritual books. To compensate for this lack of priests, laymen would maintain through different means the survival of the faith and gather the community regularly. The role played by non-religious individuals in the mission is thus a crucial element to the understanding of the spread of Christianity in Japan.

7. Research implementation and results under the program

Title of your research plan:

Faith and religious practices among Japanese Christians

Description of the research activities:

I carried out my research mostly at the *Kirishitan Bunko* library of Sophia University (Tokyo). The library holds most of the main works that were written in Japanese for the converts. I could thus study the catechisms and doctrines produced by the missionaries. I found that an extensive use of Portuguese words was made in order to translate notions such as God or sacraments... The amount and type of knowledge required from the Japanese Christians are also very similar to those required from European Christians. Finally, it seems that the works enjoyed a fairly large circulation. Japanese Christians would copy the content on prayer sheets. The sheets were also widely circulated among Christians and allowed them to be autonomous in their experience of the faith. Since *Kirishitan Bunko* is a library that specialises on the study of Japanese Christianity, its set of documentation includes many works on the subject, which have proved useful to complement my knowledge of the missions to Japan.

I also worked at the library of the Historiographical Institute of the University of Tokyo. This library owns many reproductions from various European archives about missions to Japan, allowing for a wide overview – I especially concentrated on the missions carried out by the mendicant orders, which were outnumbered by the Jesuits and had different methods.

Finally, I presented my research in Prof. Katsumi Fukasawa's seminar, which led to a discussion on various points of my thesis, notably on the relation between Buddhism and Christianity.

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

This stay was very helpful for developing my understanding of the Japanese Christian's faith as well as that of the relations between Europeans and the Japanese in the 16th and 17th centuries. Research at the various libraries was very pleasant and I greatly benefited from the generous advice of archivists and other researchers.

RESEARCH REPORT

1. Name: Robert Fischer （ID No.: SP11302）

2. Current affiliation: Dept. of Biomechatronics, Ilmenau University of Technology, Germany

3. Research fields and specialties:

Engineering Sciences, Biological Sciences

4. Host institution: University of Tokyo

5. Host researcher: Associate Professor Katsuko S. Furukawa, Ph.D.

6. Description of your current research

Mammalian cell cultivation and tissue engineering are valuable tools for biomedical research and regenerative medicine. By mimicking the growth conditions which exist in living organisms (*in vivo*), deeper understanding of cell and tissue reactions will be possible in future. The processes require highly dedicated experimental environments, which provide cells with all necessary specific ambient conditions. For good proliferation and vitality of cell cultures several requirements (e. g. temperature, nutrient and gas supply) have to be fulfilled. But besides these fundamental and vital needs, the environmental requirements get more complex when cell cultures are to show physiological reactions which are comparable to those of living tissue in an organism. *In vivo*, cells grow in three-dimensional structures.

At Ilmenau University of Technology a silicon microsystem-based cell culture system was developed which supplies the fundamental physico-chemical needs of cells. At the moment, I am involved in enhanced development of these bio-micro-electro-mechanical systems (BioMEMS) aiming at long-term cell culture applications. My core interest is to improve these systems to create culture environments, which resemble physiological conditions in regard to physico-chemical parameters, three-dimensional cell growth and application of various stimuli. Such an *in-vivo*-like system could lead to a deeper understanding of biological tissue, culminating in new biomedical applications.

7. Research implementation and results under the program

Title of your research plan:

Cell Culture Scaffolds for Bio-Microsystems Produced by Photo Fabrication

Description of the research activities:

In a feasibility study at University of Tokyo, approaches for photo fabrication of 3D cell culture scaffolds for the integration in bio-microsystems were developed. In contrast to traditional cell culture systems, BioMEMS possess overall dimensions in the scale of millimeters. Miniaturization leads to sub-millimeter-scaled functional structures, which are very sensitive. Due to this, high precision scaffolds were required and novel assembly processes – which are suitable for such delicate structures – had to be implemented.

Various preliminary scaffold models were created in consideration of these technical requirements as well as the needs of biological material. Along with this, integration processes were designed and evaluated. It could be shown that assembly is possible by different methods utilizing bonding agents as well as form closure, each with its individual advantages and disadvantages. Taking these into account, a reliable fabrication and integration process could be created. In adjacent cell culture experiments, 2D handling and seeding methods were translated to the 3D culture system. It could be proven, that the novel 3D structures are biocompatible.

By these fundamental investigations the proposed concept could be verified. The results represent a significant step towards 3D cell culture in silicon BioMEMS, forming the basis for further development targeted on an *in-vivo*-like cell culture environment.

RESEARCH REPORT

1. Name: Ulrich Hörmann （ID No.: SP11305）

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

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Center for Frontier Science and Graduate School of Advanced Integration Sci-ence, Chiba University

5. Host researcher: Prof. Hisao Ishii

6. Description of your current research

The research of my PhD project is focused on the impact of morphology on the performance of organic solar cells. These photovoltaic cells are a novel, promising type of thin film solar cells which represent a potentially cheap as well as environmentally friendly way of harvesting solar energy. State of the art devices of this type commonly apply the concept of an organic do-nor/acceptor heterojunction, where efficient charge generation is assisted by combining an electron donating material (donor) and an electron accepting material (acceptor). Upon the absorption of light charges are generated at the donor/acceptor interface. The energy level alignment at this in-terface is therefore crucial for the charge generation process and for the maximum achievable open circuit voltage (Voc) of the solar cell. This voltage in turn is one of the limiting factors of the over-all power conversion efficiency of the device.

While intense research on the impact of film morphology on the photocurrent has been carried out in recent years, only little attention has been paid to its influence on the open circuit voltage.

However, by heating the substrate during the deposition of the donor material sexithiophene (6T), the film morphology can be changed deliberately from more or less randomly oriented crystallites to a well ordered film of upright standing molecules. This is accompanied by a significant change in open circuit voltage. Interestingly, the direction of this shift depends on the choice of acceptor material. Different origins of this effect are possible, for example non-radiative recombination processes but also orientation dependent ionization potentials of the donor and the acceptor films. Comprehensive studies of morphology, energy level alignment and solar cell performance are thus required to elucidate the underlying mechanisms that create the open circuit voltage.

7. Research implementation and results under the program

Title of your research plan:

Investigation of morphology induced effects on the open circuit voltage of organic solar cells.

