RESEARCH REPORT

1. Name: Justin Acheson	（ID No.: SP13001）

2. Current affiliation: University of Wisconsin Madison

3. Research fields and specialties:

Biological Sciences

4. Host institution: University of Tokyo

5. Host researcher: Hideaki NOJIRI

6. Description of your current research

Electron-transfer plays an essential role in the cellular processes of all living organisms, and in most cases must be achieved by transient protein-protein interactions. In order to achieve efficient transfer, while deterring spurious and possibly detrimental interactions, organisms have evolved interacting partners to share complimentary surfaces as well as redox affinity. Multi-component enzymes systems like non-heme iron oxygenases are a ubiquitous and evolutionarily related group of enzymes capable of carrying out catalysis on a diverse group of compounds, and rely on these interactions. To perform their reactions, exogenous electrons must be derived through the aforementioned controlled protein-protein interactions. My current research at the University of Wisconsin – Madison has focused on diiron monoxygenase systems, which insert a single oxygen from the relatively inert molecular oxygen into unactiaved C-H bonds. These chemically intensive reactions are under rigorous investigation to unlock the key to their catalytic cycles, opening new avenues for inexpensive production of feed chemicals in industry, and better options for bioremediation.

7. Research implementation and results under the program

Title of your research plan:

Effects of redox state in protein-protein electron-transfer complexes

Description of the research activities:

Research in the Nojiri Lab is diverse, but follows a central theme, aimed at understanding the microbiology and biochemistry of toxic compound degrading organisms. During my stay I was able to learn new techniques that complement my own research, including isothermal titration calorimetry (ITC). This powerful technique allows researchers to understand binding characteristics in proteins where ligands are either small molecules, or another macromolecule including protein and DNA binding partners. In the case of multi-component enzyme systems where multiple binding interactions must occur for efficient catalysis, it is important to understand how the partners interact. Unfortunately due to protein limitations, and unforeseen set backs, I was unable to perform all the experiments I had hoped. However, I learned some important interaction characteristics that are both intriguing and challenging. I hope to continue the further experiments that should be performed with a collaboration with the Nojiri Lab.

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

Lab life in Japan is a little different than what I am used to at home, but at the end of the day everyone has the same goals. My host lab is much larger than my thesis lab, and all of the students were extremely welcoming and all seemed to take an active interest in each other's research. Lab meetings were incredibly long, but were always followed by a nice party. While in Japan I was fortunate to make connections with many Japanese people, as well as foreign researchers engaged in long-term stay. This allowed me to take part in many aspects of Japanese culture that would have been much more difficult due to language deficiency and being an outsider by myself. Being in Tokyo, this helped me see more of the city, eat better food, and learn the city itself, although I did spend a good deal of time exploring on my own. My first real cultural immersion to the past of Japan was multiple trips to Kamakura for hiking and visiting temples. From there on it was a slew of events, climbing Fuji, going to clubs/concerts, museums, travelling to Fukuoka to eat the best foods, more temples, towers and cities. I am glad I purchased a JR rail pass. I hope to come back as a short term post doc, the Summer Program is amazing, but I feel I need to spend longer here.

RESEARCH REPORT

1. Name: Jesse P Angle	（ID No.: SP13002）

2. Current affiliation: University of California, Irvine

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Institute of Engineering Innovation, The University of Tokyo

5. Host researcher: Prof. Yuichi IKUHARA

6. Description of your current research

This project focuses on determining the deformation mechanism in a widely used ceramic material, mullite ($3Al_2O_3 \cdot 2SiO_2$). Even with its uses in the aerospace and electronics industries, many of the essential mechanical properties of this material still remain unknown and by understanding the fundamental deformation mechanism of slip, both the slip direction and slip direction (or slip-system), a complete characterization of the mechanical properties of mullite can be achieved. In order to correctly determine the slip-system in mullite, dislocations, or a misalignment in the crystal lattice, must be generated, observed and measured. While previous experiments have attempted to determine the slip-system in mullite, it is believed they were unable to create the necessary localized stress needed for dislocation generation. A novel in-situ Transmission Electron Microscopy (TEM) nano indentation technique been successfully used by Prof. Ikuhara's research group to study dislocation interaction at the grain boundary interface of $SrTiO_3$. This technique will be used to form indentations on the edge of a polycrystalline mullite specimen to create a plastic deformation region and create dislocations. One advantage of this technique is that dislocation can be observed while they are being generated. These dislocations, imaged as black lines that intersect the top and bottom of the TEM foil, will tell if the proposed planes are the slip planes in addition to verifying the slip directions.

Previous research has shown the slip directions for mullite are the possibly the [100], [010] and [001] directions in the orthorhombic crystal system. We postulate that the slip planes for mullite will be the atomically dense (100) and (010) planes, but not (001) as strongly bonded chains of polyhedra along the c-axis make (001) slip unlikely. As such, the expected slip systems are [001](100), [010](100), [100](010) and [001](010).

Determination of the slip planes will allow the future design of anisotropic microstructures that limit deformation at high temperatures. A result of this project will be to design, manufacture and use critical engineering compounds made of mullite with a much high

degree of reliability, and will see direct impact in the aerospace sector where mullite is currently used in high temperature fiber reinforced composites.

7. Research implementation and results under the program

Title of your research plan:

In-situ Transmission Electron Microscopy Indentation to Characterize Deformation in Ceramics

Description of the research activities:

Two components were required to obtain results. The first being specimen preparation and the second TEM indentation. Each specimen was required to be a specific geometer and thickness ($\approx$200 nm), before indentation. Once specimen preparation was complete, the specimen was loaded into the in-situ indenter apparatus and a region was selected for indentation. The figure to the right shows the tip of the indenter and a grain of mullite before indentation. The diffraction pattern in the top right of the figure was used to determine the orientation of the grain. Knowledge of specimen orientation is required to determine the slip plane if a dislocation observed. Unfortunately, the in-situ indentation of polycrystalline mullite did not result in the formation of dislocation since each grain tested fractured before dislocation generation occurred. Without dislocation formation the slip-system could not be determined. From these experiments, it was concluded that the stress required for dislocation generated at room temperature is larger than the stress required for fracture and such, in-situ TEM indentation may not be an appropriate technique for determining the slip-system in mullite.
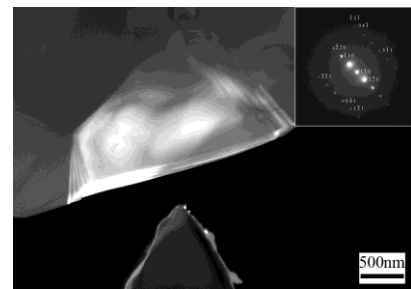
8. Please add your comments, including any cultural experience during your stay in Japan (if any):

During my stay in Japan I was invited on two professional visits. The first was to Prof. Teruyasu Mizoguchi lab at the Institute of Industrial Science and second was to Prof. Yoshikazu Suzuki lab at the University of Tsukuba. These visits gave me a great opportunity to speak with students, visit the campus and learn more about the graduate studies system in Japan. In addition to my professional visits, I took time traveled to many of the culturally significant cities and regions in Japan. Including Tokyo (where I was staying), Tsukuba, Narita, Osaka, Kyoto, Nara and Kobe. There I visited shrines, temples, parks, museums and famous landmarks; along with sampling some of the local delicacies.

RESEARCH REPORT

1. Name: Kimberly Suzanne Bowen	（ID No.: SP13003 ）

2. Current affiliation: University of Utah Department of Psychology

3. Research fields and specialties:

   Social Sciences

4. Host institution: Kyoto University Kokoro Research Center

5. Host researcher: Dr. Yukiko Uchida

6. Description of your current research

Humans are social animals, and social support is a universal aspect of relationships. Social support is also reliably associated with mental and physical health outcomes. However, social support can result in either benefits or costs to health, depending on contextual factors. As a graduate student at the University of Utah, my research focuses on the pathways and mechanisms responsible for linking social support to mental well-being, and physical health. At Kyoto University, I am examining whether belonging social support is a type of social support more strongly associated with well-being benefits within interdependent cultures as opposed to other types of support, which have deleterious effects in interdependent cultures, but not in independent cultures. I am also examining whether giving social support to another is associated with similar health benefits in interdependent cultures as in independent cultures. These aims are being examined through a study in which participants report on social support, self-esteem, social connectedness, and well-being over two weeks.

7. Research implementation and results under the program

      Title of your research plan:

      Social Support and Health: Examining Cultural Pathways of Belonging Social Support and Giving Social Support for Mental and Physical Well-being

Description of the research activities:

During my stay at Kokoro Research Center, I collaborated with Dr. Uchida and graduate student colleagues to complete translation and back translation of the questionnaires used in the study. This is a crucial part of cultural research, so learning about this process was invaluable. Additionally, data was collected from a participant sample at the University of Utah ($n = 25$) and at Kyoto University ($n = 38$), including Baseline data and the Online Survey data as proposed in my project application. The Kyoto University data collection is wrapping up during my last week of the JSPS Summer Program. Data cleaning, data entry, and data compliance review has been completed throughout the summer for these participants, as daily diary survey studies entail a large influx of new data daily. As part of the JSPS Summer Program, I also gave a presentation at Kokoro Research Center and visited Dr. Masaki Yuki at the Hokkaido University Culture, Social Ecology, and Psychology Lab to give a talk and discuss research with Dr. Yuki and his students. Following the conclusion of the JSPS Summer Program, I will continue to analyze the data collected here using multilevel modeling and hope to continue collaborating with Dr. Uchida's lab on a laboratory experiment of similar research questions to extend the current project.

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

Additionally, the JSPS Summer Program was an invaluable experience to my continued development as a critical thinker and scientist simply by virtue of being able to experience life in Japan firsthand. Meeting with other international students at my dormitory and discussing different approaches to science and learning about Japanese culture has expanded my thinking as a scientist and shifted the way I form research questions.

9. Advisor's remarks (if any):

Ms. Kimberly achieved a great progress of collaboration research. She leaned critical step of cross-cultural studies (i.e., translation and back translation) and completed data collection even within her short stay. She interacted with other members of the lab well and learned a lot of Japanese culture. The Japanese graduate students also learned a lot from her (she helped them both in English and academic discussion).

RESEARCH REPORT

1. Name: Kenneth BROWN	（ID No.: SP13004）

2. Current affiliation: Virginia Tech

3. Research fields and specialties:

Engineering Sciences

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

5. Host researcher: Dr. Kazuomi YAMAMOTO

6. Description of your current research

The current research aims to increase the body of knowledge of a novel testing configuration for wind tunnels that facilitates accurate measurements of both aerodynamics and acoustics simultaneously.   The research focuses on a hybrid anechoic test section which is named as such because it integrates an aerodynamically closed test section similar to traditional wind tunnels with an acoustically open testing capability similar to open-jet tunnels.   Incorporating these two aspects of wind tunnel measurement into one test section has widespread benefits and attracts research interest from leading world research organizations such as NASA, DLR, and ONERA.   A number of new and old technologies combine aspects of aero- and hydro-dynamics with those of acoustics such as wind turbine blades, high-speed trains, aircraft, automobiles, and submarines.

There are currently only 2 completed hybrid anechoic test sections worldwide, one at Virginia Tech's Stability Wind Tunnel (SWT) and another at Japan Aerospace Exploration Agency's Low Speed Wind Tunnel (LSWT).   Research at the SWT has been conducted within the last 5 years to solidify the correction schemes used in its hybrid test section.   A new correction scheme employing a panel method simulation derived entirely from first principles and measured relationships stands above other schemes in terms of its fidelity.   Additionally, corrections research has been conducted at the LSWT, however, with the preliminary results from the LSWT showing their correction scheme to have a different basis than that in the more established SWT.   Given that these two tunnels are yet the only two wind tunnels worldwide to employ the hybrid test section, there is an opportunity to direct the course of future aeroacoustics research by establishing a unified correction scheme for hybrid test sections.

7. Research implementation and results under the program

Title of your research plan:

Development of a Novel, Kevlar®-Walled Wind Tunnel with Implications for Low Noise Wind Turbines, Aircraft, and Naval Vessels

Description of the research activities:

Upon arrival at the host institution, the first research activity of the PI involved learning the operating procedures and test-setup of the host's wind tunnel. The PI assisted with a wind tunnel test, paying special attention to details such as the Kevlar®-wall tensioning mechanisms, airfoil mounting rigs, instrumentation on and off airfoils, and hardware outside the test section. During this period, the PI learned about a new tension measuring device from his JAXA counterparts.

Next, preparations were made to analyze the wind tunnel data by first reviewing the theory of 3D flow phenomena and then beginning to modify an existing panel method simulation to include 3D flow effects. Modification of the panel method continued throughout the entire summer, and when completed, is expected to be a benefit to both JAXA and Virginia Tech.

After having established a foundation for the test setup at JAXA, the PI in conjunction with the host researchers planned and performed a 2 week wind tunnel test. This test was co-directed by the PI and a host researcher. Standard lift, drag, and pitching moment measurements were made to compare the solid wall test section to the Kevlar wall test section. In addition, a unique aspect of this test was the employment of 122 static wall pressure ports, custom-designed and custom-manufactured by both the JAXA researchers and the PI. The data from these ports provided an in-depth view of the Kevlar test section flow.

The PI then began analyzing the data with different correction schemes, discussing the results through meetings with the host researchers. Several unexpected characteristics were found in the data such as an angle of attack offset in the Kevlar wall test section and asymmetric wall pressure signatures. Not only will the results allow for one-to-one comparison with tests done at VT, it is strongly hoped that the results will be applicable to future testing at JAXA.

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

The stay in Japan has been such a positive experience. Aside from the substantial research benefit of the trip, I have been overwhelmed with the hospitality of my hosts, the uniqueness of the Japanese lifestyle, and the curiosity to know more about Japan and its people. This trip has opened my mind to the possibility of working full time abroad and sparked my interest in Japan. The funding was sufficient and allowed me to enjoy many aspects of Japanese culture including visits to Kyoto, Nara, and Mount Fuji. These experiences along with the workplace culture have made a strong impression on me.

RESEARCH REPORT

1. Name: Carson J. Bruns	（ID No.: SP13005）

2. Current affiliation: Northwestern University

3. Research fields and specialties: Chemistry

4. Host institution: University of Tokyo

5. Host researcher: Prof. Makoto FUJITA

6. Description of your current research

The properties and reactivities of molecules contained within the well-defined nanospaces of self-assembled 'molecular flasks' often deviate significantly from what is observed in bulk, since the sterics and electrostatics of the container become important parameters in a nanoscale size regime. The recent advent of giant hollow M_nL_{2n} spherical coordination cages (where M is a metal and L is a ligand, e.g. $M_{12}L_{24}$ and $M_{24}L_{48}$) has created new opportunities to investigate larger systems in tiny spaces, such as inorganic nanoparticles, proteins, and supramolecular complexes, for which there were previously no available molecular flasks of sufficient volume. Furthermore, assemblies of supramolecular complexes within self-assembled hosts are of interest because they constitute examples of hierarchical self-assembly, a phenomenon which fully underpins the magnificent chemistry of life processes.

In my research, I study the properties of a familiar supramolecular system – the molecular recognitions of the tetracationic cyclophane known colloquially as the 'blue box' (BB^{4+}) for π-electron rich aromatic compounds such as 1,5-dihydroxynaphthalene (DNP) – within the confined nanospaces of $M_{12}L_{24}$ molecular flasks. The properties of the DNP$\Box BB^{4+}$ host-guest complex are dramatically changed by the environment of the $M_{12}L_{24}$ molecular flask. Whereas BB^{4+} binds to DNP spontaneously in bulk solution, the same binding event occurs only after the application of an ionic stimulus within the $M_{12}L_{24}$ cages. Since $M_{12}L_{24}$ and BB^{4+} are both multicationic, the addition of salt to the mixture in solution is required to lower the electrostatic energy barrier, which otherwise prevents BB^{4+} from entering the nanoscopic flasks that contain DNP. Effectively, these flasks are 'sealed' to BB^{4+} until salt is added to 'open' them. The shell of the $M_{12}L_{24}$ flask thus plays the same role in this system as transmembrane ion channels play in biology, acting as a gate that is bypassed only in response to an applied stimulus.

7. Research implementation and results under the program

Title of your research plan:

Ion-Gated Cationic Pseudorotaxane Formation Within Cationic $M_{12}L_{24}$ Molecular Flasks

Description of the research activities:

Since this research was initiated prior to the outset of the JSPS summer program, my activities were associated with finalizing the project. The final tasks of the project were to complete the characterization of the $M_{12}L_{24}$ cages by (i) X-ray crystallography, (ii) ^{1}H NMR spectroscopy, (iii) mass spectrometry, and also to (iv) optimize and (v) quantify the ion-responsive binding conditions of the DNP□BB^{4+} supramolecular complex within these molecular flasks. Tasks (i)-(iv) have been completed, and task (v) is nearly complete. Although I have quantitatively verified that the binding stoichiometry of the DNP□BB^{4+} complex is not altered by the $M_{12}L_{24}$ cage, the association constant of this complex before and after the application of an ionic stimulus is presently only qualitatively understood. The association constant can be quantified using straightforward spectrophotometric titration techniques that I have already performed on control compounds, and should be complete within a month. A manuscript detailing the results of this research has also been drafted, pending the results of this final quantitative analysis.

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

The cultural experience of this program was very fulfilling. I am grateful for the opportunities I had to learn about Japanese language and Japanese cultural traditions, such as tea ceremony, calligraphy, and clothing (e.g. yukata and kimono). I am even more grateful for the friends I made in Japan (such as my host family and my co-workers) and the experiences I shared with them in Tokyo, especially over delicious Japanese food and drink! I will always remember my summer in Japan fondly.

RESEARCH REPORT

1. Name: Andrew Burton	（ID No.: SP13006）

2. Current affiliation: University of Michigan, Ann Arbor

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Kyoto University

5. Host researcher: Professor Masayoshi NAKASHIMA

6. Description of your current research

The destruction caused by recent earthquakes demands new methods for performance monitoring of critical infrastructure. Paramount to this goal of post-event damage assessment is reliable, quantitative data for informed structural safety characterization. This depends on improved sensors and sensor networks to reliably detect structural performance. We address this challenge using a patterned carbon nanotube (CNT) – polymer composite thin film sensor to detect damage on steel structures.

While researchers have shown the strain sensing capabilities of CNT composite thin films, the need for these advantageous material properties to transition to applications remains. We bridge this gap by utilizing patterning processes to realize spatial strain sensing with relatively simple instrumentation and signal processing. This project couples sensor fabrication capabilities at the University of Michigan with steel frame testing capabilities at Kyoto University to perform one of the first tests of CNT composite thin film sensors on the scale of our built infrastructure.

Patterned sensors are fabricated in a design consisting of five parallel linear sensing elements. This allows a single sensor to span an area as needed for sensing structural damage. CNT thin films are constructed using a layer-by-layer fabrication process that sequentially deposits alternating layers of oppositely charged electrolytes onto a charged substrate. The single walled carbon nanotubes central to this work are dispersed in one of these electrolyte solutions. The patterning was realized using an optical lithography process at the Lurie Nanofabrication Facility at Michigan.

A test frame is constructed for applying static and dynamic loads to a quarter-scale steel beam-column connections. A mass is used to control dynamic loading. A jack is used to control cyclic loading to failure. The test specimen is instrumented with strain gages, dynamic strain sensors, and accelerometers in addition to the sensors under investigation. Patterned thin film sensors are connected to the beam near the beam-column connection.

7. Research implementation and results under the program

Title of your research plan:

A Patterned Thin Film Sensor for Damage Detection in Steel Frame Connections

Description of the research activities:

Two test specimens have been constructed and instrumented with CNT composite thin film sensors. The sensors on the first specimen were able to detect structural changes occurring in a beam-column connection. This was initially displayed as the sensors were able to detect the first modal frequency of the undamaged structure as confirmed with accelerometers. However, the clarity of this data was limited by significant noise. The sensors accurately identified static strain during cyclic loading of the specimen until strains became excessive. This data was confirmed with strain gages. Significantly, the sensor on the web of the beam was able to very accurately display the strains over this spatial area along the axis of the beam. This information on the strain behavior over the web of the beam embodies the desired capability for spatial strain sensing. The second specimen is to be tested this week and additional testing with further sensor development is planned for the coming January.

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

The efforts of JSPS in providing and enhancing international research collaboration and cultural exchange are greatly appreciated. I especially enjoyed the homestay during the orientation period.

9. Advisor's remarks (if any):

During his stay, he participated actively a large scale experiment that examined the seismic performance assessment of steel buildings and very much contributed to the success of the experiment. I would also like to mention that he developed strong bonds with the other students in our research group thanks to his nice and sincere personality. Our research group looks forward to further research collaborations with Mr. Burton.

RESEARCH REPORT

1. Name: Eleanor B. BYLER	（ID No.: SP13007）

2. Current affiliation: University of Washington, Seattle

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: Kavli IPMU, University of Tokyo

5. Host researcher: Kevin BUNDY and Masahiro TAKADA

6. Description of your current research

   Studying the internal structure of galaxies will help us understand the processes that regulate their growth and evolution. Star formation, chemical enrichment, and extinction all shape the emergent galaxy spectrum, encoding information about the physical processes that drive them into the light we observe. Stellar Population Synthesis (SPS) is a standard method of analyzing galaxy spectra, and is used to derive properties like metallicity, star formation history, and gas content from galaxy spectra. SPS models have an established prescription for emission from stellar populations and dust, but proper treatment of nebular emission from diffuse gaseous regions is still needed. Amongst the most widely used SPS models, only two of them include the effects of nebular emission, despite the fact that it can account for 20-60% of the flux in a given broadband filter. It is therefore necessary to build a model that can simultaneously decipher the signatures of stars, gas, and dust in the integrated spectra of galaxies.

7. Research implementation and results under the program

Title of your research plan:

Refining Stellar Population Synthesis Models Used In Analyzing Galaxy Spectra

Description of the research activities:

My work focused on incorprating the effects of nebular emission into a popular SPS code, FSPS. Following the methodology of Charlot and Longhetti (2001), I used predictions from a photoionization code to compute nebular continuum and line emission to be integrated into the final composite galaxy spectra. This project initiated a long-term collaboration between the IPMU and my home institution, as the research done this summer will be included in my future thesis work. My host scientist is the primary investigator for the Mapping Nearby Galaxies at APO (MaNGA) survey which will provide spatially resolved galaxy spectra for 10,000 galaxies. I plan to apply FSPS to galaxy spectra from MaNGA when data collection begins in 2014. Working at the IPMU this summer not only gave me the means to initiate a collaboration with the MaNGA team but it also gave me access to preliminary MaNGA data to test the code on.

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

The IPMU is a unique consortium of astronomers, physicists, and mathematicians from around the world and the opportunity to work alongside them was an absolute privilege. From a cultural perspective, I learned as much at the IPMU as I did outside of it, and I am very grateful to have spent my time amongst such a diverse community.

The EAPSI fellowship provided me with the means to travel and explore Japan, and I took full advantage of that by going as far north and as far south as I possibly could without leaving the country. Every day in Japan was exciting and confusing; it was sometimes embarrassing but always rewarding. No matter how many landmarks, monuments, or heritage sites I visited, the relationships I formed with local people were the most enriching and fulfilling aspects of this trip. My new friends taught me Japanese slang and new recipes and I went to their art exhibitions and band gigs. Above all I had some incredibly deep conversations and it was these experiences that made my stay in Japan so unique and special.

RESEARCH REPORT

1. Name: Joseph Byrnes	（ID No.: SP13008）

2. Current affiliation: University of Oregon

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: Earthquake Research Institute at the University of Tokyo

5. Host researcher: Professor Hitoshi Kawakatsu

6. Description of your current research

My PhD work, so far, has been an analysis of the seismic structure of the Galápagos archipelago. Specifically, I have investigated a sharp change around 80 km depth in the velocity of seismic waves through the Earth's mantle. The speed of seismic waves can tell us much about the physical state of the Earth, just as the speed of sound in air can tell us about the temperature and density of the atmosphere. This discontinuity had previously been assumed to be the base of the tectonic plate, defined as a mechanically strong layer in the upper most mantle that does not lose its shape on geologic times scales. The Galápagos is important in this field for two reasons. First, the volcanism is caused by some process seemingly independent of plate tectonics, such as at Hawai'i and in contrast to the 'Ring of Fire' around the Pacific. Approximately 90% of Earth's volcanoes are a consequence of plate boundaries, and the cause of volcanism in regions such as Hawai'i or the Galápagos is a somewhat open question. Second, the islands are very close to a plate boundary, where young oceanic crust is being formed. The processes occurring the Galápagos therefore tell us about the process which occur when plates are created. My research at Oregon has cast doubt that the sharp change in seismic velocity beneath this islands represents the bottom of the plate, and I am therefore getting involved in the larger field of what processes in the Earth create, define, and control plate tectonics.

7. Research implementation and results under the program

     Title of your research plan:

     Measuring the thickness of young tectonic plates.

Description of the research activities:

We attempted to do something similar to my work in the Galápagos using an instrument that was on the bottom of the ocean in an attempt to find a similar seismic discontinuity or to study the deeper mantle, between 400 and 700 km depth. It became apparent early on that the quality of the data was low and success was improbable. We switched focus to a similar line of work, shear wave splitting, that would tell us about the evolution of young lithosphere in oceanic basins. I spent a sizable portion of my time here learning the technique, which will prove valuable in my future work. However, we ultimately deemed the target data set of too low quality for shear wave splitting. I will move on to other activities when I return to Oregon.

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

I have been learning Japanese for a little less than a year and this trip greatly helped my understanding of the language. I still have considerable difficulty understanding speech at conversational speed, but I can express my self in general terms in a variety of situations. I will continue learning the language and hope to be fluent someday.

RESEARCH REPORT

1. Name: David H. CASE	（ID No.: SP13009）

2. Current affiliation: California Institute of Technology, Pasadena, California, USA

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Kochi Institute for Core Sample Research, Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

5. Host researcher: Dr. Fumio Inagaki

6. Description of your current research

This project probes the deep biosphere, a habitat functionally defined by the presence of life and the absence of light or light-derived products. Due to the high volume of habitable subseafloor material, the deep biosphere is arguably the largest reservoir of biomass on the planet. Unseen to humans, and until recently not fully appreciated by science, microbial processes in the deep biosphere may be dominating the geochemistry of those fluids which leak up from below the ocean into the water column and eventually help set the composition of the atmosphere.

The Kochi Institute for Core Sample Research, JAMSTEC houses cutting-edge facilities and instruments for the preparation and analysis of deep biosphere samples. The goal for participation in the EAPSI 2013 program was to learn the techniques and methods employed at JAMSTEC-Kochi while analyzing previously incubated microbial communities from a submarine mud volcano. In addition to any data gained during the EAPSI 2013 program, the skills and methods learned will be shared with scientists in Mr. Case's home laboratory. Thus, the EAPSI 2013 program will have fostered international knowledge transfer in addition to any specific publishable data which results from the project.

7. Research implementation and results under the program

Title of your research plan:

Stable Isotope Probing of Deep Subsurface Microbial Metabolisms in a Submarine Mud Volcano

Description of the research activities:

The results from the EAPSI 2013 project indicate microbial growth under a variety of amendment conditions, and suggest complex carbon cycling stimulated by the presence of amino acids. The addition of ^{13}C-bicarbonate and ^{12}C-amino acids resulted in low concentrations of ^{13}C-enriched methane after one year of incubation. A hypothesis to explain this geochemical observation is the amino acid-stimulated fermentation of *in situ* organic carbon by fermenting bacteria, followed by archaeal methanogenesis from ^{13}C-bicarbonate. This hypothesis will be further tested by the analysis of microbial cells by nanoSIMS.

In order to explore carbon cycling in the presence of amino acid amendments, Mr. Case will be staying in Kochi for two additional weeks for continued research with Dr. Inagaki after the termination of the EAPSI 2013 program. In addition, Mr. Case is seeking funding opportunities for a return trip to Kochi in 2014 to continue working with this set of samples and the further the research relationship with Dr. Inagaki.

In addition to work with the mud volcano samples which were the primary focus of the summer, Mr. Case was able to participate in a one week research cruise led by Dr. Inagaki in the Japan Sea. During this expedition, seafloor sediment samples were acquired and incubated with ^{13}C-methane and ^{15}N-N$_2$ at near *in situ* pressure for 10 days. Contextual environmental evidence (aerobic bottom water, presence of methane hydrates) suggests a favorable habitat for aerobic methane-oxidizing bacteria. If such microorganisms are found in the high-pressure incubation, it will represent the first such finding at this site and successful employment of Dr. Inagaki's high-pressure incubator. If the project leads to publication, the EAPSI 2013 funding will have contributed to making such a discovery possible.

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

Mr. Case was able to visit a Japanese paper museum near Kochi, enjoy onsen in Akita after disembarkation from the research cruise, view fireworks at the Nagaoka and Kochi summer festivals, experience whalewatching off the Kochi coast, and visit a colleague's laboratory at the Nagaoka University of Technology.

RESEARCH REPORT

1. Name: Clarence Olin Collins III	（ID No.: SP13010）

2. Current affiliation: Rosenstiel School for Marine and Atmospheric Science, University of Miami, Miami, FL, USA

3. Research fields and specialties:

Interdisciplinary and Frontier Sciences

4. Host institution: University of Tokyo

5. Host researcher: Dr. Takuji Waseda

6. Description of your current research

I study wind generated ocean waves. In particular I analyze wave data from several different platforms taken during field experiments. The latest experiment was in 2010 off the coast of Taiwan. The Impact of Typhoons on the Ocean in the Pacific, or ITOP, experiment was a multi-national, multi-institutional research campaign. Our group installed two moorings, and each mooring site included 2 buoys. One buoy with a 6 m Naval Oceanographic Meteorological Automatic Device (NOMAD) type hull dubbed the Extreme Air-Sea Interaction (EASI) buoy was moored to the sea bed. The second buoy, an Air-Sea Interaction Spar (ASIS) buoy, was tethered to EASI by a 60 m braided steel line. The buoys at the moorings operated continuously for approximately 4 months and endured the relatively close passages of 4 major tropical cyclones: Tropical Storm Diamnu around 8 August 2010, Typhoon Fanapi around 18 September, Typhoon Malakas around 28 September 2010, Super Typhoon Megi on 17 October 2010, and Typhoon Chaba around 17 October 2010.

The ASIS buoy has a long track record of excellent wave measurements. The EASI buoy in contrast was developed recently, so part of my research has been validating the wave measurements of EASI by comparing with the ASIS buoy. After validating the EASI, my attention has turned to analyzing the dataset. My main focus has been trying to understand the surface wave field generated by Typhoons.

7. Research implementation and results under the program

Title of your research plan:

Study of Extreme Waves in the Pacific

Description of the research activities:

My research at the University of Tokyo has focused on discovering rogue waves in the ITOP dataset, specifically from measurements from the EASI buoy. A rogue wave (also referred to as a extreme, freak, abnormal wave, etc.) is a wave which meets one of two common criteria. An apparent wave height (i.e. crest to trough), H, twice the significant wave height or a crest height, η_c, 1.25 times the significant wave height. The significant wave height, H_s, may be described as the average of the 1/3 highest waves.

I will briefly describe some of the findings from the recent analysis. Over the course of the ITOP experiment about 3338006 individual waves were measured. Of these, 267 qualified as rogue waves. 9 of these rogue waves were over 15 meters high. The highest wave measured was about 21.2 m. Also, we found waves with very high abnormality index which is defined as H/H_{m0}. The wave with the highest abnormality index was measured right at 2.7.

For the highest of the freak waves, we found a connection to the changes in the local wave field. The rogue waves seem to have occurred directly after the peak in wave steepness. At the same time the directional spread and the spectral width has been shown to be decreasing. These changes in the wave field lead to conditions which are favorable to Benjamin-Feir type instabilities which may. These instabilities are thought to be a mechanism for generation of rogue waves via non-linear focusing. The work done here has set a solid foundation for further investigation, which will include looking at the relationship between Typhoons and rogue waves.

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

I was able to travel quite a bit during my stay. When I wasn't traveling I enjoyed hanging out with my lab mates, which was always an interesting cultural exchange.

RESEARCH REPORT

1. Name: Keats R. CONLEY	（ID No.: SP13011）

2. Current affiliation: University of Oregon

3. Research fields and specialties:

Biological Sciences

4. Host institution: Hiroshima University

5. Host researcher: Dr. Shin-Ichi UYE

6. Description of your current research

The Inland Sea of Japan is a part of the East Asian Marginal Seas, which collectively represent one of the world's most productive fishery grounds, contributing 11% of world fish catch. The Sea, however, has experienced a decrease in fish production concomitant with eutrophication and an increase in jellyfish. The common moon jellyfish (*Aurelia aurita*) is the most abundant jellyfish in this region and occupies an important position in the foodweb. Since the 1950s, mass occurrences of *A. aurita* have imposed socioeconomic impacts on Japanese fishers by clogging and bursting fishing nets. Since *A. aurita* populations in the Inland Sea of Japan have increased, the socioeconomic consequences they impose have similarly escalated in severity. Multiple sectors exhibit considerable motivation to better predict variations in *A. aurita* populations.

Understanding *Aurelia* population fluctuations is impeded by the complex jellyfish life history, which consists of a benthic polyp and a free-swimming medusa. Medusae sexually produce planula larvae that settle on hard substrates and metamorphose into polyps, and the polyp stage, in turn, asexually produces new medusae. Interannual fluctuations in medusae abundance therefore depend on survival at each stage of the life history. Although the relative influence of mortality at the different stages remains unknown, the planula stage is presumably of great importance because survival at this stage determines the polyp stock.

In Japan, *Aurelia* spawning coincides with the monsoon season. These extreme rainfall events subject planulae to hyposaline conditions, which are presumed to jeopardize survival because planulae physiology may be sensitive to these abrupt salinity reductions. My research investigates the response of planulae to salinity to determine the degree to which this factor influences survival.

7. Research implementation and results under the program

Title of your research plan:

Effects of Hyposalinity on Survival and Settlement of Moon Jellyfish (*Aurelia aurita*) Planulae

Description of the research activities:

I conducted a laboratory experiment to determine how exposure to reduced salinities ("hyposalinity") affects survival and settlement of moon jellyfish (*Aurelia aurita*) larvae ("planulae"). We tested the null hypothesis that *A. aurita* planula mortality and settlement is independent of salinity. Planulae were subjected to three abrupt salinity reduction treatments (from 32 to 25, 20, and 10 psu) for six days. Every 24 hours for each replicate we counted: 1) the number of surviving planulae 2) the number of planulae moving in the water column 3) the number of planulae moving along the bottom 4) the number of settled planulae with and without tentacles and 5) the number of tentacles.

Planulae (≥95%) in 32, 25, and 20 psu exhibited negative gravitaxis (movement away from gravity) during the first four hours of exposure to salinity treatments, but the majority of planulae (70%) in 15 psu were positively geotactic (moving toward gravity). Neither salinity nor time affected planulae survival. All planulae (n=20) survived in 15 psu for the duration of the experiment, but prolonged exposure to hyposaline conditions affected post-settlement development. Salinity of 15 psu significantly increased planktonic larval duration; in contrast, planulae in the 20 psu salinity treatment settled most rapidly, but had delayed tentacle development compared to the control and 25 psu treatment. These anomalous results demonstrate that planulae response to environmental stress is more complex than previously assumed. We propose that the ability of the settled polyps to develop viable feeding tentacles may dictate whether planulae remain planktonic or become benthic.

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

I attended the Hiroshima Peace Memorial Ceremony to commemorate the 68th anniversary of the nuclear bombing of Hiroshima.

RESEARCH REPORT

1. Name: Beatrix DUDZIK	（ID No.: SP13012）

2. Current affiliation: University of Tennessee

3. Research fields and specialties: 　Biological Sciences

4. Host institution: Kyushu University

5. Host researcher: Prof. Noriko SEGUCHI

6. Description of your current research

A multitude of research exists that investigates cranial variation of prehistoric and modern Japanese populations. Previous studies that employ multivariate analyses to two dimensional cranial measurements have addressed hypotheses regarding the population history of the entire Japanese archipelago, which has mainly focused on the biological distance and relationship of the premodern Jomon, Neolithic Yayoi and modern Japanese groups within the context of the craniofacial form. While the seminal works of the last several decades have elucidated much of the population and migration history of Japan as a whole, less emphasis has been placed on the examination of skeletal samples representative of specific geographic areas and temporal continuity.

This study is one of the first to examine cranial variability utilizing the skeletal collection housed at Kyushu University in Fukuoka, Japan. This unique collection curates skeletal samples from Kyushu Island and nearby locales that are temporally representative of a nearly continuous sequence from the prehistoric Jomon culture to specimens from the 20th century. Thus, using this temporally deep sample allows for the testing of several hypotheses that build upon recent findings that suggest the neurocranium correlates more significantly with neutral genetic traits and thus is a better predictor of population affinity. This study hypothesizes that an intermediate morphology resulting from gene flow from these distinct populations may be identifiable in the later skeletal series of the Kyushu samples when emphasizing shape and size variables of the cranial base and vault. These variables were also used to examine morphological trends evident over geographic time and space within the southern Japanese archipelago to build upon the secular change work carried out by previous studies.

7. Research implementation and results under the program

Title of your research plan:

The Quantification of Cranial Variation in Japanese Populations Using 3D Data

Description of the research activities:

This study employed multivariate analyses including principal component analysis, discriminant function analysis and procrustes superimposition to analyze three-dimensional coordinate data and two-dimensional linear measurements, to allow for a thorough examination of the cranium in which the skeletal modules of the cranial base, neurocranium and viscerocranium are examined congruently and separately. Eighty five cranial landmarks were collected from skeletal samples spanning from the prehistoric Jomon and Neolithic Yayoi to the Edo and the recent Meiji periods, all excavated within Kyushu island, or neighboring prefectures. Examination of the cranial base and neurocranium without the viscerocranium was employed to test the hypothesis that migration and gene flow events during the Neolithic period in southern Japan could be better identified than with an emphasis of facial dimensions described by previous studies.

Results indicate that the removal of facial landmarks and concentration on dimensions associated with the vault and base suggests that skeletal samples subsequent to the Jomon and Yayoi periods exhibit cranial morphology intermediate to the parental samples. These findings lend support to the dual structure hypothesis proposed for the peopling of Japan, which posits that admixture rather than replacement occurred between the prehistoric Jomon and Neolithic Yayoi cultures. Differing results are found with the inclusion of facial variables, which makes interpretation of relationship between temporal groups more difficult, as more variation is identified within groups when nasal and maxillary landmarks are included. These results support the hypothesis that the cranial vault may provide better resolution for population affinity, as well as provide support for population continuity in the context of prehistoric southern Japan.