Description of the research activities:

During the JSPS Summer Program 2011 the aim of my research was to correlate the interfacial properties at the donor/acceptor junction to film morphology and device properties known from previous studies. This was carried out by in-situ investigation of the molecular films by the Kelvin probe (KP) technique available at Chiba University as well as ultraviolet photoelectron spectroscopy (UPS) at the UVSOR synchrotron facility in Okazaki. Information about the energetic landscape within the solar cell stack and at the interfaces was acquired from these methods. Furthermore Kelvin probe (KP) measurements during illumination of the sample were used to determine the photo surface potential. We are convinced that the shift of the surface potential due to light irradiation can be correlated with the open circuit voltage. Figure 1 shows preliminary results of the dependence of the surface potential shift on the light intensity.

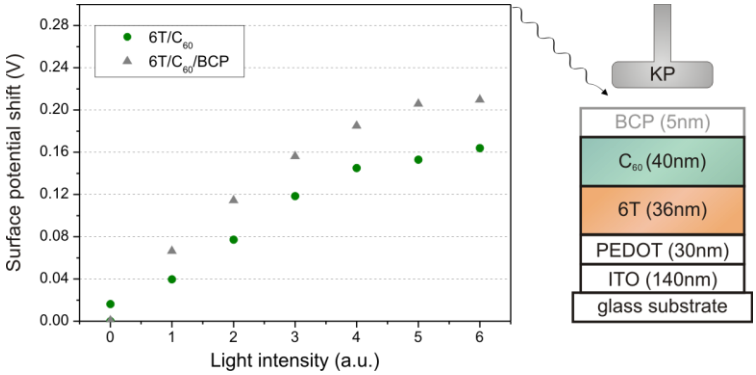


Figure 1 Surface potential shift of the 6T/C_{60} system at different light intensities. Triangles show the change if a 5 nm buffer layer of BCP is introduced.

Additionally displacement current measurement (DCM) was applied to organic solar cell devices, a technique which allows the examination of charge carrier dynamics in organic devices. As such it can be used to retrieve information about charge accumulation at interfaces and energy barriers. Clear differences were observed in the data acquired for heated and non-heated devices.

Overall the results gained during this program are very promising and will be helpful to clarify the impact of morphology on the open circuit voltage of organic solar cells. For complete understand-ing, however, more research will be necessary.

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

I am truly grateful to Prof. Ishii and all the members of his laboratory for the warm welcome and integration to the group as well as for their continuous support during my stay in Chiba. I want to thank the JSPS for giving me the opportunity to experience this unforgettable and enriching sum-mer in Japan.

RESEARCH REPORT

1. Name: Oliver Barnabas Kroemer （ID No.: SP11306）

2. Current affiliation: Max Planck Institute for Intelligent Systems

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Advanced Telecommunications Research Institute International

5. Host researcher: Dr. Hiroshi Imamizu

6. Description of your current research

My research focuses on machine learning for robot grasping and manipulation. One of the key capabilities required to efficiently manipulate objects is the ability to generalize learned actions between similar objects. Drawing inspiration from humans, the focus of the project in Japan was on predicting action-relevant subparts of an object directly from its visual perception. By executing the predicted action, and observing the results, the robot can autonomously determine if its prediction was correct. Thus, the robot can learn an improved predictor for detecting similar subparts in the future.

A key challenge of this approach was to develop a representation of the 3D visual information that was flexible enough to represent arbitrary subparts, but still maintain a suitable similarity measure between different parts of objects. In the proposed representation, visual features are defined relative to an object-centric coordinate system. The robot uses a time-of-flight camera to observe a 3D point cloud representation of the scene. Each point of the points in the cloud is the mean of a weighted Gaussian function defined relative to the coordinate system. The similarity of two subparts is therefore given by superimposing their respective coordinate systems, and computing the overlap between the Gaussian distributions.

The action linked to a specific subpart is defined as the trajectory of the object-centric coordinate system in the Euclidean world space. However, rather than using a single action, we used dynamical systems motor primitives. Motor primitives encode an action, as well as how the action should be adapted to contextual changes; e.g., changes in the initial and goal states.

Rather than just searching for a similar shape to the one used during the demonstration, the robot should learn to predict suitable subparts from multiple examples, including failures. The proposed visual similarity measure was therefore incorporated into the kernel logistic regression (KLR) framework. By using KLR, the robot can compute the probability that a certain subpart affords an action and, thus, focus on actions that are most likely to succeed.

Both the motor primitive and initial KLR predictor can be learned from a single human demonstration. Our experiments showed how the robot can subsequently interact with objects in order to learn the shape of subparts that afford a specific action.

7. Research implementation and results under the program

Title of your research plan:

Discovery of Affordance Bearing Subparts of Objects

Description of the research activities:

We implemented the dynamical systems motor primitives on the robot hardware, and integrated it with the kinesthetic teach-in system, thus allowing for intuitive demonstrations of actions by humans. We also developed a new rotation representation based on the movements of humans during tool usage.

We also developed an efficient approach for computing the visual similarity between different subparts of objects. Using this approach, an affordance bearing subpart can be found within seconds. We also determined a suitable learning method to utilize this similarity measure. The actual learning phase usually requires less than one second, and can be easily initialized with a single human demonstration.

We were able to run a set of experiments on the real robot during the final weeks. These experiments demonstrated the capabilities of the developed system, which allowed the robot to quickly learn to generalize demonstrated actions to three distinct novel objects. In order to disseminate the outcomes of the project in Japan, the results and experiments will be incorporated in a paper submission for ICRA 2012.

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

I was also invited to present some of our work on machine learning for robots at the Tokyo Institute of Technology, in the lab of Prof. Sugiyama. The lab is primarily focused on researching machine learning methods. This lab visit resulted in fruitful discussions, and we plan to start new international collaborations in the near future.

RESEARCH REPORT

1. Name: Tobias Kunz （ID No.: SP11307）

2. Current affiliation: Georgia Institute of Technology, Atlanta, USA

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Waseda University, Takanishi Labaratory

5. Host researcher: Prof. Atsuo Takanishi

6. Description of your current research

Previously, we developed a method for robot motion planning in the presence of an intelligent adversary. The robot's task was to select optimal motions in response to human actions. By representing the domain as a Markov Game, we enabled the robot to not only react to the human but also to construct an infinite horizon optimal policy of actions and responses. This could be used to ensure safety even when a nearby human chooses the worst possible action. We applied this method to robot sword defense. A simulated 7-DOF robot arm was able to block known attacks in any sequence.

One subproblem of the robot sword defense is that of planning an optimal trajectory from a start arm state to a goal arm state. The states include both, the position and velocities of all the joints. This problem is not specific to sword defense but is applicable to all situations where we have to plan fast arm motion. Existing motion planners mostly plan a path for an arm ignoring velocities and dynamics of the arm, assuming we could instantaneously move in any direction. In a second step the velocity along that path is then planned. This leads to relatively slow and suboptimal trajectories. My current research tries to consider velocities and dynamic constraints from the beginning, leading to higher quality trajectories. Existing planning methods do not perform well when considering velocities and fail to exactly reach a goal state.