RESEARCH REPORT

1. Name: Seema Ehsan	（ID No.: SP13013）

2. Current affiliation: University of California, Irvine

3. Research fields and specialties: Engineering Sciences

4. Host institution: Osaka Medical Center for Cancer and Cardiovascular Diseases   Research Institute   5. Host researcher: Prof. Masahiro INOUE

6. Description of your current research

Precise replication of complex biological environments is necessary to more accurately mimic the human response to drugs. The development of anti-cancer compounds has become dependent on either animal models or *in vitro* systems that use established cell lines, both of which have diminishing relevance to actual patient outcomes. Primary cultures derived directly from patient biopsies may enable the development of more individualized anti-cancer therapies. The goal of this project is to combine these cultures with a tissue-engineered model of the tumor microenvironment in order to create an experimental platform that is able to manipulate patient-specific "living" solid tumors. Experimental testing with this platform would enhance the efforts of personalized cancer therapy, whereupon the results could be used to individualize treatment for the patient from whom the cells were derived. The system will be characterized for its potential as an anti-cancer drug-screening platform that is faster, more cost-effective, and a better prediction of clinical response compared to current methods. Understanding the causes of cancer, and developing coordinated efforts to prevent and manage the disease, has enormous impact on public health across the country and the world. Exploring models that investigate the mechanisms of cancer biology will allow for the development of more targeted and effective treatment strategies, and may ultimately enhance the quality of care and quality of life of patients.

7. Research implementation and results under the program

    Title of your research plan:

    Development of a personalized anti-cancer drug-screening platform

Description of the research activities:

The successful implementation of this project was contingent on merging the primary cancer cultures developed by Professor Masahiro Inoue with a tissue-engineered model of the vascularized tumor microenvironment developed at UC Irvine. The first step was learning how to culture and manipulate the cancer tissue originated spheroids (CTOS), which were derived from patient biopsies collected at the Osaka Medical Center for Cancer and Cardiovascular Diseases. After optimization of culture conditions, including media and matrix formulations, the CTOS were integrated with the tissue-engineered model that included two additional primary cell types (endothelial cells and fibroblasts). The integration was successful, confirmed using immunofluorescent staining and confocal microscopy. The system was subsequently tested for response to different oxygen conditions. This project has fostered positive collaboration between Professors Masahiro Inoue and Steven George (UC Irvine), which will extend beyond the summer program. The next step in the project would be to integrate the platform with a microfluidic device developed at UC Irvine that is conducive for high-throughput drug screening.

RESEARCH REPORT

1. Name: Sara Enders	（ID No.: SP13014）

2. Current affiliation: University of California, Davis

3. Research fields and specialties:

   Mathematical and Physical Sciences

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

5. Host researcher: Dr. Naohiko OHKOUCHI

6. Description of your current research

The goal of this project is to develop a method to reconstruct how nitrogen cycles of pre-industrial landscapes responded to environmental and ecological change. Changes in past nitrogen cycle behavior—e.g. the availability of nitrogen to plants, and whether nitrogen losses from the ecosystem had a dominant atmospheric or hydrologic fate—may be inferable from the isotope ratios of nitrogenous plant compounds that persist in soil. Research will evaluate 1) the persistence of the target plant compounds in soil—duration and mechanisms; and 2) whether isotope ratios are conserved as plants tissues degrade to soil organic matter.

7. Research implementation and results under the program

   Title of your research plan:

   Developing a new biomarker-based proxy for past terrestrial nitrogen cycles

Description of the research activities:

A major component of this summer's research activities was the investigation of methods for extraction and purification of chlorophyll-derived compounds from soil. I evaluated, compared, and modified established methods for their appropriateness for my research. I have found that it will be necessary to further modify established methods in order to obtain compounds in sufficient purity for carbon isotope analysis; however nitrogen isotope analysis may be pursued with current working methods. In my exploration of different methods of extraction, I visited the lab of Dr. Rota Wagai of the National Institute for Agriculture and Environmental Sciences and Tsukuba University to learn that lab's techniques.

I measured nitrogen isotope values for bulk samples and pheophytin-a extracts from soil, litter, and plant samples from three sample sets. I found that the pheophytin-a-based measurement does not simply track the values of the bulk samples, and often does conserve the value of overlying vegetation. This suggests that the pheophytin-a-based value may in fact be useable as a proxy for a plant nitrogen isotope value, while the bulk soil value reflects post-depositional nitrogen cycle processing. At the time of writing this report, results from some analyses performed this summer are still forthcoming.

I sampled a tephra-paleosol sequence and two other soils in Kyushu with Dr. Yudzuru Inouye of Kyushu University.

I presented my ongoing research at a soil nitrogen seminar hosted by Dr. Naohiko Ohkouchi of JAMSTEC.

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

This experience was not only extremely valuable for my research, it was also eye-opening and horizon-expanding, culturally. I lived in Yokosuka, a city along the shore of Tokyo Bay on the Miura peninsula, and I regularly explored its breezy coastline by foot, bike, and train. I enjoyed fishing and barbequing the catch at the house of a generous colleague. Farther afield, I made several trips to Tokyo to take-in traditional and modern culture with other JSPS fellows. I travelled to Nagoya to attend a sumo tournament, and to Kyoto and Kamakura to visit temples and shrines. I additionally made it up Mt. Fuji, Mt. Tatayama, and Mt. Tsurugi-dake—and found that hikers who don't speak the same language can still understand each other.

RESEARCH REPORT

1. Name: Stephanie L. Fiorenza	(ID No.: SP13015)

2. Current affiliation: CUNY Graduate Center/CUNY College of Staten Island

3. Research fields and specialties: Mathematical and Physical Sciences

4. Host institution: Nagoya University

5. Host researcher: Tsutomu T. Takeuchi

6. Description of your current research

Nearly all galaxies with spheroids contain supermassive black holes (SMBHs) in their centers, and the SMBH properties are tightly correlated with those of their hosts. Furthermore, there is a strong connection between the evolution and assembly of galaxies and their SMBHs. SMBHs are claimed primarily to grow and evolve in dust-obscured environments, making galaxies that emit heavily in the infrared – luminous and ultraluminous infrared galaxies (U/LIRGs) – excellent objects to study to understand this connection. However, the nature of the nuclear starbursts and active galactic nuclei (AGN), the primary power sources of IR radiation in U/LIRGs, as well as the evolutionary connection between the two, is also poorly understood. To this effort, I examine 12 U/LIRGs within the Infrared Astronomical Satellite 2 Jansky Redshift Survey. I use CIGALE (Code Investigating GALaxy Emission) to perform stellar population synthesis modeling on optical spectra with broad wavelength coverage to measure the age of the most recent starbursts in my sample of U/LIRGs, which produce IR radiation primarily from nuclear starbursts, AGN, or both. The primary source of IR radiation is determined as being a nuclear starburst or a type of AGN with the use of key emission line ratios. Decomposing archival near- and mid-IR spectra (obtained with the Spitzer Space Telescope and the Herschel Space Observatory) into individual starburst and AGN spectral components also allows me to determine the fractional energy contributions of the IR-power sources to the overall energy outputs of the hosts galaxies. This work will be an important part of my dissertation research, in which I will quantify for the first time the correlation between starburst age and starburst/AGN strength.

7. Research implementation and results under the program

Title of your research plan:

Infrared-Bright Galaxies: The Connection Between Starbursts and Active Galactic Nuclei

Description of the research activities:

During my stay in Japan, I focused primarily on the component of my project involving the fitting of galaxy spectral energy distributions (SEDs) with the use of the code, CIGALE. Flux values for the Bessel B, V, and R filters, as well as for the Sloan Digital Sky Survey (SDSS) 'g,' 'r,' and 'i' filters were measured by convolving the filter transmission curves with optical spectra that I obtained from the 4m Mayall Telescope at Kitt Peak National Observatory. These photometric points, along with those measured using data from the 2-Micron All Sky Survey (2MASS), the Wide-Field Infrared Survey Explorer (WISE), the Infrared Astronomical Satellite (IRAS), and AKARI Infrared Astronomy Satellite – taken from the literature – were used to fit model SEDs using CIGALE. Future work will involve the comparison of the SEDs for all objects in my sample, as well as their IR-power source classifications and contributions, in order to deduce the timescales in which U/LIRGs evolve from nuclear starbursts to AGN.

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

My experience here in Japan was an invaluable one. I have thoroughly enjoyed eating new foods, dressing in kimonos, visiting temples, and learning some Japanese phrases and vocabulary. I have also made many good friends. I have never met people who are more polite and caring for others, and the abundance of cute, colorful clothing and accessories makes shopping in Japan is so much fun! I sincerely hope to return to Omega Lab at Nagoya University to continue my studies and experience Japanese culture again.

RESEARCH REPORT

1. Name: Michelle L. GALLOWAY （ID No.: SP13016）

2. Current affiliation: University of California at Berkeley

3. Research fields and specialties:

Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Professor Hiroyuki TAKAHASHI

6. Description of your current research

My current research involves the characterization of and software development for a gamma-ray detection and imaging instrument. The High Efficiency Multimode Imager (HEMI) has been developed to detect gamma-ray emission sources within a large energy range (tens of keV to a few MeV). My work includes measuring radioactive sources within the laboratory environment and benchmarking these measurements with simulations in order to understand the detector response. Data analysis of these measurements allows for the identification and imaging of radioactive sources. This yields information about the type and intensity of radiation as well as the localization and distribution of the radioactivity.

7. Research implementation and results under the program

Title of your research plan:

"Integration and Deployment of a Gamma-ray Imaging Instrument for Radiation Monitoring in the Fukushima Prefecture"

Description of the research activities:

The University of Tokyo is preparing a gamma-ray imager that uses scintillation detectors for field testing in Fukushima. To help prepare for this test I have created a model based on the prototype instrument to compare simulations to measurements made with the instrument. The simulations are being performed and validated in both spectral and imaging mode. Additionally, I have been helping to prepare the hardware for this system, such as testing the ASIC, the datalogger, and GPS systems.

Additionally, a gamma-ray imaging system (HEMI, described above) that has been developed at Berkeley was brought to the University of Tokyo to conduct measurements within the Fukushima prefecture. I have been working to develop analysis programs for this instrument that are specific for the field work from a moving aerial platform. I am currently working to prepare this system for stationary and in-flight measurements.

Both instruments will be brought to Fukushima for stationary measurements and measurements from an aerial platform. Following these measurements, I will obtain preliminary data regarding the background intensities in key areas.

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

I appreciated living and working within a culture that is based on mutual respect and maintaining a sense of harmony. I am grateful for the opportunity to have experienced exquisitely beautiful temples, shrines, and gardens and to feel that a sense of the sacred still exists in Japan.

RESEARCH REPORT

1. Name: Eric G. Gharakhanian	（ID No.: SP13017）

2. Current affiliation: University of California: Los Angeles (UCLA)

3. Research fields and specialties:

  Chemistry

4. Host institution: Japan Advance Institute of Science and Technology (JAIST)

5. Host researcher: Prof. Tatsuo KANEKO

6. Description of your current research

  My research involves the development of new biodegradable materials which change shape in response to temperature.   This response is called the shape memory effect and can be tuned so a material will always return to a pre-defined shape upon being heated, no matter its original shape.   The potential applications of this material are largely biomedical, where an arterial stent for example could expand to a larger shape as it warms to body temperature.

  The material of this research is derived from a glutamic acid polymer which has pendant hydroxycinnamic acid groups.   This material is therefore novel because it is derived from two natural materials, glutamic acid, a building block of proteins, and hydroxycinnamic acid a component of lignin.   The purpose of the glutamic acid is to provide a structural scaffold for the material providing most of its strength and rigidity.   The hydroxycinnamic acid on the other hand, is linked to the glutamic acid and upon exposure to UV light causes the glutamic acid scaffold to cross-link; this unit therefore is responsible for the shape memory response of the material.   The shape of the material, when it is exposed to UV light is the shape the deformed material will return to upon heating.

  The goal of this research is to develop a high yielding way to synthesize this material and to perform initial studies of this material's shape memory properties, in order to determine if this material shows promise for further development.

7. Research implementation and results under the program

  Under this program, it was found that the originally envisioned material which had the cinnamic acid group linked to the polymer via an amide bond was unsuitable for further development.   Specifically, one key intermediate in the synthesis of this material proved to be extremely unstable.   While it could be isolated, its instability led to low synthetic yields.   Therefore, the research plan was modified; the material was re-designed so the cinnamate group was connected to the polymer through an ester linkage.   This modified material proved to be much more achievable, and the monomer necessary to produce it was synthesized.   Although, due to time restrictions it was not isolated in a pure enough form to polymerize.   A modified procedure to allow for isolation of this material in pure form has been developed and will be executed in the United States.

Title of your research plan:

Development of Poly(peptide) Materials Demonstrating Thermally-Activated Shape Memory

Description of the research activities:

  Most of my research activities fall into the realm of organic synthesis.   A target monomer (the building block of a polymer) is produced through multiple synthetic steps.   Each of these steps involves the design of a procedure, guided by literature precedent, to make the chemical intermediate, and execution of that procedure. From there, the desired intermediate is isolated and purified from the reaction mixture, primarily through column chromatography, flash chromatography or recrystallization.   The isolated product is analyzed by NMR and IR spectroscopy to determine the purity and ensure that it has the desired structure.   If the compound is impure, or isolated with low yield, the process is repeated with a modified procedure designed to minimize the observed side-reactions.   If the side reactions cannot be overcome, despite repeated attempts to minimize them, a new target monomer is chosen which is expected to have similar properties as the original target monomer but has a structure that is anticipated to not undergo the same side reactions.

RESEARCH REPORT

1. Name: Gloria Guy	（ID No.: SP13018）

2. Current affiliation: University of California Los Angeles

3. Research fields and specialties:

  Social Sciences

4. Host institution: Meiji University, Tokyo

5. Host researcher: Prof. SASAKI Ken'ichi (佐々木憲一氏)

6. Description of your current research

    Archaeology, as a discipline, provides the scientific basis for pre-historical research used to reconstruct the origins of modern nation-states.   As such, it forms a critical component of state-mandated public education and historical self-representation in museums.   However, the conventions governing the interaction between scholarly research reports, academic texts, college and high school textbooks, and signage in museums, are highly context-dependent: This project explored how scientific research is presented to and consumed by the general public in Japan.

    Focusing on the Kofun Period (CE 250 – 538), this project examined how Japan's period of state formation (the transition from regional chiefdoms to a single central state), is discussed in scholarly versus public materials.   Unlike archaeological research in the United States, which tends to be associated with anthropology departments, in Japan archaeology is considered a historical science.   The Kofun Period, however, is considered *proto-historical* due to the scarcity of written documents.   Indeed, unlike the subsequent semi- and fully-historical Asuka and Nara periods, this period – which is critical to understanding the foundation of the Japanese state – can only be reconstructed via excavations and material analysis.

    Named after the spectacular earthen burial mounds constructed before the introduction of Buddhism to the Japanese archipelago, the Kofun Period often provides a greater portion of material remains presented in museum archaeological collections.   The wealth of grave goods found in the great tombs, along with the iconic nature of their associated funerary statues, *haniwa* (埴輪), makes the period particularly interesting to non-specialists.   This projected touched on the importance of iconography in presenting the archaeological past to the Japanese public, in addition to the unstated assumptions made in public representations, and the multivocality of translations between Japanese and English.

7. Research implementation and results under the program

Title of your research plan:

Comparing Narratives of Japanese State Formation

Description of the research activities:

The core of this project was the comparison of the work of Dr. SASAKI Ken'ichi, a Kofun Period specialist, for different audiences, with two popular high school textbooks, the Meiji University Museum archaeological collection signage, and the Tokyo National Museum's archaeological collections signage.   Key texts include:

- 『はじめて学ぶ考古学』　佐々木憲一・小杉康・菱田哲郎・朽木量・若狭徹［著］、有斐閣アルマ 2003 年 8 月
- 『関東の後期古墳群』佐々木憲一［編］、考古学リーダー12 六一書房、2007 年 12 月
- 『常陸の古墳群』佐々木憲一・田中裕［編］、六一書房、2010 年 2 月
- 『発掘された日本列島 2013:新発見考古速報』文化庁［編］、朝日新聞出版、2013 年 6 月
- 『詳説日本史図録、第 6 版』、山川出版社、2013 年 1 月 31 日
- 『高等学校日本史 B:100 のテーマによる通史と多角的視点の歴史像』青水書院、2007 年 3 月 22 日

Despite the fact that archaeological evidence points to a gradual and continual change over time, historical periodization tends to draw sharp distinctions where none exist at a material or social level.   Thus key technological or social changes often occur within a period, leading to a sub-periodization within archaeologically determined chronologies.   However, findings include the unexpected tendency for high school texts and museums to present a narrative of discrete or autonomous periods.   In the Meiji Museum Archaeology Collection, signage assumes key knowledge about this periodization and the definition of each period, such that date ranges often given in English translation are omitted, as are basic definitions of terms of key types (of bronze tools, iron weapons, or pottery).   The museum's Yayoi Period BCE 400 – 250 CE) collection Japanese explanations were frequently not directly translated into English, rather, two separate culturally-dependent explanations were presented.

RESEARCH REPORT

1. Name: Heather Harper-Lovelady	（ID No.: SP13019）

2. Current affiliation: Department of Physics, University of South Florida, Tampa, FL, 33620, USA

3. Research fields and specialties:

  Mathematical and Physical Sciences, Biological Sciences

4. Host institution: Waseda University (TWIns), 2-2 Wakamatsu-cho, Shinjuku-ku, Tokyo 162-8480, Japan

5. Host researcher: Professor Toru Asahi

6. Description of your current research

  Recently, Professor Asahi and his colleagues developed a tissue engineering method for creating highly anisotropic collagen membranes for use as a corneal stroma replacement. On this subject, current research in Prof. Asahi's Laboratory has been focused on investigating the optical and structural properties of parallel oriented collagen membranes.

  During my tenure in Prof. Asahi's Laboratory I learned the collagen membrane fabrication process, imaged the surface morphology of collagen membranes with atomic force microscopy (AFM), quantitatively investigated the linear birefringence of collagen membranes with polarized light microscopy, and qualitatively measured the optical properties of the membranes using the generalized-High Accuracy Universal Polarimeter (G-HAUP). The G-HAUP enables the simultaneous measurement of linear birefringence (LB), linear dichroism (LD), circular birefringence (CB), and circular dichroism (CD). These optical properties are influenced by the orientation of the collagen molecules and fibrils in the membrane as well as the chirality of the collagen molecules.

  After learning the fabrication and measurement procedures, my role in the project was to fabricate and measure the optical properties of orthogonally oriented membranes. Native corneal stroma exhibits specific optical and mechanical characteristics and contains collagen lamellae oriented in varying directions. Artificial corneal stromas must exhibit similar optical and structural properties to be viable for use as a medical replacement. The optical properties of orthogonally oriented collagen membranes had not previously been measured. We found that the orthogonally oriented membranes exhibit little to no LB and LD however, the optical rotatory power increases with decreasing wavelength. These results are currently being written for submission to a peer-reviewed journal.

7. Research implementation and results under the program

Title of your research plan:

A Study of the Physical Properties of Highly Anisotropic Collagen Sheets

Description of the research activities:

In current medicine, cornea transplant surgeries are organ donations. Due to the large number of cornea transplants every year, finding viable donated corneas can become a problem and there can also be immunogenicity issues. To this effect, numerous researchers are aiming to engineer a viable artificial cornea tissue for human transplant. Most of these techniques are complex and require specialized equipment. Professor Asahi and his colleagues have developed a simple, reliable, and inexpensive method for fabricating collagen membranes for use as transplantable corneal stroma. In Prof. Asahi's Laboratory I fabricated numerous types of collagen membranes and measured the optical properties of these membranes using G-HAUP (Generalized-High Accuracy Universal Polarimeter). With G-HAUP, the linear birefringence, linear dichroism, circular birefringence, and circular dichroism can be measured simultaneously. Accurate measurement of these complex optical properties is essential for manufacturing an artificial corneal tissue.

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

The JSPS Summer Program was an amazing experience. I had the opportunity to work with some of Japan's leading researchers, traveled to numerous cities, enjoyed karaoke with my lab mates, explored numerous temples, shrines, and castles, and made friends and colleagues that I will keep in touch with forever.

RESEARCH REPORT

1. Name: Justin C. HAVIRD 　　　　　　　　　　　　（ID No.: SP13020）
2. Current affiliation: Auburn University
3. Research fields and specialties: 　Biological Sciences
4. Host institution: University of the Ryukyus (Sesoko Marine Station)
5. Host researcher: Prof. Michio HIDAKA

6. Description of your current research

　　　Taxa from anchialine habitats (coastal ponds and caves with subterranean influences from marine and freshwaters) represent an opportunity to explore physiological and ecological adaptations to an "extreme" environment, although few such studies have considered anchialine taxa. My research addresses this by examining osmoregulatory mechanisms, patterns of oxygen consumption/metabolism, and ecological response to invasive species in anchialine shrimps. My earlier work on the Hawaiian anchialine atyid *Halocaridina rubra* suggests that anchialine shrimp may have unique patterns of gene expression during salinity transfer compared to previously studied crustaceans. Also, *H. rubra* tends to decrease metabolic rate as oxygen is consumed, with oxygen consumption reaching immeasurably low levels after ~36 hours. However, it is unclear if these trends are unique to *H. rubra*, are a common feature of the "anchialine clade" of atyid shrimps, are found within all atyid shrimps, or are present in all anchialine shrimps (even those not in Atyidae).

　　　Anchialine shrimps from the Ryukyus Islands of Japan offer a system to address these questions in a comparative framework. Specifically, *Antecaridina lauensis* and *Halocaridinides trigonophthalma* are closely related to *H. rubra* and found within the "anchialine clade" of Atyidae, while *Caridina rubella* is a more distantly related atyid found outside the "anchialine clade" (although it still inhabits anchialine caves), and *Metabetaeus minutus* is an alpheid shrimp that has independently invaded anchialine habitats. Therefore, the goal of the current research was to collect these shrimp species from anchialine cave across the Ryukyus, transport them to the laboratory at Sesoko Marine Station, and perform acclimations to varying salinities to measure gene expression during salinity transfers. Other osmoregulatory properties were also of interest, including hemolymph osmolality and $AgNO_3$ staining during transfers. Finally, measuring oxygen consumption in these species under differing scenarios was also highlighted as a research goal.

7. Research implementation and results under the program

Title of your research plan:

Molecular mechanisms of salt balance in Japanese anchialine shrimps

Description of the research activities:

C. rubella ($n = 152$) was collected from two closely separated caves (Yamato-ga and Butori-ga) on the island of Miyako-jima, *H. trigonophthalma* ($n = 149$) was collected from four anchialine caves (Shuga-ga, Fushyato-ga, Ama-ga, and Futatsu-ga) on the island of Tarama-jima, *A. lauensis* ($n = 52$) was collected from Shuga-ga on Tarama-jima, and *M. minutus* ($n = 168$) was collected from Futatsu-ga on Tarama-jima. In the laboratory, all species were chronically acclimated to 32‰ for one month, except for *C. rubella*, which did not survive in 32‰ and was acclimated to 25‰. They were then transferred to 2‰, 15‰, or 45‰ for one day. Gills were then dissected out and preserved with RNAlater for future gene expression analyses (cDNA preparation and RNA-Seq). Hemolymph osmolality, $AgNO_3$ staining, and oxygen consumption experiments were also performed for all species; results were surprisingly different than *H. rubra* (e.g., rates of oxygen consumption did not decrease with decreasing oxygen concentration).

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

Staying at the Sesoko Marine Station, I had a very intimate cultural experience with ~20 local students/researchers that became fast friends. Although experiences like eating out, attending local festivals, and spending all night at karaoke were great, what will stay me will be the quiet evenings on the beach at the laboratory: just talking with friends and visiting researchers, maybe listening to someone trying to pick out a song on the guitar, or setting off some fireworks.

9. Advisor's remarks (if any):

Justin found that anchialine shrimps from Okinawa exhibited different metabolic response to salinity or anoxic stress than Hawaiian species. I hope that he will elucidate molecular and evolutionary mechanisms of this difference. I would like to thank Dr. Fujita who served as co-host and helped Justin collect samples.

RESEARCH REPORT

1. Name: Gengen Friday He	（ID No.: SP13021）

2. Current affiliation: The University of Tennessee, Department of Geography, the University of Tennessee

3. Research fields and specialties: Social Sciences

4. Host institution: The University of Tokyo   5. Host researcher: Dr. Toru Ishikawa

6. Description of your current research

This summer, we designed and implemented a novel experiment testing people's spatial perceptions, cultural specific tendencies, navigation behaviors and spatial communication patterns.   This study is influenced by previous research by my host Professor as well as other relevant literature in the field.   We set out to understand how people, particularly foreigners in Japan perceive space in a culturally unfamiliar Japanese neighborhood. Through observing the behaviors of the participants, we hope to gain insight on how people navigate through this space while providing information for others at the same time.   In the experimental design, we chose two routes in a neighborhood in western Tokyo which share the same starting point.   From that point, two people at a time are led to two distinct destinations on pre-defined routes and then back to the origin.   During the guided navigation, the participants are asked to record their thoughts into a voice recorder – a "think out loud approach" regularly utilized in this field of research.   Upon returning to their destination, the two participants are asked to switch routes and guide the other person through a mobile phone on the route that they had just completed.   Successful completion of the task is depends on memory, strategy, and common ground in communication.   People have to be able to put landmarks in a spatial context and share similar navigation strategies with their partner for this challenging task to be successful. Through analysis of the transcripts, we hope to find communication patterns and common strategies which can lead to greater efficiency in navigation.   We hope to show that there is a correlation between successful navigations and in the similarity in which a person describes the route to themselves and how they describe the route to the other person.   In other words, common navigation strategy is just as important as memory in the rate of success of guiding the prospective partner to their destination.   In the upcoming analysis, we hope to find key words throughout the conversations and highlight the importance of certain landmarks which are essential to the success of the task.   In typical cases, if the participants mentioned certain landmarks, and have a good idea of their relative location, the navigation task is more likely to be successful.   On the contrary, if neither the guided nor the guiding person mentioned these landmarks, or have them out of the sequential and spatial context, both are likely to be lost.   For this experiment in particular, one of the

routes had more culturally distinct landmarks for Japan – i.e Temple and Japanese Commercial building, combination of study participants from 14 different countries had varying results in this task, which can lead to further studies in the future to aid in the understanding of how foreigners perceive and navigate the spaces in Japan.

7. Research implementation and results under the program

Title of your research plan:

Investigating Collaborative Navigation in a Culturally Unfamiliar Setting

Description of the research activities:

A major part of this research is designing the experiment, selecting appropriate routes and recruiting study participants. A total of 32 participants were selected for this study and compensated for their time. The participants come from 14 different countries and have various experiences living in Japan. Before the commencement of the exercise, each participant is asked to take a Santa Barbara Sense of Direction Survey, discipline standard self survey which gauges the participants' own sense of how well they navigate and perceive the environment. From the results of the experiment, the participants were then divided into groups based on their score – we have a total of 16 groups, four groups of high-high pairing, four groups of low-low pairings and eight groups of high-low pairings. The participants are brought to the study site two at a time and given the protocols for the experiment. Upon completion of the experiment of the expiration of time, the participants are asked to fill out a few post navigation questionnaires. Typically, each group of experiment lasts around 2 hours in length. The time for each navigation and conversation is recorded and placed into a database.

Upon completion of the experiment, the voice recordings are transcribed and analyzed using python text analyst. The majority of time is spent transcribing and analyzing the text of the conversations. From the experiment, approximately 18 hours of recordings will be transcribed and analyzed as well as answers from 32 surveys and 196 routes recorded during the navigation and in the post navigation interview. A diverse and complete dataset has emerged from the activities of this summer.

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

This has been a very challenging experiment and a great experience for me. I am very thankful for this opportunity to understand the academic culture and research environment in Japan. This experiment and the data collected this summer will serve as an important basis for my own dissertation topic. I really got to know the people and culture of Japan and I hope to have another opportunity to come back in the future with JSPS.

RESEARCH REPORT

1. Name: Laramie P. Jameson	（ID No.: SP13022）

2. Current affiliation: Texas Christian University

3. Research fields and specialties:

    Chemistry

4. Host institution: Kyushu University

5. Host researcher: Prof. Noriho Kamiya

6. Description of your current research

The ability to control chemical, physical and structural properties of molecules simply by placing them in structurally distinct solvents is a currently underdeveloped paradigm, but an interesting and potentially useful phenomenon. Ionic liquids (ILs) are materials that are composed entirely of ions. Structural variations within ILs gives rise to distinct physical properties, which in turn impact different processes. This idea has led to the notion of ILs as "designer solvents". However, this ability of ILs is rarely illustrated outside of the use of ILs as milieu for synthetic organic transformations. Our laboratory has initiated research on exploring the "designer solvent" paradigm of ILs in relation to modulating intermolecular and intramolecular interactions of various small molecules. Specifically, the aggregation of amphotericin B and dimerization of building motifs suitable for supramolecular polymeric assembly were explored in IL-rich and IL environments. We have also investigated the potential of ILs to control intramolecular processes, using tetracycline and a porphyrin rotor as model systems. In all cases, the structure of a particular assembly as well as a particular conformation of a small molecule were shown to be modulated by simply tuning the nature of the cationic and anionic counter parts of the ILs. Tentatively, the aggregation of ILs has been suggested as the physical property responsible for the observed effects. Overall, we have established that the "designer solvent" ability of ILs could be used to control a variety of different intermolecular and intramolecular processes.

7. Research implementation and results under the program

      Title of your research plan:

       "Ionic liquids in micelles: Controlling the conformation of small molecules."

Description of the research activities:

Previously, our group has shown that it might be possible to affect the conformational equilibrium of small molecules, in particular a porphyrin dimer (PD) which serves as a molecular rotor/viscometer, by simply adjusting the structure of bulk (i.e., neat) ionic liquids (ILs). Some reports suggested that the structure of neat ILs could be distinct from that found within a micelle. Thus, we investigated the effect of confinement on the conformation of PD by placing it within reverse micellear (RM) systems.

Specifically, based on the previous reports from the Kamiya laboratory, using a 2:3 ratio (w/w) of Tween-80 and Span-20 surfactants in isopropyl myristate (IPM), we prepared several different IL-RMs based on imidazolium ILs. Using dynamic light scattering (DLS), we confirmed the IL-RM formation for [C2-mim]X (where X= BF4 and NTf2), [C4-mim]X and [C9-mim]X (where X = PF6, NTf2, NO3) ILs. Next, we incorporated PD into the [C2-mim] and [C4-mim]-containing IL-RMs. Using fluorescence and UV-VIS spectroscopy, the effect of confinement on the conformation of PD was investigated. The twisted and extended conformations of PD exhibit emission maxima at 710 and 780 nm, respectively, thus allowing for a facile determination of PD conformation as a result of the media. In bulk [C2-mim] and [C4-mim]-containing ILs, PD exists predominantly in the planar conformation. We found that in all IL-RMs, PD also largely existed in the planar conformation, yet the amount of the planar conformation decreased as compared to the bulk ILs. This effect did not depend neither on the size of the IL-RM, nor on the structure of the IL.

However, we also evaluated the effect of confinement on the conformation of PD as it pertains to molecular solvent-containing RMs. Specifically, we found that DMSO was a suitable molecular solvent for the formation of RMs due to immiscibility with IPM. Consistent with literature reports, in bulk DMSO, PD existed in the planar conformation. Yet, in DMSO-RMs, PD adopted a significantly larger amount of the twisted conformation. This result indicated that the confinement of PD is more significant in controlling the conformation than the nature of the media, as a similar effect was seen in both IL-RMs and DMSO-RMs. Further experiments are required to elucidate the exact nature and mechanism of the observed effects.

9. Advisor's remarks (if any):

During her short stay, Laramie has studied extensively on the small molecular conformation in confined environment provided by the ionic liquid-in-oil reverse micellar systems (IL-RMs). In the beginning, she faced difficulty to formulate RMs due to unexpected factors, but finally she found a way by carefully checking the experimental conditions. Afterward, she formulated a variety of IL-RMs, evaluated the inclusion of small probe molecule into them, and obtained very interesting results, which could deserve new scientific findings, although further exploration is required. I am really impressed by her ability to conduct research. My students are also happy to be with her.

RESEARCH REPORT

1. Name: Elizabeth Jensen	（ID No.: SP13023）

2. Current affiliation: University of Minnesota

3. Research fields and specialties:

   Mathematical and Physical Sciences　/　Engineering

4. Host institution: Tohoku Gakuin University

5. Host researcher: Dr. Ken Sugawara

 6. Description of your current research

When an environment is too dangerous for humans to enter, such as a disaster scenario, dispersing a small team of robots can provide humans waiting on the outside with insight into the situation. Our primary focus in this research was to develop and test an algorithm for multi-robot teams to explore an unknown and potentially dangerous environment. We were particularly interested in distributed algorithms, in which each robot would act independently of the other robots—by which we mean the robots made their decisions of what action to take individually—though with some additional information provided by the other robots.　Though a distributed algorithm allows for less communication in general, it also requires more attention to the coordination aspect of the robot team.　In our scenario, fully exploring the environment is crucial, but communicating any points of interest to the human rescue team is also critical.　In an earlier algorithm, the exploration and dispersion into the environment is achieved through the use of wireless signal intensity, but in the given environment, this was infeasible.　Instead, we altered the algorithm to use chemical-based communication to send basic messages and guide the robots through the environment to the unexplored frontiers.　We tested the algorithm in physical experiments with modified E-Puck robots on an LED screen with two cameras to track the robots' locations and display graphics on the screen below the robots.

7. Research implementation and results under the program

Title of your research plan:

Distributed Algorithms for Multi-Robot Dispersion and Exploration

Description of the research activities:

We started with preparing the experiment environment and becoming familiar with the robots and camera software.   Dr. Sugawara prepared 10 modified E-Puck robots to have infrared LEDs on the top and three infrared sensors to detect red blue and green below the robot.   We calibrated the cameras to correct for distortion in the lenses, so that we could track the robots and display their locations on the screen accurately.   We also made walls that could be moved within the environment to allow for different configurations in experiments.   With these basics completed, we developed a program to locate multiple robot positions and display them to the screen.   We then modified an earlier iteration of the dispersion algorithm to work without direct robot-to-robot communication (which was a critical component of the earlier version).   Lastly, we ran experiments using the E-Puck robots in the prepared environment.

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

I did some sightseeing around Japan, but it was two very different experiences that stood out.   The first was the opportunity to participate in a Kyudo class at my host university, where I not only learned about the tradition and art of Kyudo, but also became friends with some of the other students, in spite of language difficulties.   Second, we had several lunches in the group office where the other students would cook (in the office) and we'd all get together to eat traditional Japanese dishes, providing an opportunity to socialize and for me to learn about Japanese cuisine.

RESEARCH REPORT

1. Name: Ian JOHNSTON	（ID No.: SP13024）

2. Current affiliation: Boston University

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Hiroshi MAMITSUKA

6. Description of your current research

Presently I am working on a genome-wide association study (GWAS) by developing a new statistical model for the task of determining significant associations between genetic markers and human diseases. In particular, I am exploring a novel hierarchy based on genomic distances between markers known as single nucleotide polymorphisms (SNPs) and genes to prioritize the markers that lie closest to the genes which are relevant to a disease of interest. I am investigating the usefulness of this hierarchy to help alleviate the curse of dimensionality in the typically large GWAS data sets by exploiting external biological knowledge related to the functional aspects of genes to allow for the joint modeling of SNPs instead of the traditional but limited single SNP analyses.

In addition to the computational difficulty in modeling high-dimensional GWAS data sets, a well-known biological phenomenon known as "linkage disequilibrium" often causes a non-random association between SNPs. When modeling the SNPs jointly as in my proposed model, this correlation can translate into high variability in the fitted estimates of the model parameters. As a result, another goal of my research is to investigate a way to de-correlate the markers in order to improve my model's ability to perform variable selection on the SNPs. I am currently working on a document that demonstrates the effect of using these de-correlated markers which I call "latent genotypes" in my proposed model as well as other popular models for GWAS.

7. Research implementation and results under the program

Title of your research plan:

Developing Latent Genotypes for Genome-Wide Association Studies

Description of the research activities:

I conducted a large simulation study on a subset of real GWAS data in order to compare the performance of my model to other related models that have previously been proposed for GWAS, including simple logistic regression models and the LASSO and Fused LASSO penalized regression models. I met frequently with experts in biology to discuss and refine my proposed relationship between SNPs and genes. Our discussion led to the idea of using text-mining algorithms and network analysis methods to quantify the relevance of a gene with respect to a particular disease for my model in a principled way. I analyzed 32,702 SNPs on chromosome 1 to detect significant associations to the presence or absence of Rheumatoid Arthritis in 3,503 individuals. In July I presented a poster of my work at the International Workshop on Bioinformatics and Systems Biology at Kyoto University, and in August I gave a talk on my work at the International Workshop on Machine Learning and Applications to Biology at Hokkaido University. Currently I am compiling all of the results and finishing a draft of a paper that details our method to be submitted to the Annals of Applied Statistics journal in the near future.

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

I am truly grateful for the incredible opportunity to participate in this program. As an undergraduate student, I minored in Japanese and wrote a thesis about the cultural artifact known as SANGAKU. Finally I was able to see some of these inspirational mathematical tablets left over from the Edo period in person. I hope to return to Japan and continue my collaboration with Professor Mamitsuka's lab in the future.

RESEARCH REPORT

1. Name: Hiroto Kameyama	（ID No.: SP13025）

2. Current affiliation: University of California, San Diego

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Ehime University

5. Host researcher: Dr. Masayoshi Watada

6. Description of your current research

In 1969, Dr. Hiroshi Ikeda investigated the occurrence of "sex-ratio" females in wild populations of *Drosophila bifasciata* in Japan. "Sex-ratio" or SR females have been shown to kill XY zygotes in early developmental stages, producing a strong bias toward female offspring. Later investigations showed that the *Wolbachia*-infected *D. bifasciata* induce male deaths during embryonic development, and further analyses illustrated some of the fundamental mechanisms of selective male killings. A closely related species, *D. tsukubaenensis,* was later described, leading to question if the previous study may have misidentified some of the samples.

To study the distribution of *Wolbachia* in wild populations of *D. bifasciata* three sampling trips were taken to; Mt. Ishizuchi, Ehime; Mt. Daisen, Tottori; and Mt. Hakkoda, Aomori. The targeted species were identified morphologically (small black *Drosophila*) and females were separated into isofemale lines to check for the SR trait. Once F1 larvae were produced, DNA was extracted from the flies and the COI region was sequenced to identify the fly species and create a phylogenetic tree. *Wolbachia* infections were then identified by amplifying *Wolbachia* DNA via Polymerase Chain Reaction (PCR).

7. Research implementation and results under the program

   Title of your research plan:

   (Re)investigation of *Wolbachia* Infections in Wild Japanese Populations of *Drosophila bifasciata*

Description of the research activities:

The first sampling trip to Mt. Ishizuchi (6/18) yielded only 15 small black *Drosophilae* amongst 6,000+ other unwanted *Drosophila*. Sequencing data showed that of the 15, 14 were *Scaptodrosophila coracina* and one was *D. tsukubaensis*. The presence of *D. tsukubaensis* at Mt. Ishizuchi confirms our suspicions that Dr. Ikeda's study may have misidentified these flies as *D. bifasciata*.