7. Research implementation and results under the program

Title of your research plan:

Dynamic Chess: Strategic Planning for Robot Motion

Description of the research activities:

I developed a method to improve existing planning methods when including velocities into the planning process. The currently most popular motion planning method are rapidly exploring random trees (RRTs). They rely on a distance metric to evaluate how close two states are to each other. I developed a new metric that performs better than the usually used Euclidean distance metric.

I ported the robot model of my host lab's robot WABIAN into the simulator my home lab is using. I used the newly developed planning method to plan a trajectory for the arm of WABIAN and successfully executed it in simulation. The robot's task was to hit a ball with a stick in its hand, a task similar to baseball.

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

My most memorable experiences in Japan were seeing the sunrise on top of Mount Fuji and celebrating the Tanabata festival in Rikuzentakata.

RESEARCH REPORT

1. Name: Anton Nippe （ID No.: SP11308）

2. Current affiliation: Technische Universität Berlin

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Nagoya University

5. Host researcher: Prof. Yamada

6. Description of your current research

As I am writing my “Diplomarbeit” (Master Thesis) this Summer of 2011, I started a research focused on Attitude Control Systems, in particular on control loops integrated in a magnetic levitation system.

In the first quarter of 2012, “Beesat2“, the next Cubesat Satellite of the Department of Aerospace Engineering of the Berlin Institute of Technology will be launched. Cubesats are satellites with 10x10x10cm length and their popularity at Universities all over the world rises exponentially, because of their small size – affordable Satellites with educational benefits. The Beesat2 satellite will have an active attitude control system onboard, with the focus on reaction wheels in combination with magnetic coils. For that, the TU Berlin is in need for verification tests. I am part of a crew that designes and builts a Helmholtz Cache simulating the orbit in which Beesat2 will fly in by applying magnetic fields in all 3 axis to the Satellite.

In order to test the attitude control systems in-flight behavior, a frictionless mounting system needs to be designed. This shall be done by electromagnetic levitation, which basically means the cancellation of the gravitational force by a varying magnetic force created by a solenoid to keep a magnetic object floating in mid-air. The major part of my work will be the implementation of either analog and/or digital control loops for stabilization of the spacecraft while within the Helmholtz Cache. The minor part will be the simulations of the electromagnetic interactions and magnetic topologies and then the design and building of the frictionless mounting system with the help of electromagnetic levitation.

7. Research implementation and results under the program

Title of your research plan:

Satellite verification testing with the help of a closed loop controlled electromagnetic levitation system

Description of the research activities:

Research activities in Nagoya were studying and simulating about control systems and implementing that knowledge to design a small magnetic levitation system. With the help of the Professor and a student, a test bed was designed and assembled. The system was realized by an FPGA (field programmable gate array), which was programmable with the help of the LabView software package. With the help of the small system, which was able to levitate a steel-ball of 85g, the systems behavior was analyzed and comparisons to the simulations were drawn.

The system will be integrated differently in Berlin one more time. The difference will be the actual control systems interface, because it will be a programmed microcontroller, instead of the FPGA, that will give commands and supervise the solenoids duty cycles.

After this is done, the system will be resized from the 85g steel ball, to a system capable of levitating the 2kg satellite.

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

First of all I want to take this opportunity to thank my host Professor, Mr. Yamada from the Nagoya University, to have taken time and effort while supporting my project.

Second, I want to thank JSPS for an amazing three months.

Besides studying, I took the week-ends to explore Japan and I will do so for one more week after this program ends. Among cultural activities were, climbing Mt.Ontake (Fujiyama will be done also), spending a night in Shirakawa-go, Isu, getting to know fellow lab researchers and talking about Japanese and German culture, including similarities and differences.

RESEARCH REPORT

1. Name: Milan Padilla （ID No.: SP11309）

2. Current affiliation: Technische Universität München

3. Research fields and specialties:

Mahematical and Physical Sciences

4. Host institution: Keio University

5. Host researcher: Kohei M. Itoh

6. Description of your current research

At the Walter Schottky Institute for semiconductor physics at the TUM, my current research revolves around the study of time-resolved photocurrent measurements in different sorts of semiconducting nanostructures.

With the use of a pump-probe technique, we are able to sample the photocurrent dynamics of a contacted nanostructure with a time-resolution of about one picosecond. In the applied measurement scheme, a pulsed femtosecond laser pulse locally illuminates a contacted nanostructure, creating electron and hole pairs. These charges are then subject to drift, diffusion and other individual and collective phenomena. These effects result in the generation of an electromagnetic pulse, that propagates along a metallic coplanar stripline circuit. The amplitude of the transient field is then probed with a second (probe) pulse that creates a in a ultrafast photoconductive switch made of ion-implanted silicon on sapphire to sample the pulse by delaying the time between the pump and the probe pulse. Since the photoconductive switch is located between the stripline and a field probe, a lock-in amplifier detects the changes in the transient field.

This allows to resolve processes at time-scales between the picoseconds and the low nanosecond regime. Particularly, we recently achieved measuring for the first the time the response of a single, p-doped GaAs nanowire. We were able to observe an instantaneous displacement current, a slower current caused by drifting charge carriers and even the recombination of the charge carriers.

Previous studies with this measurement technique in our group were performed on graphene, networks of carbon nanotubes and low-temperature grown GaAs.

7. Research implementation and results under the program

Title of your research plan:

CONFOCAL PHOTOLUMINESCENCE OF SINGLE NITROGEN-VACANCY CENTERS IN DIAMOND

Description of the research activities:

My research work was mostly about creating the experimental setup for confocal photoluminescence spectroscopy of an atomic point defect in the diamond crystal lattice, consisting of a nitrogen atom and a lattice vacancy. The samples were created by AIST laboratories in Japan. We successfully established the laser beam path to focus a 632nm laser with a microscope objective on a diamond sample and lead the light emitted by the sample into a spectrometer to study the energies and intensities of the emitted radiation. The spectra we obtained at room temperature were well in accordance with previous experiments.

Moreover, we began installing a piezoelectric positioning system, that performs computer controlled scans of a sample surface to detect single nitrogen-vacancy centers. Since a single nitrogen-vacancy center shows a very small signal, we use single photon counters for a high resolution.

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

Overall, my stay in Japan was a truly marvelous experience. Not only was I able to successfully conduct my proposed research, but I was also able to immerse into Japanese culture. My work allowed enough free time to explore the country, even together with my Japanese colleges from the laboratory. I knew so little about Japan and in such short time I ended up almost feeling at home in this country once so foreign to me.