Seventeen small black female flies were captured in the next sampling trip to Mt. Daisen(7/3-7/7). Though DNA sequencing, five of the flies were determined to be *D. bifasciata* and nine were *D. tsukubaensis,* thus proving the coexistance of these two species and the inability to discriminate if not by DNA. No flies tested positive for *Wolbachia.*

The last trip to Aomori (7/12-7/17) was separated into two localities; Mt. Hakkoda and Yachi Onsen. This trip was the most fruitful with 31 black female flies at Yachi and 45 at Mt. Hakkoda. To our relief, the majority of the black flies were identified as *D. bifasciata;* 81% (25) at Yachi and 73% (33) at Mt. Hakkoda. The other flies fell into three other clades; *D. imaii* and two unknown (perhaps undescribed and novel) species. Furthermore, one female from Yachi onsen and four from Mt. Hakkoda tested positive for *Wolbachia* infection.

Without the ability for DNA identification 40+ years ago, 4 out of 45 black Mt. Hakkoda specimens would have indicated an infection rate of about 9%, very similar to Dr. Ikeda's initial results. However, with the recent ease of DNA sequencing and identification, the *Wolbachia* infections tell a different story. All specimens who tested positive for *Wolbachia* belong to one of the unknown species. With only 10 female specimens of this species caught, 50% were infected with *Wolbachia.* In all 70+ *D. bifasciata* were tested for *Wolbachia* and none showed any infection.

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

I absolutely loved my time in Japan and I am very grateful for this opportunity to conduct research abroad, make professional and personal relations, and experience living in my motherland. It is a great feeling to see my "roots" first hand and I feel that two months is not long enough.

RESEARCH REPORT

1. Name: Carolyn Keogh	（ID No.: SP13026）

2. Current affiliation: University of Georgia

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Kochi University

5. Host researcher: Gyo Itani, Osamu Miura

6. Description of your current research

As part of my dissertation research, I am studying the interactions between invasive species and their parasites. Invasive species often leave behind natural enemies such as parasites when they become established in their invasive range, and this loss of parasite-mediated selective pressure on the invasive host may lead to a change in the immune system of the host. We are using a common shore crab, *Hemigrapsus sanguineus*, as a model system for testing the effect of parasite release on energy allocation and susceptibility to future infections. In the Northwest Atlantic, *Hemigrapsus sanguineus* is highly invasive and has fully escaped infection by fitness-limiting parasites. By studying the host's parasite community in the native range in Japan, and comparing the response of crabs from both invasive (parasite-free) and native (parasitized) populations to parasite challenges, we can determine whether resource allocation to immune defenses trades off with investment in other fitness components.

7. Research implementation and results under the program

Title of your research plan:

Ecoimmunology of invasions: testing the effect of parasite release on energy investment in immune defense

Description of the research activities:

From field sampling trips, we identified two sites with high prevalence of the focal parasite in the crab host, and two sites with low to moderate levels of parasitism, and were able to successfully culture the parasite in the laboratory. Using these cultured parasites, we set up infection experiments in the laboratory to determine whether crabs from US invasive populations had different levels of susceptibility to the parasite compared to crabs from the native range in Japan. At this time, it is uncertain whether the infection experiments were successful because the parasite is below the detection limit in the crab hosts. Crab tissue samples were saved for future PCR-based analyses. We also collected RNA samples from crabs at the time of capture in order to compare relative expression levels of immune-system genes in crabs from the native and invasive ranges. These samples will be compared with RNA samples collected during the laboratory exposure experiment to understand induced changes in immune gene expression under parasite challenge.

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

I greatly enjoyed my time conducting science and living in Japan.　The great kindness of the people with whom I interacted made the experience especially enjoyable.　I will look forward to future opportunities to work in this wonderful country.

RESEARCH REPORT

1. Name: Sheila Kitchen （ID No.: SP13027）

2. Current affiliation: Oregon State University

3. Research fields and specialties:

Biological Sciences

4. Host institution: Okinawa Institute of Science and Technology (Primary), University of Ryukyus Tropical Biosphere Research Center (Secondary)

5. Host researcher: Dr. Noriyuki Satoh and Dr. Chuya Shinzato (Primary), Dr. Saki Harii (Secondary)

6. Description of your current research

Symbiotic corals form mutualistic associations with photosynthetic algae. These associations are threatened by global climate change where the partnerships collapse resulting in the loss of algae from the host, known as coral bleaching. We are beginning to identify the physiological and molecular consequences of bleaching events on host-symbiont associations in adults, but very few studies address the affects of temperature-induced stress during onset and establishment of symbiosis in coral larvae. Understanding the mechanisms that underlie the formation of coral symbiosis during early developmental stages is critical to understanding and predicting coral resilience and resistance to stress and overall health of the reef ecosystem in the future. Historically, waters surrounding southern Japan islands have experienced elevated temperatures resulting in significant coral bleaching. For this study we will examine larvae of *Acropora digitifera*, an established coral model that is thermally sensitive and dominates southern Japan's reefs. This study extends work on hyperthermic stress of coral larvae through examination of elevated temperature exposed larvae's health and survival, symbiont colonization success, and RNA-Seq transcript expression profiles. The outcome of this study furthers our understanding of the physical environment and biotic pressures that mediate pre-settlement events in corals and provides novel transcriptional patterns of the molecular coral stress response.

7. Research implementation and results under the program

Title of your research plan:

Impacts of Hyperthermal Stress on Coral Larvae Undergoing Symbiont Colonization

Description of the research activities:

Three different analysis, survivorship, symbiont colonization success and RNA-Seq, were performed on coral larvae exposed to ambient and elevated seawater temperatures while undergoing uptake of symbiotic algae or remaining without symbionts. First, survivorship was measured by following a subset of treated larvae over time and noting mortality events. A survival statistical test indicates both temperature and symbionts affect the survival rates of larvae with the greatest mortality under increased seawater temperature and symbiotic conditions. The second analysis measured the success of symbiont colonization and the density of symbionts. The number of larvae with symbionts was counted as a percentage of the total larvae for colonization success. Of those larvae that had successfully acquired symbionts, the total number of symbionts within each larva were quantified using fluorescent microscopy. There was no evidence to suggest that elevated temperature altered the colonization success or symbiont density in the larvae. Finally, RNA-Seq was performed, which is an unbiased, high-throughput approach of gene expression analysis whereby the number of sequence reads is a function of gene abundance in a given sample. The analysis of the RNA-Seq data will be performed at my home institution.

RESEARCH REPORT

1. Name: Christien Laber	（ID No.: SP13028）

2. Current affiliation: Rutgers University, Institute of Marine and Coastal Sciences

3. Research fields and specialties:

 Biological Sciences

4. Host institution: University of Tsukuba

5. Host researcher: Yoshihiro Shiraiwa

6. Description of your current research

The phytoplankton *Emiliania huxleyi* is a coccolithophore found in most regions of the ocean and is known for producing large summer blooms in the North Atlantic frequently terminated by a double stranded DNA virus called coccolithovirus (EhV), 'short circuiting' carbon transport to higher trophic levels and influencing the biogeochemical cycling of carbon.   This host-virus interaction has not yet been documented in the Pacific Ocean.   We are using a set of nucleic acid and lipid based molecular tools to probe Pacific waters for the presence, diversity, and activity of coccolithovirus off the west coast of Japan.   This includes the detection of homologous sphingolipid biosynthesis genes in *E. huxleyi* and EhV as well as viral glycosphingolipids (vGSLs), which are reliable markers for EhV presence and activity in natural assemblage. Nucleic acid tools are being used to investigate the historical presence and preservation of EhV in the sediment record as well.   Laboratory experiments are being conducted to observe the interaction of cultured *E. huxleyi* and EhV with viral concentrates.   This approach will address whether EhVs are prominent in the western Pacific, if the vGSL biosynthetic pathways triggered during viral infection are similar to those used by North Atlantic EhV, if natural conditions are sufficient for infection to progress, and the historical preservation of EhV infection in regional sediment.

7. Research implementation and results under the program

Title of your research plan:

Exploration of Coccolithovirus Infection in the Western North Pacific Ocean

Description of the research activities:

Two strains of E. huxleyi, a Pacific and Arctic strain, were incubated in the presence of three different virus strains to determine the degree of resistance to the viruses. The Arctic strain showed high susceptibility to two of the three virus strains while the Pacific strain exhibited resistance through most of the incubation to all viruses. Seawater was collected from many regions around Japan including Hakodate, Shiogama, Akita, and Tomari as well as from several cruises in the Pacific Ocean near Japan and in the Sea of Japan. DNA, RNA, and lipid samples were collected (cruise samples were collected by collaborators) from the seawater as well as samples for virus counts. DNA extractions were performed on most of the samples currently collected.

Two ocean sediment cores, hosted in the Kochi Core Center, were sampled at 1 cm depth intervals for ancient preserved viral and E. huxleyi DNA. DNA was extracted from these sediment samples and quantitative gene amplification was performed on all samples.

Attempts were also made to isolate new virus strains from the coastal waters at Shimoda Marine Research Labratory. This involved creating seawater concentrates of viral like particles and introducing the concentrate to cultured E. huxleyi.

Two trips were also made to other research laboratories, Tohoku National Fisheries Institute and Hokkaido University, to prepare for the three sampling cruises, two in July-August, and one at the end of August.

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

I was part of a very large lab group with 15+ members, both Japanese and international. I was able to share many cultural experiences with them and learn about life in Japan and as a Japanese scientist. This was the most profound cultural experience to me.

RESEARCH REPORT

1. Name: Arianna Lark	（ID No.: SP13029）

2. Current affiliation: University of Iowa

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Nagoya University

5. Host researcher: Dr. Azusa KAMIKOUCHI

6. Description of your current research

My work looks at the role of DopEcR, a novel *Drosophila* dual g-protein coupled receptor (GPCR) for steroid hormone (ecdysone) and dopamine, in modulating behavior. This receptor is novel for two reasons 1) through this receptor steroid hormones can act directly at the cell surface initiating signaling cascades effecting immediate changes in the cell as opposed to classically recognized mechanisms altering gene transcription 2) other dual receptors for steroid hormones and monoamines have yet to be identified. Interestingly this novel receptor is primarily present in the nervous system which suggests that it may play a role in mediating behavioral response to steroid hormones or dopamine. In my current project I have identified that mutants for DopEcR are deficient in a type of stress induced behavior -starvation induced sleep suppression (SISS). SISS has been observed in humans, rats and flies and likely results from an evolutionarily conserved response to food scarcity overriding sleep urges to induce food searching behaviors. In my current project I hope to identify DopEcR's role in mediating changes in neuronal activity which alter behavior. To measure changes activity in the brains of live specimens, I look at calcium transients which serve as a proxy for neuronal activity. Changes in calcium can be imaged using genetically encoded calcium reporters, like GCaMP3, which bind to calcium and fluoresce. To measure DopEcR initiated changes in activity in regions of interest I apply DopEcR's ligands to control and DopEcR mutants flies and identify the differences florescence of both groups. By identifying changes activity I hope to better understand the mechanism by which DopEcR alters behavioral response to stressors such as nutritional deficiency.

7. Research implementation and results under the program

   Title of your research plan:

   Imaging neuronal activity to identify the role of novel steroid hormone receptors in stress behaviors

Description of the research activities:

Description of the research activities: My primary research activities have been genetic crosses, identify locations of DopEcR, and to image DopEcR initiated activity. In order to make the flies necessary for my research I completed 6 crosses genetic crosses of flies stocks to be used in Japan which were mailed my hosts lab. After building up my fly populations I was able to do the final cross. I initially continued my previous work to identify areas which express *DopEcR* using the superior confocal imaging equipment available in the Kamikouchi Lab. By double labeling for DopEcR and several regions of interest I was able to determine DopEcRs expression in GABAergic neurons, and confirm some minimal expression in PDF neurons. Finally, for my primary project, using the progeny from my genetic crosses, I attempted to observe changes in activation via florescence GCaMP induced by ligand application to DopEcR. Previous work had shown that DopEcR expressing neurons display altered activity via calcium transients when stimulated with dopamine. Although I had identified two regions of interest both expressing DopEcR and likely involved in my behavior, I was unable to detect change in florescence with dopamine or ecdysone application. I used multiple different concentrations and different preparations to identify issues with the protocol, finally I expressed the calcium indicator GCaMPs3 in all DopEcR expressing neurons. During these final experiments I saw some change in florescence in alternate neuronal populations expressing DopEcR. The activation was not that striking however, this is potentially due to use of heterozygotes for DopEcR and GCaMPs. In the future I plan to use GCaMP homozygotes to increase expression and sensitivity as well as look at GABA neurons (as identified by confocal imaging) and other regions that have shown activation in my final experiments.

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

I had a very rich experience in Japan my colleagues and mentor in the lab were kind, friendly and helpful. They help teach me techniques and work through issues in experiments, made efforts to include me in lab seminar by doing either part or much of it in English or gave me copies of the papers discussed, helped me with a few daily life issues, chatted, went to karaoke, and had small parties for my arrival, a new assistant professors arrival and my leaving. Outside of lab I also was able to travel to Osaka, Kyoto, Tokyo, and Nara on the weekend with friends. I met up with previous and new Japanese friends and went to a 500 year old festival, an amusement park/onsen, and Ise shrine.

9. Advisor's remarks (if any):

It was my great pleasure to host Ms. Arianna Lark. During her stay, she successfully learned many methods she will use in her research. I was impressed that she was always conscientious and rapidly grasped new techniques and concepts. Moreover, she acted in harmony and made others feel easy. I appreciate the JSPS's support for her stay.

RESEARCH REPORT

1. Name: Katie May Laumann	（ID No.: SP13030）

2. Current affiliation: Virginia Institute of Marine Science, College of William and Mary

3. Research fields and specialties:

　Biological Sciences

4. Host institution: Natural History Museum and Institute, Chiba

5. Host researcher: Dr. Masaki Miya

6. Description of your current research

All 25 extant sturgeon species are considered endangered, threatened, or otherwise imperiled. Despite this, the study of their evolutionary history began only fairly recently, and many questions about evolutionary relationships (phylogenetics) among sturgeonsare still unanswered.Sturgeons have been traditionally classified in four genera (*Acipenser, Huso, Scaphirhynchus*, and *Pseudoscaphirhynchus*). Until recently, *Huso*was considered to hold the basal position among sturgeons, and *Scaphirhynchus*and *Pseudoscaphirhynchus*were consideredsister genera. Recent studies have suggested rearrangements tothissturgeon family tree, but each study recommends different rearrangements of sturgeon phylogeny, meaning that evolutionary relationships among sturgeonsremain unresolved. Most of the molecular-based studies of sturgeon phylogenyhave relied onrelatively few, shortfragmentsof mitochondrial (maternally inherited)DNA to inform their analyses. The use of shortfragments(rather than complete genes or genomes)of DNA limits the data available upon which analyses are based, and may therefore be a contributing factor to the lack of resolutionamong sturgeon phylogenetic studies. My dissertation research is focused on working towardsresolution insturgeon phylogeneticsby reconstructinga phylogeny based onmore complete molecular data than has previously been available-full mitogenomic data of at least 21 sturgeon species.Thisphylogeny willbe further used to explore sturgeon biogeography, addressing such topics as historic distributions and the origin of diadromy(movement between fresh and salt water)in sturgeons. Additional dissertation work includes study of the ontogeny (development) of sturgeon jaws and investigation intothe potential utility of ontogenetic andmorphometric characters for future phylogenetic studies.

7. Research implementation and results under the program

Title of your research plan:

A Whole Mitogenome Approach to Sturgeon Systematics

Description of the research activities:

Research activities have primarily been focused on learning the skills necessary to sequence full mitogenomic DNA (maternally inherited DNA)of sturgeons.　Sequencing full mitogenomes first requires amplification of segments of the mitogenome. Techniques for amplifying large segments of DNA are different from those for amplifying shorter segments, and the techniques for amplifying long segments were learned, due to the generous support ofJSPS and theNSF EAPSI Program,during this program.

After learning the necessary techniques, segments of mitochondrialDNA were amplified and prepared for the process of sequencing. Of the 19 species for which (tissue)samples were brought to Japan, amplification of the complete mitogenomehas been successful for 15, and ¾ of the mitogenomehas been successfully amplifiedfor an additional two taxa.Tissue was obtained for a 20th sturgeon species while in Japan, and amplification of the full mitgenome was successful for this taxon.　Sequencing has been successfully conducted for one species thus far, and, using the DNA amplified during this program, sequencing of the remaining taxa will be completed upon return to my home institution. Once sequencing is completed for all taxa available, sequence data will be used to reconstruct sturgeonphylogeny, explore evolutionary relationships among sturgeon species, and investigatesturgeon biogeography.

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

This is a great program and has been a fantastic opportunity.　I have greatly enjoyed experiencing Japanese culture, visiting temples and natural parks, and taking advantage of some ofthe many fantastic museums and exhibits in the Tokyo/Chiba area.　I highly recommend this program to any student, and hope to return to Japan soon.

RESEARCH REPORT

1. Name: William C. LENNON, Jr.	（ID No.: SP13031）

2. Current affiliation: University of California, San Diego

3. Research fields and specialties:

    Biological Sciences

4. Host institution: University of Electro-Communications

  5. Host researcher: Dr. Nobito YAMAMOTO // Dr. Tadashi YAMAZAKI

  6. Description of your current research

I'm interested in how one part of the brain -- the cerebellum – enables smooth, well-timed, coordinated movement.　In particular, I study the role of one neuron type – the molecular layer interneurons (stellate and basket cells) – in the cerebellar cortex by building theoretical and computational models of their function based on the available physiological, anatomical and other experimental evidence.

  7. Research implementation and results under the program

      Title of your research plan:

      The role of the molecular layer interneurons in cerebellar function.

      Description of the research activities:

      My work this summer focused on two aspects of building realistic models of the molecular layer interneurons (MLIs). First, on deriving a mathematical model of the *behavior* of the neuron itself and in the presence of a network of neurons.　Second, by deriving a mathematical model of *learning* at one synapse type to the neuron.

      With respect to the first part, I modeled these neurons types as conductance based leaky integrate and fire neurons (a popular mathematical model for neurons) and found model parameters that match phyiosological.　I showed that when you combine many of these neurons in a network a certain phenomenon that appears *in vitro* and *in vivo* appears; namely, asymmetric interspike interval distributions. Further work is needed to derive additional parameters for this model from the available physiological data.

With respect to the second part, I reviewed the available evidence of plasticity (learning) at the parallel fiber – MLI synapse.   I met with Dr. Kuzihiko Yamaguchi at RIKEN Brain Science Institute to discuss physiological details regarding plasticity at this synapse.   I derived a mathematical model that is consistent with the experimental data that describes plasticity at this synapse.   Further, I showed analytically that this learning rule can be interpreted as another form of learning present in a different part of the nervous system.   I showed in a rate-based neuron model simulation that this in fact occurs. I am now implementing this in a spiking neural network model.

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

Japan was an amazing and novel experience for me.   I had the opportunity to explore many parts of the country including Nara, Kyoto, Nagoya, Toyohashi, Tokyo, and Sapporo.   I visited numerous temples, shrines, renowned cities, world heritage sites and more.   I even climbed to the top of Mt. Fuji.   I enjoyed a very pleasant home stay with a very generous family.   I tried many new types of food and styles of dining.   I had the pleasure of getting to know my host, Prof. Tadashi Yamazaki, and learning about Japanese customs and culture from him.   Over all, I really enjoyed immersing myself in Japanese culture and society.