そうですね！

9. Advisor’s remarks (if any):

none

RESEARCH REPORT

1. Name: Ann Reckhenrich （ID No.: SP11311）

2. Current affiliation: Technical University of Munich, Germany

3. Research fields and specialties:

Medical, Dental and Pharmaceutical Sciences

4. Host institution: Department of Material Science & Engineering, Graduate School of Engineering, The University of Tokyo

5. Host researcher: Prof. Kazunori Kataoka

6. Description of your current research

The major challenges of regenerative medicine are poor functionality and vascularization, high infection rates and unacceptable stability of the regenerating tissue. My current research focuses on the development of bioactive implants, by combining scaffolds with gene vectors to release therapeutic molecules after transfection of relevant cells in the wound area and therefore provide optimal conditions to (re)generate fully functional tissues [Reckhenrich et al. 2011]. The release of bioactive molecules by seeding stem or gene modified cells in scaffolds has been suggested as a therapeutic option [Bleiziffer et al. 2007, Nomi et al. 2002, Egaña et al. 2009]. However, such approaches are difficult to implement in clinical settings. Among others, donor side morbidity, limited availability or transmissions of diseases are drawbacks [Sheyn et al. 2010, Tomford et al. 1995]. Gene therapy is a promising alternative to avoid those problems because it allows local expression of specific growth factors. Viral gene vectors have been shown to be useful in tissue engineering [Zhang et al. 2006], and gene-activated matrix approaches have been applied extensively in animal models. Their use in humans is limited due to their difficult clinical translation, predominantly with respect to costs, efficacy and regulatory constraints. A gene-activated collagen matrix loaded with adenovirus encoding platelet-derived growth factor homodimer (PDGF-BB) has been shown to be safe and active in healing diabetic ulcers in a recent clinical trial [Margolis et al. 2000, Margolis et al. 2004]. However, viral vectors are costly to produce and safety precautions require a complex logistics concerning their use. In contrast, non-viral vectors allow avoiding most safety concerns associated with viral vectors and are certainly less demanding concerning manufacturing, handling and costs. Their major limitation remains efficacy.

7. Research implementation and results under the program

Title of your research plan:

Matrix-mediated gene delivery with biodegradable polyplex nanomicelles to enhance revascularization in hind limb ischemia

Reckhenrich AK[1], Itaka K[2], Ikegami M[2], Baba M[2], Plank C[3], Machens HG[1], Kataoka K[2]

[1] Department of Plastic and Hand Surgery, Klinikum rechts der Isar, Technische Universität München, Germany, [2] Division of Clinical Biotechnology, Center for Disease Biology and Integrative Medicine, Graduate School of Medicine, The University of Tokyo, Japan, [3] Institute of Experimental Oncology, Technische Universität München, Munich, Germany

Description of the research activities:

Revascularization is a crucial step after tissue damage to persist oxygen and nutrient supply and therefore enable tissue survival and prevent necrosis. In this study, we developed a gene-activated matrix (GAM) to release erythropoietin (EPO) and vascular endothelial growth factor (VEGF) over a determined period of time. GAM releasing VEGF showed effective *in vivo* functionality on neovascularization, but the formation of leaky vessels was observed [Reckhenrich et al. 2011]. Besides its hemopoietic role, EPO promotes endothelial cell proliferation and migration, and is closely related to neovascularization [Lombardero et al. 2011].

Here, we immobilized polyplex nanomicelles composed of plasmid-DNA (pDNA) and biodegradable PEG-PAsp(DET) block-polycations on a FDA approved collagen type II scaffold. The nanomicelles have been previously shown to be safe and effective gene carriers and efficiently facilitate transfection *in vitro* and *in vivo* [Itaka et al. 2010]. GAMs composed of Integra™ Matrix and PEG-PAsp(DET) nanomicelles were able to transfect a variety of cell types *in vitro*. Moreover, distribution and metabolic activity of cells in the scaffold was not affected by the presence of gene vectors. GAMs were implanted in ischemic hind limbs of mice after ligation of femoral artery. First, transgene expression was confirmed by bioimaging of firefly luciferase at the implant site. The second *in vivo* study was performed to confirm previous data and therapeutic effects of VEGF or a combination of VEGF and EPO were determined. 7 days after surgery blood perfusion was evaluated by Laser Doppler measurements. The VEGF group showed increased blood perfusion and synergistic effects of simultaneously EPO/VEGF delivery were observed relative to controls. Therefore a third *in vivo* study was performed to approve the effect of combined EPO/VEGF delivery in ischemic hind limbs. Up to 14 days after surgery no significant differences in blood perfusion of hind limbs were observed between EPO/VEGF and control group. This study is still ongoing and further analyses will be performed.

We were able to show that the use of gene-activated scaffolds with biodegradable PEG-PAsp(DET) nanomicelles presents a smart technology to locally deliver therapeutic molecules and therefore presents a promising tool for future applications in different tissue engineering approaches.

RESEARCH REPORT

1. Name: Tessa-Karina Tews （ID No.: SP11312）

2. Current affiliation: Leuphana University of Lueneburg

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Tokyo University

5. Host researcher: Prof. Taro Kanno

6. Description of your current research

Affective Computing is an important approach for future-oriented Human-Computer and Human-Machine Interfaces. Since cars become increasingly computerized, Tews and her colleagues in a research group at the Institute of Experimental Industrial Psychology at the Leuphana University of Lueneburg, Germany focused on emotional interfaces in cars. In the automobile context emotions are leading to maladjusted driving behavior and thus they are main contributors to traffic accidents. While there has been much progress in the research of the relation between especially negative emotions, maladjusted driving, and accident risk; little attention has been paid to the detection of drivers' emotions in cars. Researchers and manufacturers are still facing severe problems of detecting the drivers' emotional state reliably. Therefore, Tews et al. focused on the automatic detection of emotions in car drivers for emotional interfaces following a promising new dynamic approach.

Most of the current studies on emotion detection with facial expressions are using only static recognition methods, e.g., detecting emotions in still pictures frame by frame. To detect the facial expressions with our new dynamic approach, we placed four dots in the face of the driver. A new measure, the variance of an area, was implemented, to distinguish a driver's emotion (Tews et al., 2010; in press a; b). The variance of the area between the four dots was calculated, using an autonomous algorithm. By plotting the area between the dots, emotion specific graphs can be generated and compared to the neutral, i.e., non-emotional face graph of a person. The positions of the points were derived from earlier studies, investigating facial muscle movement with the help of EMG as well as observation of human mimics (e.g., Cohn & Ekman, 2005). Consequently the research focus of Ms. Tews lies on the detection of emotions.