RESEARCH REPORT

1. Name: Sara Linker	(ID No.: SP13032)

2. Current affiliation: University of Miami Florida

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Center for iPS Cell Research and Application, Kyoto University

5. Host researcher: Dr. Knut Woltjen

6. Description of your current research

My current work determines the trends of retrotransposon accumulation based on endogenous factors such as the co-localized gene orientation, gene type, retrotransposon type, and transcription factor binding motifs located within the retrotransposons. I then use this bioinformatics analysis to guide the study of transcriptional dynamics of retrotransposon expression in human cells. Specifically the small non-coding retrotransposon, Alu. Our lab has developed a technique that enriches for Alu transcripts from whole RNA. This method is optimized to capture the 3'-end of the Alu that is a highly unique portion of these repetitive elements, and is therefore used to map the Alu to the genome. Together the purpose of this study is to understand the functional impacts of retrotransposons on the human genome, specifically that of Alu retrotransposon expression.

7. Research implementation and results under the program

Title of your research plan:

Evaluating the transgenic applications of mobile DNA in human pluripotent stem cells

Description of the research activities:

Transgenics, delivering engineered genes stably into a target cell's genome, is a mainstay of functional genomics. For proper function, gene-trap transgenesis requires that an engineered vector integrates into the correct portion of a gene. Despite this requirement current gene-trapping methods proceed with little or no empirical knowledge of integration profiles, thereby limiting the efficiency of the approach. We will bioinformatically evaluate the integration profiles of transposons which are commonly used for integration and then couple each transposon with the best possible gene-trap. The successful completion of this project will result in a system of transgenic tools that are highly efficient for integration in human stem cells.

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

My stay in Japan has been a wonderful experience. From the home stay to the host lab to visiting cities around the country, I have experienced kindness from everyone I've met. I've been exposed to new foods that my friends and family will now be introduced to, such as shiso, yakitori, and tonkotsu. And, mostly, being in Kyoto has exposed me to an ancient culture, and how it directly influences the town and people that currently inhabit the city. I have had a wonderful time here, both personally and scholastically, and am very thankful for the opportunity to have studied in Japan for this summer.

RESEARCH REPORT

1. Name: David M Linz	（ID No.: SP13033）

2. Current affiliation: Miami University (Oxford, Ohio)

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Center for Developmental Biology-RIKEN Kobe, Japan

5. Host researcher: Dr. Shigeo Hayashi

6. Description of your current research

  This research project aims to understand the genetic mechanisms underlying the formation of the evolutionarily integral wing structures (elytra) in the coleopteran insects (beetles). The elytra of beetles have been a driving force in the impressive evolutionary success of these insects by providing a protective armoring over the dorsal surface. This project provides the first detailed documentation of these wing structures in a Japanese stag beetle, *Dorcus hopei*. RNA sequencing techniques along with gene knockdown are also implemented to elucidate the molecular basis of the elytron evolution in these beetles. These specific aims also help advance my current PhD work by providing a second coleopteran reference in the search for genes that have been critical for the evolution of elytra.

  A separate component of this project is the cultural standing of this species of beetle. *Dorcus* is an integral aspect of Japanese culture; its popularity among the Japanese people is unmatched throughout the world. Despite this popularity, the beetle has remained virtually unused in the scientific community. This offers an intriguing opportunity to simultaneously utilize *Dorcus* in its first scientific role and capitalize on the cultural popularity of the beetle to spawn scientific interest in the general public. This project, through its specific aims, will utilize a culturally significant beetle to examine formation of its wing structures, while concurrently placing a Japanese icon at the forefront of scientific study.

7. Research implementation and results under the program

Title of your research plan:

Beetles in flight: using RNA sequencing to analyze stag beetle wing development

Description of the research activities:

This research project was highly successful. During the time in Japan we were able to complete each of the three specific aims of our project.

1. Documentation of stag beetle wing form: Using various microscopy techniques we were able to document both the adult and developing wing of the stag beetle producing an array of data which will assist in further molecular analysis

2. Sequencing: We were able to sequence the messenger RNA of the stag beetle wing allowing us to assess both the genes present in the developing tissue as well as the differences in the expressed in different wing tissues. We were also able to compare those genes to other insect species which have had sequencing performed on them

3. RNA interference: Lastly we were able to implement a molecular technique that allows us to knock down specific genes in the stag beetle. This is the first time that this has ever been attempted in this beetle and while we are currently waiting for the results, the initial experiment was completed successfully and results appear positive.

The research performed during my time in Japan was both highly interesting, as well as extremely beneficial for my accomplishments as a graduate student, and my future scientific work. The lessons and information learned through my advisor Dr. Hayashi are indispensible to my growth as a scientist, and I am grateful for his help and guidance through the summer.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): The science I was able to accomplish during my time in Japan has been invaluable to my scientific career. However, the cultural experiences I have gained in this program are equally as important. Japan is an amazing country filled with kind and helpful people. They showed me the many differences between their culture and my own, but most importantly they showed me how similar we truly are. This has been an experience I will never forget and I am immensely grateful for the opportunity and the memories that I will always have.

RESEARCH REPORT

1. Name: George LIVINGSTON	（ID No.: SP13034）

2. Current affiliation: University of Texas at Austin

3. Research fields and specialties:

　Biological Sciences

4. Host institution: National Institute of Environmental Studies (NIES)

5. Host researcher: Prof. Noriko TAKAMURA

6. Description of your current research

I study ecological systems, striving to generate feedback between theory and its illustration, testing, exploration and application. My dissertation centers on spatial community and ecosystem dynamics in landscapes (meta-systems) and particularly how the flow of biodiversity across space generates emergent properties and ecosystem functions. I currently approach these interests experimentally using microbial microcosms including bacteria, protists, and algae. I am also interested in the application of ecological theory to socio-environmental problems. I approach this interest by 1) developing concepts that bridge disciplines and 2) by direct application of theory. I currently focus on the crisis of neotropical land-use change and the associated loss of biodiversity and ecosystem services to humans.

7. Research implementation and results under the program

　　Title of your research plan:

　　Using microcosms to test the effect of disturbance on spatial food webs

Description of the research activities:

We implemented an experiment testing spatial ecological theory using aquatic microbial microcosms. The experiment was aimed at testing the combined effects of dispersal and disturbance on the matching between species and their optimal environments, food webs, and ecosystem function. This was accomplished by manipulating the rate at which patches are destroyed in landscapes with low levels of dispersal. Disturbance events coupled with low levels of dispersal are found in many real-world landscapes. Humans are dramatically reducing connectivity in many landscapes, resulting in the decline and collapse of food webs and ecosystem services like the biological control of agricultural pests.

During the course of the two-month research period of my JSPS tenure, our experiment was successfully completed as planned. Our core experimental treatment involved the use of three different landscape disturbance rates; no, moderate and high. The preliminary results suggest that predators interact with disturbance rate to regulate the dispersal dynamics of their prey and the matching between environmental conditions (carbon saturated and carbon limited patches) and species. In the no disturbance treatment, the predator had a strong effect in reducing the matching of prey species to their optimal environments. Surprisingly, this effect was also strong in the high disturbance treatment. Even though the abundance of the predator is reduced by the disturbance, the predator results in unoccupied patches that interfere with the recolonization of disturbed patches. To further understand the matching between prey and their environment, we will next-generation sequence the bacterial communities from our microcosms. Overall, the results of this experiment will help provide general mechanisms for landscape-level food web decline and the associated loss of ecosystem services.

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

On a professional note, my host researchers and NIES were extremely helpful in providing me the resources needed for a complex experiment. This involved the use of four different laboratory spaces, high-level equipment and the expertise of a diverse group of researchers. Culturally, I think the program provided essential skills for young scientists whose labs increasingly include a diverse mixture of students from all regions of the globe. I highly recommend the JSPS program.

RESEARCH REPORT

1. Name: Rex Lundgren	（ID No.: SP13035）

2. Current affiliation: The University of Texas at Austin

3. Research fields and specialties:

   Mathematical and Physical Sciences

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

5. Host researcher: Dr. Masaki Oshikawa and Dr. Shunsuke Fukuwara

6. Description of your current research

There are many ways to describe quantify entanglement between two regions in a system. My focus is on entanglement spectrum, which is obtained from the ground state wave-function. My current research in Japan involves studying the entanglement between two coupled one-dimensional systems. Besides being of interest on their own merit, the coupled 1-d systems describe the entanglement properties of some two and three dimensional materials quite well. Shunsuke Furukawa, Masaki Oshikawa and I have analytically studied this problem in a simple model and found an easy way, involving free particles, to prove the correspondence between edge states and the entanglement spectrum for gapped systems of matter (insulating materials). We also found certain conditions for gapped systems where this correspondence between edge states and the entanglement spectrum break down.

While a large amount of knowledge is available for gapped systems of matter, not much is known for gapless states of matter (conducting materials). As such, we also have applied this technique to gapless systems of matter and found a interesting dispersion relation for the entanglement spectrum.

7. Research implementation and results under the program

    Title of your research plan:

    Entanglement Spectra of Topological Phases and Coupled Tomonaga-Luttinger Liquids

Description of the research activities:

My main research activities involved analytics done with pencil and paper. I also read many research papers and books while in Japan. I have finished a first draft of a paper that will be submitted to Physical Review B, a leading condensed matter journal shortly. Part of my research activities also involved giving a seminar the Institute for Solid State Physics at Tokyo University. Finally, I attended a conference in Kyoto, titled Mathematical Statistical Physics, where I meet many top researchers from Japan and other countries and presented a poster.

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

I have really enjoyed my stay in Japan. It was a very rewarding cultural experience. I learned a lot about the Japanese culture by going to museum, temples, shrines and eating lunch and dinner with my host researchers and his graduate students. I was shocked at how different American and Japanese cultures are. Overall, I am very glad I had this experience.

RESEARCH REPORT

1. Name: Jonathan Monk	(ID No.: SP13036)

2. Current affiliation: University of California, San Diego

3. Research fields and specialties: Biological Sciences

4. Host institution: Nara Institute of Science and Technology 5. Host researcher: Prof. Hirotada MORI

6. Description of your current research

The Systems Biology Research Group at the University of California, San Diego (UCSD), headed by my thesis advisor Dr. Bernhard Palsson, has pioneered many important advances in network reconstruction and constraint-based analysis methods. Biochemical network reconstructions provide a common denominator in systems biology. These reconstructions contain the most up-to-date information on molecular components and their interactions available for an organism thus serving as both content databases and as bases for computational models. Genome-sequencing together with biochemical and physiological literature has enabled the development of genome-scale metabolic network reconstructions for many different organisms including *E. coli*, *Saccharomyces cerevisiae* (yeast), and *Homo sapiens*.

My research uses systems biology methods to analyze the metabolism of *E. coli.* My thesis will consist of exploring the metabolism of *E. coli* and incorporating new knowledge into our knowledge base and computational model of *E. coli*. The most recently published genome-scale *in silico* metabolic reconstruction of *E. coli* is called *i*JO1366. This model was published in 2011 and contains 1366 genes, 2251 reactions, and 1136 unique metabolites. It represents a comprehensive knowledge base for *E. coli* metabolism as it contains every known and validated metabolic reaction up to 2011. However, since not every *E. coli* reaction or gene has been fully characterized yet, this model is not complete. By comparing experimental results to model based predictions, it is possible to identify where knowledge is missing.

New knowledge can be used to develop new antibiotic targets. This project will further our understanding of gene function and pathway architecture in this important model organism and could ultimately lead to the development of novel combinatorial antibiotic therapies.

7. Research implementation and results under the program

Title of your research plan:

Improving characterization of *E. coli* genes using genome-scale computational models and high-throughput experimental screens

Description of the research activities:

During the summer I constructed 10 pairs of double gene knockout mutants in *E. coli*. I analyzed these strains by growing them on minimal media with glucose. These double knockouts are useful for understanding how gene products interact in an organism to produce unique phenotypes.

Additionally, I profiled all 3985 single-gene knockout *E. coli* strains on 20 different carbon sources. This led to the generation of nearly 80,000 new phenotypes. This data will be extremely useful to the community of biologists studying *E. coli*.

I focused my summer on generating data but plan to analyze all of this data as soon as I return to my home institution. Using the i*n-silico* model predictions in conjunction with this data set I am sure that much new biological knowledge will be uncovered.

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

The JSPS program was an absolutely fantastic experience. Both for research and the aspects of Japanese culture I was able to immerse myself in during the 10 weeks I was here. I was able to travel as far north as Tsuruoka in Yamagata all the way down to Hiroshima. Also, being based in Nara, I experienced the unique culture of Japan's Kansai area thoroughly. I took many weekend trips to both Osaka and Kyoto. I was lucky enough to watch a Sumo tournament in Nagoya, see fireworks in Nagaota, taste a large amount of sake in both Fukushima and Yamagata, as well as climb Mount Fuji! Thank you so much for the opportunity and I look forward to my next visit to Japan. Okini!

9. Advisor's remarks (if any):

We also have many thanks to this program to support students from abroad. Both Mr. Monk from US and students in my lab have had excellent experiences not only in science but also in the aspect of human communication. He has had an explosive power for performing biological experiments during his stay and has been so eager to enjoy different culture from his home country. Japanese students also have an important experience of the communication by the second language. I believe that both Mr. Monk and Japanese students have had a great benefit from this program.

RESEARCH REPORT

1. Name: Sven K. Nelson	（ID No.: SP13037）

2. Current affiliation: Washington State University

3. Research fields and specialties:

   Biological Sciences

4. Host institution: RIKEN Plant Science Center, Yokohama

5. Host researcher: Prof. Mitsunori SEO

6. Description of your current research

The balance between seed dormancy and germination is governed by two plant hormones, abscisic acid (ABA) and gibberellin (GA). Dormancy is a period during which seeds will not germinate, even under favorable conditions. Dormancy is released by dry storage called after-ripening. During dry after-ripening levels of ABA fall. GA levels rise when after-ripened seeds imbibe water, but it is unclear whether GA levels rise during after-ripening of dry seeds. One reason for this is that the low hormone levels in dry seeds are difficult to measure. Use of new highly sensitive techniques employed at the RIKEN institute has enabled me to investigate the roles of ABA and GA in seed dormancy release and germination. This research will benefit society because knowledge of the hormonal control of seed dormancy will allow better control of germination in cereal crops to prevent problems such as preharvest sprouting and poor seedling emergence. Knowledge of seed germination will also allow the development of crops with good germination and seedling emergence, a major determinant of yield. It will advance discovery in the area of seed biology while advancing learning through teaching the Fellow new technologies for hormone analysis.

7. Research implementation and results under the program

Title of your research plan:

Investigating the roles of two plant hormones, gibberellin and abscisic acid, in Arabidopsis seed dormancy.

Description of the research activities:

My research is an investigation of how seed dormancy is alleviated. As such, I am particularly interested in the levels of ABA and GA which are key hormones in the release of seed dormancy to allow seeds to germinate. High ABA levels are associated with a more dormant seed, whereas levels of bioactive GA (GA_4 and GA_1) are high and ABA levels low at the time of germination. It is likely that changes in the levels of these two hormones are a major factor in the seed's ability to regulate its germination timing. At RIKEN in Yokohama, I spent 7 weeks measuring hormone levels for ABA and fourteen GAs including the bioactive forms GA_4 and GA_1 and 12 GAs that reside up- or down-stream in the biosynthetic pathway. GA is one of the most challenging plant hormones to measure, however adjustments to the protocols and the inclusion of non-bioactive GAs have allowed a more full picture of what is happening to GA levels with storage and release of dormancy. This research has produced unique findings in the filed that will provide insight into the processes occurring inside a dry seed as dormancy is released.

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

It has been a great experience that has resulted in a great deal of data in a very short time. With good planning this can be a threefold win: an exciting cultural experience, a big chunk of data from start to finish in 7 weeks, and a new collaboration with an expert in your field. I highly recommend it.

9. Advisor's remarks (if any):

I would like to thank the JSPS summer program for providing us with a good opportunity to work with Mr. Sven Nelson. He worked very hard and he finished all the experiments as he planned. All the members in our laboratory were happy to work with him. I hope we could have a next opportunity to work together in near future.

RESEARCH REPORT

1. Name: Andres F. OSORIO	（ID No.: SP13038）

2. Current affiliation: University of California, Berkeley

3. Research fields and specialties:
    Engineering Sciences

4. Host institution: Hokkaido University

5. Host researcher: Prof. Osamu FUJITA

6. Description of your current research

A fire inside a spacecraft can have disastrous consequences for the crew onboard and therefore it is necessary to understand the conditions that may lead to fires in spacecrafts. One of the potential sources of fires in a spacecraft can be electrical wires, arcing and/or overheating can lead to fires, which can be aggravated by conditions such poor ventilation and environmental variables such as microgravity and elevated oxygen concentrations.

The objective of the current research is to experimentally determine the maximum oxygen concentration that results in extinguishment of ETFE insulated wires in normal and microgravity environments. ETFE insulated wires were selected because they are routinely used in aerospace applications, and in addition exhibit fire-resistance behavior. This research project has been broken into three distinct tasks: development of experimental apparatus, normal gravity experiments, and microgravity experiments.

A new experimental was required because combustion of ETFE insulated wires results in emissions of Hydrogen Fluoride gas, a highly corrosive and toxic gas for humans. In order to circumvent this issue an airtight airflow system was designed, including a system for the remote advancement of wire samples. The experimental apparatus was also fitted with two infrared heaters that can simulate the effect of large fires in the flammability of ETFE insulated wires.

The experimental apparatus described above will then be used to conduct normal and microgravity ETFE insulated wire flammability experiments. Normal gravity experiments will be conducted at Hokkaido University, while microgravity experiments will be conducted in parabolic flights during the Fall of 2013. These experiments will allow determining how microgravity conditions affect the flammability limit of materials, and how the addition of an external radiation can further enhance such limits.

Results from this research will be used to help in the selection of a material for flammability experiments that will be conducted onboard the Japanese module of the International Space Station currently scheduled for 2016. The combination of normal gravity, microgravity parabolic flights and International Space Station experiments will be used to improve current an/or develop new methods for determining the fire behavior of materials in space applications.

7. Research implementation and results under the program

Title of your research plan:

Material Flammability in Microgravity Environments

Description of the research activities:

During the course of the JSPS Summer Program I was tasked with the design of the new experimental apparatus and selection of associated hardware. Several iterations were necessary to arrive to a design that satisfied the experiment requirements as well as the dimensions and weight restrictions of the parabolic flights. Computer Aided Design (CAD) was used to design each individual component of the experiment and to visualize the end result. After the design portion was completed I have been in contact with different companies that will manufacture the components of the experiment. Besides the design work I've also helped in the selection and purchasing of different components, and started developing an image processing code to analyze results from the ETFE wire flammability experiments.

After the completion of the JSPS Summer Program I will return to Hokkaido University and continue working on the research until December of 2013. During this time I will be able to conduct both, normal and microgravity experiments. The current plan with my host researcher is to present the findings of this research in the *35th International Symposium on Combustion*, which will take place in August of 2014 in San Francisco, CA.

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

During my time in Japan I have had the opportunity to experience Japanese lifestyle and culture. From my interactions with people in the laboratory to complete strangers in the streets I have found everyone to be extremely friendly and eager to help me even when they may not understand me, or vice versa. Living in Sapporo I have had the chance to tour Hokkaido and enjoy the natural beauty of this part of Japan. I have been lucky to enjoy beautiful landscapes, experience summer festivals and fireworks, try local foods, and even climb Mount Fuji. All these experiences have left and a lasting positive impression about Japan, its people, culture and landscapes.