7. Research implementation and results under the program

Title of your research plan:

Emotion Detection for an Interviewer Agent

Description of the research activities:

Taken together, both research groups in Japan and Germany have benefit from this collaboration since Prof. Kanno's research group was able to provide the Human-Computer Interaction basic, i.e., the chat-based interviewer agent and Ms. Tews' research group could improve and enrich this software with an emotional interface providing emotional awareness.

Above all, this research was not limited to chat-based systems and the collaboration could promote scientific progress both in Japan and Germany. A first joint presentation of work in progress was hold at the International Society for Research on Emotion (ISRE) Conference 2011 in Kyoto, Japan. Further national and international publications as well as further collaborative research are intended.

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

My summer in Japan provided myself and my coworkers with a fruitful collaboration between my current work at Leuphana University of Lueneburg (Germany) and the work at Todai University. During my stay in Japan I met many interesting people and made many friends. In order to fully experience Japanese culture I only ate Japanese food, I travelled to many historical places within Japan, and I practised my Japanese. I am very thankful for this experience that was able to give me a fruitful research opportunity that will lead to many years of collaboration as well as an unforgettable cultural experience.

RESEARCH REPORT

1. Name: Julia Waltermann （ID No.: SP11313）

2. Current affiliation: University of Technology Clausthal, Energy research center (EFZN)

3. Research fields and specialties:

Mathematical and Physical Science, Engineering Science

4. Host institution: Institute of Advanced Energy, Kyoto University

5. Host researcher: Takashi SAGAWA, Ph D. Associate Professor

6. Description of your current research

My current work deals with a Dye-sensitized solar cells composed of an n-doped ZnO nanorod array and a p-doped polymer layer. A ruthenium complex (called N719) serves as dye and for polymers the so called PEDOT:PSS and P3HT is used. Both latter materials could achieve a good hole conductivity and additionally P3HT is also able to absorb the sunlight under electron-hole pair generation.

Because of the various components used in this device: a glass substrate coated with a transparent conducting oxide layer, the ZnO nanorods, a dye, a polymer and metal contacts a lot of parameters will have an influence on the performance of such solar cells. To give just one example: the density and length of the ZnO nanorods will directly change the surface area which could be covered with the dye. The larger the surface the more dye is adsorbed and greater parts of the incident light can be absorbed.

For revealing such coherences series of solar cells are manufactured under different conditions and with changing parameters and the effect on the photovoltaic performance is investigated.

In summery I am working on dye sensitized hybrid solar cells based on a ZnO nanorod array and the p-conducting polymers PEDOT:PSS or P3HT. This setup has the advantages of being a non liquid system with good capability to guide the excited electrons through the ZnO nanorod directly to the electrode.

7. Research implementation and results under the program

Title of your research plan:

Photophysical characterizations of inorganic/organic hybrid solar cells

Description of the research activities:

I successfully prepared ZnO/P3HT hybrid solar cells, which consist of glass-ITO/ZnO nanorod array (rod length was 100 - 200nm)/P3HT (~ 250 nm thickness including the nanorods)/Vanadium oxide layer (5, 7.5, 10 and 12.5nm thickness)/Silver contact (100nm thickness) with their current-voltage characteristics as follows: short circuit current density 1.02 mA/cm^2, open circuit voltage 0.31 V and power conversion efficiency (PCE) 0.16%. We also measured the electron mobility and electron lifetime in such ZnO/P3HT hybrid solar cells, which are two important values to understand the mode of operation in these devices through CELIV (Carrier Extraction by Linear Increasing Voltage) technique. A laser light pulse creates charge carriers in the solar cell, which are extracted by applying an increasing voltage pulse. The comparison of the different thicknesses of electron blocking layers in the hybrid solar cell indicated that a layer is needed to prevent electrons to enter the device during the voltage pulse, because they would superpose the light created charge carriers. It was found that a vanadium oxide layer of 5nm is best for solar cell performance, but at least 10nm are needed for measuring the mobility of around 180-280 micro cm^2/Vs and the lifetime of 10.0-0.1 ms by CELIV method.

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

For me the period of two months was very short for lab work, because it takes some time to learn how to use the manufacturing equipment and measuring instruments. But in the end we were able to do some good research together. Perhaps we will go on with the cooperation, but for sure I will know, who I would like to see on the next international conferences.

9. Advisor's remarks (if any):

Instead of dye sensitized hybrid solar cell, she tried to prepare and characterize the ZnO/P3HT hybrid cells, which had already been proposed and reported by us. Through the careful SEM observation and CELIV measurement, interesting results on carrier transporting properties by using 1D-ZnO materials could be obtained as shown above. Although further systematic investigations to prove the above preliminary assumption will be required, such as precise measurement of the thicknesses and analyses of the crystalline structures, and so on, it is expecting to get fruitful and useful information to improve the photovoltaic performance for the inorganic/organic hybrid solar cells in the very near future.

RESEARCH REPORT

1. Name: Tuan Hoang （ID No.: SP11401）

2. Current affiliation: Wilfrid Laurier University, Waterloo, ON, Canada.

3. Research fields and specialties:

Biological Sciences

4. Host institution: Institute for Protein Research, Osaka University

5. Host researcher: Dr. Toshimichi Fujiwara

6. Description of your current research

I am currently working towards understanding the biochemical properties of neuronal uncoupling protein (nUCPs), including three homologs: UCP2, UCP4 and UCP5. These proteins are located at the inner mitochondrial membrane of the central nervous system (CNS) and are suggested to have potential roles in the function and protection of the CNS. A clear biochemical understanding for these proteins, however, has not been achieved, especially for UCP4 and UCP5. Therefore, the goals of my study are to gain further information on conformational and functional properties of neuronal UCPs using proteoliposome systems. Using *E. coli* bacterial expression system, we have successfully cloned, expressed, and purified the hexa-histidine tagged recombinant version of all nUCP homologs. Circular dichroism (CD) spectroscopy is used as a central technique for estimating nUCPs conformations in liposomes and their dynamics upon interacting with different ligands. On the other hand, ion transport assays (proton and chloride) for reconstituted neuronal UCPs are developed using anion-sensitive fluorescent probes. Comparative studies of conformation and ion transport of nUCPs have allowed us to gain better biochemical understandings of neuronal UCPs, especially UCP4 and UCP5, which have not been studied in liposome system before. The second objective of my study is to investigate the role of the mitochondrial specific lipid, cardiolipin (CL), on the structure and functions of UCPs. Differences in UCP – mediated ion transport properties and UCP conformations in the presence of CL showed strong evidence that this lipid might play an essential role in defining the characteristics of mitochondrial membrane proteins, especially UCPs in our study. The study is planned to continue looking for other functions of nUCPs using liposome system as the ultimate goal is to reveal the true physiological role of these protein in the CNS.