9. Advisor's remarks (if any):

I am very happy that I could have Andres in my lab. The topic Andres is working with is the most important project in our lab and I am sure that his contribution will be one of the most important parts in the whole five years project. Also I really hope that he experiences Japanese culture, learns way of thinking of Japanese people, builds up friendship with members of the lab. I believe they will be a valuable background for his future success in the global world. (by Osamu Fujita)

RESEARCH REPORT

1. Name: Michael Edward Page	（ID No.: SP13039）

2. Current affiliation: Florida International University

3. Research fields and specialties: Engineering Sciences

4. Host institution: Tohoku University   5. Host researcher: Prof. Eiji Ohtani

6. Description of your current research

My research can best be summarized as under the field of high-pressure mineral physics. Simply put, I make rocks in a lab then study and report their properties. The research I conducted centered around one type of chemical, silicon dioxide or SiO2, and the various forms it can take. You might be familiar with two: silica gel, a desiccant, and quartz. There are more than ten other forms it can take, believe it or not, and they all have the same chemical composition just different atomic arrangements and therefor crystal structures. My goal was to investigate the relationship between three of these other forms. The most newly discovered form, called seifertite, happens to be the hardest and densest silicate mineral found on earth. The only problem is it isn't really found on earth; it is assumed to be within the earth, near the core. It is so hard and elusive that the scientific community had previously accepted that only an intense meteorite impact could cause it to form, as it is generally only found in shocked meteorites. I have helped to prove that this assertion is, at the very least, somewhat erroneous. I have helped discover that when the starting material is another SiO2 form called cristobalite, seifertite forms at significantly lower pressures than previously assumed. But it does not last, because if held at high temperature and high pressure for long enough, the seifertite then becomes yet another different mineral, stishovite. My investigations have shed light on the reaction kinetics of SiO2 as it changes from cristobalite to seifertite to stishovite, in that order. I have also pinpointed the upper limit: the most extreme pressure, temperature, and heating conditions, of seifertite formation.

7. Research implementation and results under the program

Title of your research plan:

High Pressure Synthesis of Phases Appropriate for Earth's Interior

Description of the research activities:

My day-to-day research activities consisted of a lot of waiting, but only because the machine I used on a regular basis takes a minimum of 4 hours to reach the incredible pressures like those at the core of the earth. Upon reaching pressures that mimic the core, it was then my duty to apply high temperatures, up to 1000 degrees Celsius. While waiting for the machine to reach these conditions, I was often running analyses from the previous trial, or setting up the next day's experiment so that little time was wasted, if any. On any given day, after waiting for the machine to reach the high pressure, my experiment would typically last 1, 10, or 100 minutes at the elevated temperature, after which I would immediately shut off the power to perform a "quench" of the material. This is one of only 2 ways to synthesize and observe seifertite at the newly discovered "low" pressure and temperature conditions I previously mentioned.

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

I stayed in Sendai, a city very near the epicenter of the 3-11 earthquake that devastated eastern Japan. One weekend I visited the coastal town of Matsushima, where hundreds of people were swept to sea. The center of the town still is clean now but has reminders of the damage, such as signs indicating where the water-height used to be. However on the outskirts of town you can still see the effects firsthand. One that struck me the hardest was the fact that an entire countryside field was dull and bare because the soil beneath it was still so salty. This was well over a kilometer inland.

9. Advisor's remarks (if any):
We like Michael so much here that we've invited him to stay and continue his research in our lab through the fall and remainder of this year. He has accepted our offer and we are very pleased to announce our results will be presented at the American Geophysical Union Conference in San Francisco this December.

RESEARCH REPORT

1. Name: John J. PARDO 　　　　　　　　　　　　　　（ID No.: SP13040）

2. Current affiliation: Pennsylvania State University

3. Research fields and specialties:

　　Mathematical and Physical Sciences

4. Host institution: JAIST

5. Host researcher: Prof. Keita YOKOYAMA, Prof. Mizuhito OGAWA

6. Description of your current research

　I am currently between projects with my advisor at Penn State, however our work generally has to do with the notion of algorithmic randomness and particularly randomness for graphs. 　That is, we study what it rigorously means for something to be random - often one might say "take a number at random": we seek to understand what this vague process might actually entail. 　In looking at graphs the question becomes how do we adapt these established notions to deal with objects that are graphs in a way that is true to the original notion of randomness.

7. Research implementation and results under the program

　　　Title of your research plan:

　　　The Reverse Mathematics of Ramsey's Theorem

Description of the research activities:

Professor Yokoyama and I have spent the summer engrossing ourselves in lecture notes on the reverse mathematics of Ramsey's Theorem written by Hirshfeldt. The material primarily dealt with determining the reverse mathematical strength of different versions of Ramsey's Theorem, often using the computational complexities of homogeneous sets for different colorings along with some standard model theory to prove results. The notes contain an almost encyclopedic level of information on this area of research, so we felt it was important to understand this work fully before progressing into our own work. We ran a biweekly seminar in which I presented the current material to Professor Yokoyama as well as another interested student. I would prepare for these talks by meeting frequently with Professor Yokoyama beforehand. In this way our understanding of the material was solidified.

Additionally, Professor Yokoyama and I visited several other universities to talk about our work this summer. In particular, I visited Kobe University and Nagoya University to talk about how the technique of forcing can be used to prove several basis theorems in computability theory, and Professor Yokoyama and I visited Tohoku University, Keio University, and Tokyo Institute of Technology to speak as well. There was also a mini-workshop near JAIST at which we each spoke.

Although we have not yet yielded any original results in our work, Professor Yokoyama and I intend to continue our collaboration through online communication.

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

In 10 weeks of time in a land as vibrant as Japan it would be impossible (and unwise) to avoid cultural experiences. During my time here I visited Kanazawa, Tokyo, Kyoto, Kobe, Nagoya, Hiroshima, and Sendai with each place yielding its own unique experiences for me. I tried food as renowned as the fabled Kobe beef and as unusual as the innards of a sea cucumber. I birthday-suited up to relax at an onsen and I felt like an epic hero performing a Kamehameha in virtual reality. I saw all sorts of incredible wildlife: spiders, frogs, bats – I even saw a tortoise get flipped onto its back by another tortoise! I was humbled by the great history and beauty I witnessed: the Peace Museum in Hiroshima, the "Ninja Temple" and gardens of Kanazawa, the towering glory that is Tokyo Tower – all of these places will forever be etched in my memory.

Without a doubt these experiences were the highlights of my summer in Japan.

RESEARCH REPORT

1. Name: Hyunbae Park	（ID No.: SP13041）

2. Current affiliation: University of Texas at Austin

3. Research fields and specialties:

Mathematical and Physical Sciences

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

5. Host researcher: Prof. Naoki Yoshida

6. Description of your current research

This action funds Hyunbae Park of University of Texas at Austin to conduct a research project in astronomy during the summer of 2013 at IPMU in Tokyo. The project title is 'The interaction between star formation and cosmic reionization'. The host scientist is Naoki Yoshida.

In order to study the universe in large scales with limited computation power, one needs to incorporate unresolvably small-scale physics into simulations in approximate ways. *The epoch of reionization* that the first stars in the cosmic history were ionizing hydrogen atoms in the universe is an example that requires such technique as its physic spans a wide dynamic range from the size of star forming clouds of a few parsecs (1 parsec = $3.1*10^{13}$kilometers). to the size of the ionized bubbles of the intergalactic medium of tens of megaparsecs (1 megaparsec = $3.1*10^{19}$kilometers). As a member of Dr. Shapiro's group, who have been developing a cosmological reionization simulation code with massively paralleled supercomputers of the Texas Advanced Computing Center, the PI worked on predicting observable signals from the epoch of reionization using our simulations as his 2nd year project at the University of Texas at Austin, and recently started working on the proposed project for his PhD thesis. Collaboration with Japanese scientists including Dr. Naoki Yoshida provides a key piece for the proposed research.

7. Research implementation and results under the program

Title of your research plan: The Interaction Between Star Formation and Cosmic Reionization

Description of the research activities:

I mainly spent time on learing to run cosmological hydrodyamical simulation suitable for my research project. My host, as one of the main developer of the code I am using, was able to provide me with helpful technical helps. I have accumulated basic experience needed to continue research in this field on my own back in my institution. I am planning to stay connected with the host researcher and finish the project.

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

RESEARCH REPORT

1. Name: Yves Petinot	（ID No.: SP13042）

2. Current affiliation: Department of Computer Science, Columbia University

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: The Institute of Statistical Mathematics

5. Host researcher: Professor Daichi Mochihashi

6. Description of your current research

My current research addresses the problem of modeling, and ultimately generating, short abstract summaries (i.e. gists) of Web pages. For instance a Web gist for the homepage of the New York Times is : "*An international and national news site featuring past archives, current articles, reviews, and special features.*". The goal of my research is to design algorithms able to automatically produce such single-sentence summaries given all available data associated with the URL of the target Web page. This work fundamentally relies on data from the Open Directory Project (ODP), which, among other things, provides a very large source of manually curated (URL,gist) pairs for a wide range of Web pages. The availability of such data makes it possible to investigate both supervised and unsupervised learning methods to model and generate Web gists.

7. Research implementation and results under the program

   Title of your research plan:

   Modeling Web Gists using Hierarchical Bayesian Models

Description of the research activities:

During my visit at ISM, I have been investigating, with the support of my host, a novel approach to Web gist modeling that is based on the intuition that gists are built around (latent) sentence templates.

A visual analysis of the ODP data led us to consider a generative story of Web gists based on two types of structures: (1) top-level templates and (2) slot-level micro-patterns. Each of these structure corresponds to a different type of linguistic phenomenon. Top-level templates are expected to control the overall organization of gists and thus consist of a combination of generic vocabulary ("Includes", "Offers", "and", etc.) and of "slot locations" where instance-specific descriptive content can be instantiated. The content occurring within slot locations is expected to be result of an accumulation of micro-patterns, and for this work, we based our initial slot models on previous work by (Gimpel et al. 2011).

My research activities during my stay have involved addressing both the theoretical and practical considerations underlying the prospected model. In its current form, this model is based on a hierarchical combination of Dirichlet Processes which allows the model to consider the full space of possible sentence templates and slot patterns present in ODP gists. I also worked on the implementation of a statistical (Gibbs) sampler based on this model. The purpose of this sampler is to elicit the distributions underlying both the top-level templates as well as the individual slot-level constructs.

This work is still in progress and will extend beyond the framework of the JSPS summer program. In particular, once the implementation of the basic model has been completed, we will investigate the possibility of extending its representational power by conditioning the generative process on the target URL as well as on hierarchical information available from the ODP data.

(Gimpel et al 2011)：K. Gimpel and N. A. Smith (2011a). Generative Models of Monolingual and Bilingual Gappy Patterns. WMT 2011

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

I have been extremely well integrated in my host's lab at ISM. I have had the opportunity to take part in several research activities taking place there and to interact with local researchers and graduate students. As such, I believe I benefited from an excellent first-hand research experience in Japan. While the time frame for this project was limited, this project will extend beyond the context of the summer program as I believe it to be an integral part of my doctoral thesis.

RESEARCH REPORT

1. Name: Tyler A PRITCHARD	（ID No.: SP13043）

2. Current affiliation: The Pennsylvania State University

3. Research fields and specialties:

   Mathematical and Physical Sciences

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

5. Host researcher: Prof. Ken'ichi NOMOTO, Assistant Prof. Keiichi MAEDA

6. Description of your current research

Core-Collapse Supernovae are the result of a massive star exploding at the final age of its stellar evolution. These cosmic explosions are extremely important as our understanding of them influences a number of astrophysical subfields in addition to that of particle and plasma physics at high energies. Ultraviolet (UV) light observations of these events are important to advancing our understanding of these objects at early times, but they are also rare and difficult to obtain. With my advisor Dr. Roming, I use the NASA *Swift* space telescope to observe these objects in the UV, and obtain supporting observations in the optical and infrared from ground based telescopes.

Using these observations and some simple modeling we examine the total energy output of these events, and examine the UV contribution to it and it's behavior. We do this with both a large UV-only data set and a smaller but higher quality data set with comprehensive UV-NIR observations, with an eye towards how the UV behavior of Core-Collapse supernovae varies with supernovae subtype and implications that that has for supernova progenitors.

Since UV observations are somewhat limited, we also use both our large and detailed sample to calculate empirical corrections based off of observed optical and IR light curves for other observers or supernovae that lack this UV data. Many current modeling codes are based upon this total light output, and the UV correction can be substantial at some points in time.

7. Research implementation and results under the program

Title of your research plan:

The Death of Massive Stars: UV Modeling of Core-Collapse Supernovae

Description of the research activities:

Over the course of the JSPS summer program we modified existing modeling code written by Dr. Maeda to reproduce *Swift* UVOT observations. Using this modified code, a number of models were generated in an effort to reproduce observations of exceptionally observed type IIP Supernova 2012aw. We were able to produce models with similar UV emission to that seen in 2012aw, strongly suggesting that this observed UV plateau is in fact a typical characteristic of this type of supernovae, and is just very rarely seen due to its intrinsic faintness. From the calculated models we are also analyzing variances in observed properties amongst them and comparing them to a larger sample of UV observations of type IIP supernovae. This analysis is in progress with the goal of providing insight on how differences in progenitor properties, such as metal content in the star before it explodes and the obscuring gas and dust around it, effect the UV emission and supernova explosion properties.

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

The JSPS summer program has been a fantastic experience for me both culturally, and professionally. Beyond the myriad of people that I met and conversed with (greatly aided by the language course available at my host institution), as well as all of the sights, food, and summer festivals that Kashiwa & Tokyo allowed me to partake in, I was able to travel some weekends and explore Japan outside of the Tokyo area. I also had a productive summer conducting my research, exploring side projects, and building collaborations for future work.

RESEARCH REPORT

1. Name: Rachel A. RACICOT	（ID No.: SP13044）

2. Current affiliation: Yale University

3. Research fields and specialties: 　Biological Sciences

4. Host institution: National Museum of Nature and Science, Tokyo and Tsukuba   5. Host researcher: Dr. Naoki KOHNO

6. Description of your current research

For my PhD thesis, I am concerned with "what goes on inside the heads of porpoises". Using CT-scan based methods I study the internal anatomy of fossil and recent porpoise skulls to infer aspects of their sensory systems and document characters for reconstructing phylogeny. Three main chapters will result from this research: 1) cranial endocast anatomy reflecting the evolution and function of the brain and it's vascular supply in extant porpoises (Racicot & Colbert 2013); 2) description of a new fossil porpoise complemented by a case study of it's internal anatomy compared with extant material (Racicot et al., *in prep*; Racicot and Rowe, *in revision*); 3) inner ear labyrinth anatomy of porpoises and delphinoid relatives to infer aspects of evolution of hearing, biosonar, and other sensory capabilities. This research is the first to use high-resolution CT scanning methods to obtain 3D measurements, characters, and potential functional information from both the vestibular (sense of space and balance) region of the inner ear and the cochlea (sense of hearing) from a wide sample of toothed whale material. The other chapters are the first to use a sample including all porpoise species and the first CT-based description of a unique fossil porpoise. Results improve our knowledge of the diversity and disparity of fossil and recent toothed whales, and provide a lasting digital resource for other researchers and the general public.

7. Research implementation and results under the program 　　Title of your research plan: 　　Evolution of echolocation in porpoises and dolphins elucidated from high-resolution CT scans revealing inner ear morphology

Description of the research activities:

I continued ongoing research on the inner ear labyrinths that I had previously scanned, obtained additional fossil and extant material for scans by visiting museum collections around the country, and have begun CT-scanning these specimens from Japan at the scanner in the National Museum of Nature and Science in Tokyo. In Tsukuba, I have been producing 3-D volumes to visualize the inner ear labyrinths, as well as preparing manuscripts based on this and other work. Research in Japan has substantially increased my sample size of fossil and recent ears and skulls, and I have begun additional side projects with new colleagues as well as Dr. Kohno. Preliminary results show that the fossil porpoise inner ear labyrinths are very similar in appearance to extant species. Aspects of the nature of delphinoid evolution and changes associated with acquisition of biosonar may be elucidated after compiling and comparing all of the results.

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

This entire experience could not have gone more smoothly. The museum visits helped me understand the way paleontologists and zoologists work in Japan. I saw many interesting local museums with incredible exhibits, often on par with national museums in the United States. These experiences alone will help me in the future if I can become a curator at some point. Additionally, CT scanning material in the National Museum of Nature and Science was a great outreach experience, and interesting concept for dual purpose/use of the CT scanner in a research and public forum. Apart from research, I learned about Japanese culture by visiting shrines, temples, and looking for wildlife when I could throughout Japan. I really enjoy the food, the tatami mat floors and futon beds, and pretty much everything!

RESEARCH REPORT

1. Name: Jonathan Reeder	（ID No.: SP13045）

2. Current affiliation: The University of Texas at Dallas

3. Research fields and specialties:

　Engineering Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Takao Someya

6. Description of your current research

Flexible electronics has garnered much interest recently, especially for applications in medicine and healthcare where they have the potential to provide novel treatments for common diseases, disorders, and ailments such as Alzheimer's, Parkinson's, stroke, and tinnitus. By placing electronics in contact with tissue, various organs can be stimulated to regain a previous body function, or can have their signals captured such as neurons firing, or blood pressure and glucose levels.

　In order for electronics to be chronically viable inside the body they must behave similarly to body tissue and be soft and conformal, allowing for the natural motion of the body. By employing smart polymers substrates which change shape and stiffness upon insertion into the body, we can create devices which can remain in intimate contact with tissue for long periods of time. Electronic functionality is added to these polymers films through a series of metal, semiconducting, and insulator deposition steps which form components such as transistors.

Future work aims to create neural implants with high electrode density which can capture brain signals for the purpose of giving doctors methods of diagnosing or treating patients in ways that were not previously possible. Additionally, devices such as blood pressure monitors and glucose monitors may enable remote diagnostics for chronic, noninvasive healthcare.

7. Research implementation and results under the program

Title of your research plan:

Adaptive Electronics for Healthcare Applications Enabled by Smart Polymer Substrates

Description of the research activities:

The inside of the human body is a curvilinear, dynamic, and aqueous environment which requires desired flexible electronic devices to be able to accommodate deformations without damaging neighboring tissue. As a result, these devices must form soft, intimate, and secure interfaces with organs such as nerves, blood vessels, and intra-cortical tissue. Various polymer films were created which soften or deploy into complex shapes upon insertion in to the body by exploiting the shape memory effect of certain polymers. Electronic components were fabricated on these films using thermal deposition, and were tested before and after implantation in rats to evaluate *in vivo* stability.

RESEARCH REPORT

1. Name: Jonathan Root	(ID No.: SP13046)

2. Current affiliation: Boston University

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: The Institute of Statistical Mathematics

5. Host researcher: Professor Kenji Fukumizu

6.   Description of your current research

Many modern applications of machine learning, ranging from computer vision to computational biology, require the analysis of large volumes of high-dimensional data. Complex statistical features are commonplace, including multi-modality, skewness, and rich dependency structures. A relatively new modeling framework to take into account these diverse statistical features is based on kernel embeddings of probability distributions. This project considers high-dimensional kernel methods where the number of variables in a dataset of interest is of the same order of magnitude as the number of observations. Our analysis addresses the estimation accuracy of such kernel methods for large-dimensional data.

7.   Research implementation and results under the program

Title of your research plan:

large-dimensional kernel methods

Description of the research activities:

My research has been purely theoretical. Thus it consisted of reading papers, meetings with Fukumizu-sensei, and calculations.

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

This program has been a wonderful opportunity for me. I made many new friends here in Japan and shared many great experiences with them. Thank you.

RESEARCH REPORT

1. Name: Nicholas Sakamoto	（ID No.: SP13047）

2. Current affiliation: Purdue University

3. Research fields and specialties:

    Engineering Sciences

4. Host institution: Kansai University

5. Host researcher: Prof. Yasuhito Kawai and Prof. Masahiro Toyoda

6. Description of your current research

To further understand tire noise and vibration, current research focuses on determining if the dynamic characteristics of a tire correlate to airborne sound radiation and structure-borne components in automotive vehicles.　Improving the prediction of sound radiation from a tire gives automotive OEMs a design tool to improve passenger comfort and reduce road noise in the environment.