7. Research implementation and results under the program

Title of your research plan:

Structural Analysis of Inner Mitochondrial Membrane Neuronal Uncoupling Protein by Solid-State NMR

Description of the research activities:

Protein structure plays an important role in defining the protein's true physiological function. Although being discovered for a few decades, a high-resolution structure of uncoupling proteins has not been determined. With the recent development of magic-angle spinning solid-state NMR spectroscopy (MAS-ssNMR), high resolution structure of UCP2 in a native-like bilayer environment is hoped to be determined in this study. We have successfully expressed the uniformly labeled recombinant version of UCP2. The uniformly-labeled UCP2 was then purified using immobilized metal affinity chromatography (IMAC) followed by reconstitution into liposomes. Proteoliposomes containing UCP2 was collected by ultracentrifugation and the pellets were then deposited into a 3.2mm rotor for MAS-ssNMR. 2D DARR NMR was performed for UCP2 reconstituted in liposome vesicles. The NMR spectra were simulated for extended and helical states according to the protocol of Matsuki *et al.* (*J. Biomol. NMR* **38**: 325-339, 2007) , and compared with the simulated spectra of ADP/ATP model (PDB ID: 1OKC) and recently solved UCP2 structure by NMR molecular fragment searching (PDB ID: 2LCK). Optimization of reconstruction protocol will be done in the future to obtain a higher population of native UCP2. Overall, the study has initiated an interest in long-term collaboration between the two laboratory groups. The experience in the lab has been tremendously wonderful. I am so grateful to be a part of the group and appreciate the opportunity that JSPS has given me!

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

This has been the greatest time in my research experience. I consider myself very lucky to be able to work with one of the most talented groups of scientists, and to become good friends with everyone I have met in Japan during these two months. Members in the lab have become parts of my extended family! Therefore, I want to express my deep appreciation to both JSPS and NSERC to have given me this wonderful opportunity.

RESEARCH REPORT

1. Name: Zachary M. Hudson （ID No.: SP11402）

2. Current affiliation: Queen's University, Kingston, Ontario, Canada

3. Research fields and specialties:

Chemistry

4. Host institution: Nagoya University

5. Host researcher: Prof. Shigehiro Yamaguchi

6. Description of your current research

Triarylboron compounds have recently attracted considerable interest as electron-transport materials, chemical sensors, and compounds with nonlinear optical properties. When protected with bulky substituents and accompanied by electron donors such as amines, stable compounds that show bright charge-transfer luminescence can readily be prepared. Furthermore, our group has shown that this luminescence can be switched off in the presence of small anions such as fluoride, which block the boron acceptor site and activate emission pathways elsewhere on the molecule if a second, non-conjugated chromophore is present.

My research thus far has focused on the development of triarylboron-containing compounds as chemical sensors and as luminescent materials for organic light-emitting diodes (OLEDs). OLEDs represent an emerging display technology using solid-state organic materials to directly emit light pixel-by-pixel, eliminating the need for the large backlight found in commercial liquid crystal displays. In this way, devices with higher efficiencies, better contrast, and higher durability may be achieved using OLEDs relative to traditional LCDs.

Triarylboron compounds are ideal materials for use in this area as the electron-accepting boron moiety can promote efficient electron transport. Furthermore, we have shown that the boron functionality can greatly promote metal-to-ligand charge transfer (MLCT) phosphorescence when incorporated into a phosphorescent dopant material. Using this strategy, high efficiency OLED devices have been achieved based on triarylboron and Pt(II).

7. Research implementation and results under the program

Title of your research plan:

Photochromic Boron Compounds as Sensors for Molecular Oxygen

Description of the research activities:

Shigehiro Yamaguchi and coworkers at the University of Nagoya have recently taken a novel approach to this chemistry, directly incorporating the arylboron unit into the π skeleton of their materials. Four-coordinate boryl chromophores such as those reported by Yamaguchi have recently been demonstrated to undergo a remarkable photoisomerization reaction on excitation with UV light. Promoted by the steric bulk of the boryl chromophore, molecules such as these are rapidly converted in solution from a colourless, transparent state to a dark state, with the introduction of a strong, broad absorption band in the visible region of the spectrum. In this dark state, however, these materials are highly sensitive to molecular oxygen, decomposing rapidly on contact with O_2.

At the University of Nagoya, I have prepared a series of boron-based photochromic materials tagged with a second, higher energy blue fluorophore. When irradiated with UV light in the absence of oxygen, the green fluorescence of these materials is quenched, and the materials themselves become dark in colour. When exposed to oxygen, however, the boryl chromophore decomposes, activating the luminescence of the blue fluorescent tag. Chemical synthesis made up the majority of my research activities in Nagoya, and were followed by photophysical studies using the instrumentation available at the university on the optical properties of these new materials.

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

I was thoroughly impressed by the kindness and work ethic of the Japanese people, both in the university and otherwise. A very welcoming and fascinating place to visit. In addition, I was fortunate enough to have opportunities to visit Kyoto and Tokyo, both very memorable experiences. Finally, I am proud to say I reached the summit of Mt. Fuji in the middle of a thunderstorm.

RESEARCH REPORT

1. Name: Daniel Jeffery （ID No.: SP11403）

2. Current affiliation: University of Guelph

3. Research fields and specialties:

Biological Sciences

4. Host institution: Tokyo Metropolitan Institute of Medical Sciences

5. Host researcher: Dr. H. Masai

6. Description of your current research

I am currently studying the mechanism of epigenetic conversions in telomere position effect variegation in Saccharomyces cerevisiae. I have observed that deletion of the chromatin remodeling factor, CAC1 (Chromatin Assembly Complex 1), results in a loss of this epigenetic switching. I hypothesize that Cac1p is phosphorylated to incite its recruitment to the replication fork via interaction with Pol30p (PCNA), where it works with other histone chaperones to faithfully disassemble and reassemble chromatin onto the newly replicated DNA. However, when approaching a border of euchromatin and heterochromatin, such as at the telomere, Cac1p loses specificity and this permits the assembly of chromatin with a different epigenetic state approximately once every twenty generations in wild-type budding yeast, producing the variegation phenotype.

Currently, I am testing the first step of the hypothesis, phosphorylation of Cac1p by Cdc7p or Cdc28p (two important cell cycle kinases). Both kinases were able to phosphorylate Cac1p in vitro but only the mutation of cdc28 showed a loss of Cac1p phosphorylation in vivo when tested by Phos-TagTM SDS PAGE, not cdc7, suggesting that Cdc28p may be responsible for regulating the recruitment of Cac1p to the replication fork. I also discovered that mutations in the kinases caused a loss of epigenetic switching at the telomere, cdc7-1 particularly more so than cdc28-1. These effects are being tested by complementation of the mutated genes to establish if they are due to the specified mutation or just undetected secondary mutations in other genes. Also, these effects will be tested when the cells are grown at semi-permissive temperatures.

I am also currently pursuing the analysis of Cac1p by mass spectrometry to help predict the potential sites of phosphorylation on the amino acid sequence, which can then be mutated and examined for loss of phosphorylation of Cac1p. The next steps are to examine the interaction of Cac1p with chromatin in strains with the mutated kinases and site-directed mutants of cac1 in order to determine if Cac1p's phosphorylation affects its loading onto chromatin, as hypothesized.

7. Research implementation and results under the program

Title of your research plan:

Studying the Control of Epigenetics

Description of the research activities:

While in Japan, I performed numerous immunoprecipitations (small and large scale) of Cac1p::MYC for the purpose of Phos-TagTM SDS PAGE or use in Mass Spectrometry. This was done in three strains (wild-type, cdc7-1 and cdc28-1) after growth at both permissive (25oC) and non-permissive (37oC) temperatures since the two mutant strains are temperature-sensitive. The Phos-TagTM assay was performed on these samples and it was discovered that cdc28-1 grown at 37oC lost the phosphorylation of Cac1p, while all others maintained Cac1p phosphorylation. MALDI-TOF mass spectrometry was performed on Cac1p and any interacting proteins that were pulled-down with the Cac1p::MYC immunoprecipitations were also examined. Results were analyzed for differences in interacting proteins in the mutant strains and also for potential phosphorylation sites in the Cac1p amino acid sequence for future mutation and testing.

Throughout, I performed epigenetic switching assays to test cdc7-1 and cdc28-1 for loss of switching at the telomere, which uses alternating negative and positive selections of a telomeric marker to determine how often, if at all, the gene is able to turn on and off. I also began the cloning of plasmids for complementation assays of the kinase mutants, as described in the current research above.

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

I had the opportunity to visit several museums, temples, shrines and parks in the Tokyo area and I was also able to participate bi-weekly in a Shorinji Kempo martial arts class, which my host family had invited me to join. I think these activities greatly added to my overall Japan experience and gave me a little background on Japanese history and culture.

RESEARCH REPORT

1. Name: Miguel Angel Murran （ID No.: SP11405）

2. Current affiliation: University of British Columbia

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Dr. Hidetoshi Kotera

6. Description of your current research

Digital microfluidic system is a miniaturized version of macro-scale laboratories. The miniaturization of macro-scale laboratories into a Lab-On-a-Chip device has its benefits including disposability, higher sensitivity, low energy consumption, portability, reduced reagent consumption, and waste production. A digital microfluidic system controls nano/micro-liter reagent droplets over a surface. The droplets sit over an array of electrodes and capped by a top electrode, such a device configuration is termed a closed digital microfluidic system. The mechanism for droplet actuation is attributed to electro-hydrodynamics principles. In electro-hydrodynamics, electrical forces generated from the interaction of an external electrical field and free charges in conductive liquids or dipoles in dielectric liquids are the primary actuation forces. The external field is produced upon the application of a potential difference across the upper and lower electrodes. To initiate actuation, the applied voltage must be greater that a threshold voltage which heavily dependents on the surface conditions of the device. Fundamental fluidic operations for any experimental analysis are the union and division of droplets on a digital microfluidic system. Typically, the voltage magnitude as well as the sequence and duration of bottom electrode activation to perform droplet union or division are experimentally predetermined through manual turning. Such technique for droplet manipulation is termed an open loop control system whose performance is affected by disturbances including, modifying device configuration, droplet solution, and surface imperfections. A solution to this issue is a closed-loop (feedback) controller that measures the actual system response and corrects for any disturbance, thus offering optimal droplet manipulation. My research objectives are to design a high resolution plug & play droplet sensor and implement a programmable feedback controller for digital microfluidic platforms. This research increases the reliability and robustness of digital microfluidic devices and promotes the development of fully automated technology.

7. Research implementation and results under the program

Title of your research plan:

Micro-Total Analysis System for Cellular Studies based on Microfluidic Platforms

Description of the research activities:

From the start of this research internship, we addressed the most important objective of our JSPS research proposal which involved learning and acquiring hands on experience with micro-fabrication techniques for microfluidic devices. Under guidance from professors, I fabricated microfluidic devices at Kyoto University.

The second objective involved learning a cell analysis process with potential in micro-total analysis systems. Through team discussions, it was decided to research into cellular transfection through electroporation in a microfluidic platform. The microfluidic system must immobilize cells, perform transfection by electroporation, and incubate cells. Between fabrication lessons, I read biology books and journal publications to review cellular biology and learn about electroporation.

The final objective was to fabricate a cell analysis system. To date, a single cell microfluidic system was fabricated and undertaking experiments. The microfluidic system consists of cell loading and particle loading syringes, a cell electroporation device, a cell collection dish, and a waste flow valve. The cell electroporation device consists of two parallel micro-channels spaced 50um apart joint by a micro-bridge. Preliminary experiments, demonstrate that micro-beads can be immobilized and detached with a pressure difference manually controlled.

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

During my short stay in Japan, I am happy to have experienced many Japanese foods including Unaju, Takoyaki, Udon, Mitarashi Dango, Nagashi Somen, and lunch boxes. I participated in the following events: Tanabata, Gion Matsuri, Mitarashi Matsuri, and Gozan Okuribi. I was exposed to different Japanese customs and dialects in the various cities I travelled including Kyoto, Kurama, Kibune, Yasehieizanguchi, Osaka, Nara, Kobe, Mount Fuji, and Shikoku island (Takamatsu, kochi, and Naoshima).

9. Advisor’s remarks (if any):

Mr. Miguel Angel Murran accomplished his very difficult research theme and successfully fabricated the vertical-type electroporation device. To understand the theme and fabrication method, he studied aggressively from many professors and post doctoral fellows not only in my Lab. but another university. He also communicated with many Japanese students and staffs and he affected to them very well. I should say thank you to JSPS and Mr. Murran to stay in my Lab. I hope I can collaborate with him in future.

RESEARCH REPORT

1. Name: Yanina Shevchenko （ID No.: SP11407）

2. Current affiliation: Carleton University

3. Research fields and specialties:

Mathematical and Physical Sciences, Engineering Sciences

4. Host institution: Osaka University

5. Host researcher: Dr. Eiichi Tamiya

6. Description of your current research

This project was focused on the development of a highly sensitive fiber biosensor utilizing Surface Plasmon Resonance (SPR) effect. SPR fiber biosensor was tested for detection of immunoglobulin A (IgA), an antibody playing important role in mucosal regulation. Detection of this biomolecule was implemented via sandwich bioassay approach. The novelty of this work stemmed from combining of fiber biosensor technology with bioassay approach which has not been implemented before for this kind of biosensors.

Tested bioassay approach was tailored towards detection of IgA while relying on secondary antibody conjugated with gold nanoparticles. Use of gold nanostructures allowed for a significant enhancement of the SPR shift observed during binding of secondary antibody thus leading to improved limit of detection. Obtained results indicate that combination of bioassay approach with used fiber biosensor technology allows for detection of biological target at concentrations well below 1ng/mL.

7. Research implementation and results under the program

Title of your research plan:

Fiber biosensor utilizing gold nanoparticles

Description of the research activities:

Implemented research activities included:

1. Preparation of gold-coated fiber sensors using gold sputtering system;
2. Functionalization of prepared gold-coated sensors using first antibody;
3. Detection of target IgA biomolecules at various concentrations;
4. Monitoring of interaction of secondary antibody with IgA;
5. Analysis of the experimental data using Matlab software;
6. SEM and AFM imaging of fiber sensors exposed to various concentrations of biological targets and secondary antibody;

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

It was an exceptional experience that allowed me to deepen my understanding of studied field while also providing me with a unique opportunity to discover Japanese culture. My hosting group was very welcoming and provided me with everything that was required for successful implementation of the proposed ideas. I would like to thank my hosting supervisor Dr. E.Tamiya and both JSPS and NSERC for this excellent opportunity.

RESEARCH REPORT

1. Name: Chit (Gavin) Tsui （ID No.: SP11408）

2. Current affiliation: University of Toronto, Toronto, Canada

3. Research fields and specialties:

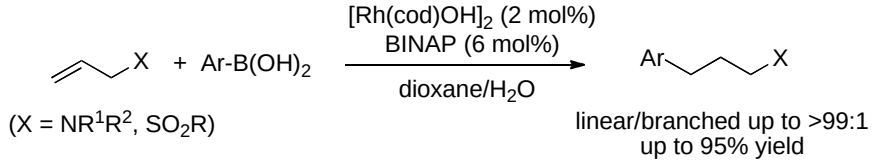
Chemistry

4. Host institution: Kyoto University, Kyoto, Japan

5. Host researcher: Prof. Tamio Hayashi

6. Description of your current research

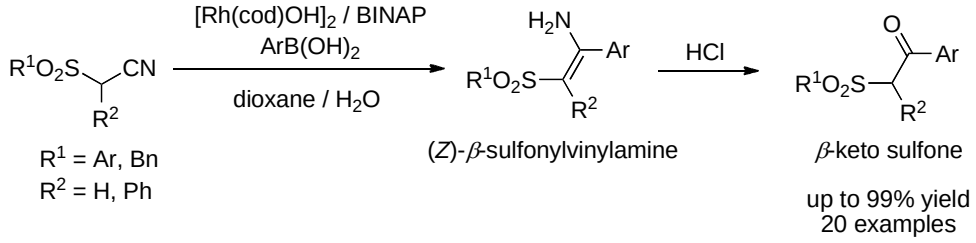
The focus of my Ph.D. work at the University of Toronto (supervisor: Prof. Mark Lautens) is on regioselective rhodium-catalyzed addition of arylboronic acids to unactivated alkenes. The catalytic system employs $[Rh(cod)OH]_2$ and BINAP to effect the addition of readily available arylboronic acids to protected allyl amines and allyl sulfones. Linear (formal) hydroarylated products can be obtained in good yields and excellent regioselectivities.



Tsui, G. C.; Menard, F.; Lautens, M. *Org. Lett.* **2010**, *12*, 2456.

Tsui, G. C.; Lautens, M. *Angew. Chem. Int. Ed.* **2010**, *49*, 8938.

The same catalytic system is also efficient in the addition of arylboronic acids to (benzyl-/arylsulfonyl)acetonitriles. Novel β-sulfonylvinylamine products are formed in a stereoselective fashion (*Z*-alkene). Upon hydrolysis, useful β-keto sulfones are obtained with a broad scope of aryl and sulfonyl substituents.



Tsui, G. C.; Glenadel, Q.; Lau, C.; Lautens, M. *Org. Lett.* **2010**, *13*, 208.

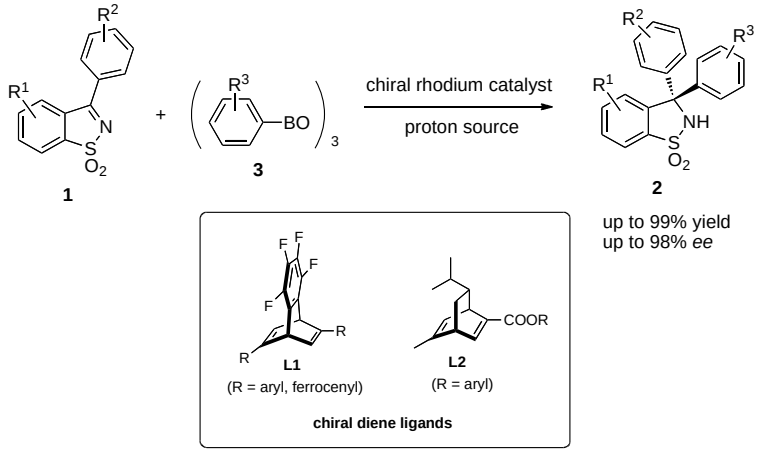
7. Research implementation and results under the program

Title of your research plan:

Rhodium-Catalyzed Asymmetric Arylation of Cyclic *N*-Sulfonylimines

Description of the research activities:

During the two-month term at Kyoto University (supervisor: Prof. Tamio Hayashi), I was involved in the development of a methodology to synthesize chiral sultams **2** bearing an α-tetrasubstituted carbon stereocentre *via* rhodium-catalyzed addition of organoboron reagent to readily available cyclic *N*-sulfonylimines **1**.



After extensive optimization, we were pleased to find by using arylboroxine **3** in the presence of a catalytic amount of chiral rhodium-diene complexes (ligand types **L1** and **L2**), a variety of the desired products can be obtained with excellent yield and enantioselectivity. The application of these novel chiral sultams in asymmetric reactions (as chiral auxiliaries) and removal of the sulfone group which will lead to chiral amine derivatives are currently investigated in the Hayashi group.

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

Words are not enough to describe this wonderful life-time experience! I truly thank JSPS, NSERC, Prof. Mark Lautens and Prof. Tamio Hayashi for making this opportunity possible. I have learned so much from the Japanese scientists as well as made many new friends. Outside of lab I have traveled to many Japanese cities during which I experienced a diverse array of Japanese foods, sceneries, arts, festivals and people, all of which have made this trip so memorable. I wish to visit Japan again in the near future and experience more!