Noise and vibration measurements have been recorded for a sample set of tires.　The data gathered was processed and analyzed for comparison between tires.　Then, the velocity response of a fixed tire excited by a point force from a shaker was measured. The results from this experiment provided insight into the propagation of various waves at specific frequencies within the tire.　The data from both experiments was compared to search for correlation between a tire's dynamic characteristics and noise radiation components. Future work to build on this research includes increasing the sample set and designing an experiment that uses a patch excitation force.

A theoretical model of tire vibration would be an additional tool for comparison to experimental data.　Previous modal models have problems in the high frequency region (near 1 kHz) because of the heavy damping of the tire structure and number of modes. Since most tire noise is generated in this region, developing a Finite Difference Time-Domain model may be more effective at predicting a tire's acoustic and vibroacoustic qualities.

7. Research implementation and results under the program

Title of your research plan:

Applying the finite difference time-domain method to a tensioned membrane

Description of the research activities:

During my time at Kansai University, Professor Toyoda taught me how to apply the finite difference time-domain method to a mechanical system. I coded a program to simulate the response of a one-dimensional tensioned membrane under various boundary conditions to an input force. His thorough instruction of the general concepts allowed me to pursue further by applying the method to beams and sound fields. By the end of the program, I completed modeling a ring membrane with two surrounding sound fields terminating with different boundary conditions. We also began working on a two-dimensional membrane with a three-dimensional sound field. The work accomplished should be a great starting point to pursuing a finite difference time-domain model of a tire.

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

Besides traveling to historic sites within Japan, I met with several colleagues of my Purdue major professor and learn about their companies and research. My host professors also invited me to accompany them to one of their experiments being conducted off of campus. I was able to enjoy the culture of Japan while learning a great deal from my hosts. Thank you very much for this wonderful experience.

RESEARCH REPORT

1. Name: Benjamin SCHRAGER	（ID No.: SP13048）

2. Current affiliation: University of Hawaii at Manoa

3. Research fields and specialties:

   Social Sciences

4. Host institution: Sophia University

5. Host researcher: Professor Farrer

6. Description of your current research

This research is focused on Japan's policy on agricultural biotechnology, particularly as it pertains to the import of genetically modified (GM) crops and the introduction of GM food. Japan is the largest importer of GM corn and soybeans from America. Japan's regulatory policy has many practical implications. On May 29th, 2013, the Japanese government decided to halt wheat imports from America after unapproved GM wheat was discovered in Oregon. Prior to the ban, America exported almost $1 billion of wheat annually. This incident demonstrates how agricultural biotechnology policy in Japan can have a significant impact on trade relations between America and Japan. Beyond just regulatory policy, this research also investigates the implications of GM crops on food certifications, consumer literacy, and consumer perceptions of risk.

7. Research implementation and results under the program

    Title of your research plan:

    Genetically Modified Food in Japan: The Intersection of Science, Policy and Consumer Perceptions

Description of the research activities:

I set up numerous interviews with experts on this topic. These included academics such as my host researcher Professor Farrer from Sophia University, but also Professor Yamaguchi from International Christian University, Professor Hisano from Kyoto University, and Professor Hagura from Hiroshima University. From the government perspective, I was able to interview the agricultural biotechnology policy expert from the United States Department of Agriculture (USDA) Foreign Agriculture Service (FAS). From the industry perspective, I was able to attend farm tours at Monsanto Japan in Ibaraki Prefecture. I also attended an extended tour arranged by a non-profit called "Life & Bio Plaza 21." This tour included Tsukuba University and the National Institute of Agrobiological Sciences. There were also lectures by leading researchers in the field including Professor Kamada, the director of the Gene Research Center at the University of Tsukuba. I received a tour of Iseki's tractor construction plant and Ehime University's green houses from Professor Masata at Ehime University. From August 5th until the 9th I attended the International Geographic Union geography conference in Kyoto. This conference enabled me to connect with others from my field, share my findings, and get their insights. Throughout the summer, I also studied vocabulary relevant to my research and continued to compile government, academic, and corporate documents. Many informal conversations with friends and acquaintances gave me invaluable insights into my research topic as well.

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

This was an amazing opportunity for me to establish a strong foundation in Japan's agricultural biotechnology policy as I move forward with my PgD research. I am thankful to JSPS for giving me this remarkable opportunity. I had many different cultural experiences over the summer. Some of the most memorable include a trip Miwajima Island and a trip to Kashima Island in Ehime Prefecture. On the ferry back from Kashima Island, I was invited along with another JSPS fellow to eat dinner with a group of middle-aged Japanese from the area. The food was particularly delicious and the conversation entertaining.

RESEARCH REPORT

1. Name: Michael D. Schulz	（ID No.: SP13049）

2. Current affiliation: University of Florida

3. Research fields and specialties:

　Chemistry

4. Host institution: Kyoto University

5. Host researcher: Yoshiki Chujo

6. Description of your current research

At Kyoto University, I am currently synthesizing aromatic ring-layered polymers and studying their properties. Conjugated polymers have gained wide scientific interest due to their potential as components in organic optoelectronic devises. The optoelectronic properties of these materials ultimately derive from the high level of pi-electron delocalization along the polymer backbone, due to through-bond conjugation. Although through-bond conjugation is key in intramolecular energy transfer, it is face-to-face stacking of pi-electron systems that enables intermolecular energy transport, which is paramount in obtaining superior device performance. There are very few examples of polymers in which pi-electron systems are stacked in a single polymer chain. Recently, the Chujo group pioneered a method of aligning aromatic rings in a single polymer chain by using a terphenylene-layered polymer as a scaffold and attaching various aromatic moieties via boronate esterification. In my current work, this methodology was used to synthesize polymers that incorporate various electron-donating groups and larger pi-systems. These polymers were then characterized by NMR and IR to verify their structure, and optical measurements (UV-vis absorption, luorescence quantum yield, excitiation, fluorescence lifetime) were performed. Model compounds were also synthesized to conclusively show the effects of the through-space conjugation facilitated by the polymer structure.

7. Research implementation and results under the program

Title of your research plan:

Synthesis and Characterization of Novel Through-Space Conjugated Polymers

Description of the research activities: Conjugated polymers are of interest to the scientific community due to their potential application in electronic devices. Such materials are being investigated for applications in organic solar cells, organic light-emitting diodes, and flexible transparent displays. The performance of organic optoelectronic devices, however, depends on the arrangement and orientation of their molecular components. There are two types of conjugation—through-bond and through-space. Traditionally, molecules have been constructed that transport charge through the molecular bonds. While this is effective for charge transport within a single molecule or polymer, it is less effective for transporting charge between molecules. This intermolecular charge transport is vital for superior optoelectronic device performance. We are exploring a system where charge transport occurs through space. This requires that the synthesis of a polymer scaffold that will force the pendant side groups to organize in such a way that through-space charge transport occurs. I synthesized a series of polymers and model compounds to study charge transport in this new and important class of materials.

8. Please add your comments, including any cultural experience during your stay in Japan (if any): My time in Japan afforded me many opportunities to meet interesting people and experience Japanese culture firsthand. I am extremely grateful to the friends I have made among my Japanese colleagues for their time and effort in sharing their culture with me. While I greatly enjoyed the opportunity to see various temples and shrines, climb Mt. Fuji, and try new foods, I think the it is that connections with the people here that will have the most lasting impact. Working in Japan has also given me a thorough understanding of the country's scientific infrastructure, and I've had the opportunity to give several scientific presentations at both Kyoto University and elsewhere.

RESEARCH REPORT

1. Name: Darren Seibert	（ID No.:SP13050）

2. Current affiliation: Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology

3. Research fields and specialties:

    Biological Sciences, Interdisciplinary and Frontier Sciences

4. Host institution: RIKEN Brain Science Institute

5. Host researcher: Justin Gardner

6. Description of your current research

We are interested in the algorithms implemented by the ventral visual stream which give rise to our ability to rapidly recognize objects from visual information cast on the retinae. Past work has suggested that these algorithms are implemented through a series of simple candidate computations that are stacked hierarchically. To test this hypothesis we have collected neural responses to thousands of images depicting objects (ex. animals, cars, boats, planes, …) at different scales, positions, and orientations. For each image, we use a convolutional neural network to predict brain activity. If our model is an accurate representation of visual object perception, we expect to be able to map out the horizontal components of the model *across* brain areas of the ventral stream and furthermore to map out the vertical components *within* each brain area along the ventral stream (ex. sub-populations of LOC, or V4).

7. Research implementation and results under the program

    Title of your research plan:

    Encoding human brain activity using a multi-staged model of visual object perception

Description of the research activities:

During this summer internship, we used a rapid serial visual presentation (RSVP) paradigm to collect fMRI brain responses from large quantities of images. Through twenty-three scanning sessions, we have collected responses to 2560 images and 221 five-second movies. We additionally collected individual responses to 420 of the movie frames to further study the temporal aspects of visual perception. In total, we have collected over four times more data than used in previous studies which utilized simpler models of visual perception (ex. Kay et al., 2008).

Our analyses thus far have focused around verifying the integrity of the data to ensure our experimental parameters were reasonable. For example, to ensure that the recorded brain activity were stable, we computed split-half correlation responses—the idea being that the response to an image shown on one trial should elicit a similar response to the same image shown on another trial. From these analyses we believe our data will have sufficient explainable variance for further model fitting and validation.

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

I found it extremely valuable to visit Japan and experience its unique culture. In particular, staying at my host family's home during the beginning of the program gave me a first-hand view of Japanese family life. This is something I would have otherwise not experienced while working at my host institution.

9. Advisor's remarks (if any):

Darren worked creatively and independently on his project. He is very focused and thoughtful in his approach and was a great pleasure to have in the lab. It was also a learning experience for me as Darren is highly knowledgeable in object vision and algorithms and was clear in his discussions and explanations. I expect to continue a collaboration with him in the future.

RESEARCH REPORT

1. Name: Kelly Spendlove	（ID No.: SP13051）

2. Current affiliation: Montana State University

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Hiroshi KOKUBU

6. Description of your current research:

Complex dynamical systems, which range from physiological systems and financial markets to models of the Earth's climate, often exhibit critical thresholds - commonly entitled tipping points - at which the system may radically shift its behavior from one state to another. For instance, in physiology, there are spontaneous systemic failures such as asthma attacks or epileptic seizures, as well as the sudden onset and progression of certain diseases; in ecology there is the collapse of wildlife populations or catastrophic desertification of environments; in the Earth climate system, abrupt shifts in ocean circulation or climate may occur.

It is notoriously difficult to predict such critical transitions before they happen: empirically, systems may show little change before reaching a tipping point; theoretically, it has been proven that changes in global dynamics can occur on all scales in both phase space and parameter space. Moreover, models of complex systems are typically imprecise, parameters are rarely known exactly and computations may contain errors of various magnitudes. In spite of this difficulty, recent work now suggests the existence of generic early-warning signals, not specific to any particular class of system. Utilizing such generic indicators, we are researching a novel form of analysis, based on ideas from dynamical systems theory and applied algebraic topology, aiming to uncover the fundamental characteristics - or signature - of critical transitions before they occur.

7. Research implementation and results under the program

     Title of your research plan:

     Computing the Signatures of Critical Transitions Arising in a Complex System

Description of the research activities:

The purpose of this research is to explore the interplay between the dynamics of complex systems and its dependence upon parameters. In these systems, it is typical to observe bifurcations, or small changes in the parameters which lead to radical qualitative changes in the behaviors. With conventional mathematics it is very difficult to predict when bifurcations may occur. Recently, however, an approach has been proposed which analyzes the dynamics at a resolution specified a priori, and characterizes the global dynamics in the form of a directed graph. We are interested in clustering such graphs to infer changes in the robust structures within the graph as the parameters are varied.

We propose a simple yet effective method of clustering the directed graphs, modeled after persistent homology theory. Consider a clustering algorithm which places weights on the edges of the directed graph; roughly, these weights may be thought of as probabilities of an edge, or the strength of the connection. We are interested in analyzing the superlevel sets of this function; that is, the subgraph having edges with weights only higher than some threshold. In particular, we are interested in the strongly connected components of the superlevel set, and their behavior with respect to the thresholding parameter. Intuitively, strongly connected components which exist for large ranges of the thresholding value may correspond to dynamics at a finer resolution. Our empirical evidence from a variety of dynamical models suggests this form of analysis is quite effective at discerning the behavior at finer scales, as well as detecting when strongly connected components are bifurcating. Furthermore, we are investigating the behavior of this type of analysis with respect to which clustering algorithm is utilized (we have developed several distinct clustering algorithms). Finally, we are in the process of developing mathematical theorems which relate this form of analysis back to traditional concepts from dynamical systems theory, such as the invariant measure.

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

Kyoto University proved a wonderful host institute for mathematics. For instance, Kyoto University is home to RIMS, the Research Institute for Mathematical Sciences, which hosted a variety of weeklong workshops during the summer. In particular, RIMS was hosting a yearlong international research project on dynamical systems, my area of research.

Over the course of the summer I attended many of the festivals in Kyoto, such as Daimonji and the Yamaboko Junko and Yoiyama during Goin Matsuri. Further, I traveled by train to Sapporo, which both established a excellent collaboration with mathematicians at Hokkaido University, and provided a brief escape from the heat of the Kyoto summer!

RESEARCH REPORT

1. Name: Erik S. Steinmetz	（ID No.: SP13052）

2. Current affiliation: University of Minnesota

3. Research fields and specialties:

   Mathematical and Physical Sciences

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

5. Host researcher: Prof. Kenichi MATSUMOTO

6. Description of your current research

The current research project is a computer software artificial-intelligence effort. It focuses on methods to improve a kind of search called "Monte Carlo Tree Search". Monte Carlo search utilizes playouts of random moves in the search tree in order to quickly locate the best options. This research will allow the application of expert knowledge to the Monte Carlo technique, which normally relies on not being restricted by contextual knowledge so that it can use randomness to properly explore a search tree. Preliminary results have shown one measure which has improved play of a computer Go engine that uses Monte Carlo search, and this project is developing further measures along with discovering their effectiveness and limitations. By studying these modifications which touch the very nature of Monte Carlo search, this project is exploring the applicability and limitations of Monte Carlo search in general and whether or not hybrid methods offer an opportunity for their improvement.

7. Research implementation and results under the program

   Title of your research plan:

   Improving Opening Strategy in Computer Go Players

Description of the research activities:

During this summer program, a study of various ways to modify the beginning of a Monte Carlo search using knowledge obtained from experienced people in the target field (in this case, the game of Go) was carried out. The information used in the modifications was changed in three different ways, and results of the combinations were observed by conducting large-scale trials against a third program. The modifications were varied in the following three ways: size of the database from which the Go knowledge was derived, the number of clusters into which this knowledge was divided, and the length of the modification in terms of the number of actions affected. A baseline success rate of the unmodified software was established using a very large number of trials (16,000) against a third program. The modified program was then tried against the third program to find its success rate while changing the modifications in each of the three areas described above. Each combination of modifications was measured using its success rate over 2,000 trials.

In addition to this planned research, two other programs have been begun.

In the first, a server has been set up to allow humans to compete against the programs in a consistent fashion over time. The purpose of this is to measure possible relative weakening of the programs over time, if any, as the humans learn how to compete against these algorithms.

The second program involves exploring the use of Monte Carlo tree search techniques to improve resource allocation in the testing of large software projects.

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

During my stay in Japan, I was able to tour Nara and Kyoto, along with the center of Nagoya, including its castle and an afternoon at a Sumo tournament.

RESEARCH REPORT

1. Name: Joshua G. STEPANEK	（ID No.: SP13053）

2. Current affiliation: University of Colorado Boulder

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Tokyo Gakugei University

5. Host researcher: Dr. Shigeki MAYAMA

6. Description of your current research

     My research involves the investigation of the evolutionary history and oil production potential of the diatom genus *Amphora*. Diatoms are a large and diverse group of photosynthetic algae found in virtually all aquatic environments from the tropic to the poles. Diatoms are particularly important in the aquatic ecosystem as they potentially account for over 40% of all aquatic primary production and are the preferred food source for many aquatic grazers. Unlike most algae, diatoms utilize liquid oil as their primary photosynthetic storage product. For this reason diatoms, particularly members of the diatom genus *Amphora*, have been singled out as a potentially important source for biofuels production. Although shown to be promising, only a small number of species (approximately 5 out of over 700 described *Amphora* species) have been thoroughly investigated. In light of the small number of examined taxa and the fact that the taxonomic and evolutionary history of the group continues to be confused, research into this potentially important genus is especially critical.

     This research is focused on the targeted collection and culturing of *Amphora* taxa from across the evolutionary and ecological breadth of the group. From these cultures, molecular techniques for the extraction and sequencing of nuclear and chloroplast DNA will be employed, and this data used to create a phylogeny, (evolutionary tree) describing the relationships within the genus. With the phylogeny completed, included species will be grown in controlled laboratory conditions to determine the maximum growth rate and oil production for each species. By mapping ecological data, growth rate and oil production onto the evolutionary tree, this research will create a predictive evolutionary based tool for the selection of groups of high oil producing diatoms, as well as the systematic comparison of traits between closely related lineages. This project will, for the first time, bring phylogeny, ecology, growth and physiological data together to address a question in applied diatom research. The combination of these individual lines of research will allow for the examination of whether the propensity for high oil production exhibits a phylogenetic signal (more closely related species are more similar to each other than they are to more distant species), and therefore if these traits can be predicted through evolutionary relationships. This research has both the potential to change our understanding of oil production within algal lineages, as well as change how algae are selected and utilized in applied research.

7. Research implementation and results under the program

Title of your research plan:

Taxonomic and phylogenetic investigation of the high lipid producing diatom genus *Amphora*

Description of the research activities:

The focus of my research activities in Japan include; the collection and culturing of unique *Amphora* species from marine and freshwater environments; the implementation of new techniques available through Japanese diatom researchers; and, finally, to utilize these collections and cultures as a starting point for a detailed taxonomic investigation of the genus.

Over the nine week research period approximately 100 environmental samples were collected and examined. Collection sites included the Tokyo Bay area and tributaries, rivers and coastal waters of Chiba prefecture, coastal waters of Niigata prefecture, coastal and saline lake sites in the Mikatagoko area, sites along the west shore of Lake Biwa, and coastal areas of Okinawa.

From these collections, approximately 15 unique *Amphora* species, several of which are new to science, were isolated and grown in monoculture. From these cultures and collections detailed light microscope observations have been conducted and high resolution scanning electron microscope observations have begun. Using these collections, new techniques have been employed in both the isolation of difficult to culture taxa, as well as in sample preparation for observation of detailed fine structure of the cells. From these observations taxonomic work is continuing with three species currently thought to be un-described.

Specific outcomes of this work include first, a broadening of the taxonomic scope of the phylogenetic and lipid production portions of my research, which until now only included species from North America. Second, the development of a new skill set in the isolation and preparation of diatom samples. Lastly, strengthened relationships with Japanese diatom researchers, including continuing collaboration between myself and Dr. Mayama for the description and publication of several new species from the genus *Amphora* from coastal waters of Japan.

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

This research provided me with the opportunity to travel extensively outside of the Tokyo area. Many of my collecting sites took me well into the country-side where I was often collecting in small coastal towns. I found the experience of exploring rural Japan and interacting with the friendly people there as culturally rewarding as any of the many festivals and tours I attended.

RESEARCH REPORT

1. Name: Agnieszka A. SZYMANSKA	（ID No.: SP13054）

2. Current affiliation: University of California Irvine

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: University of Tokyo

5. Host researcher: Dr. Yuji IKEGAYA

6. Description of your current research

      Given growing interest in brain computer interfacing (BCI), and recent progress in the design and manufacturing of intracortical multi-sensor microelectrodes, the field of experimental neuroscience is increasingly relying on extracellular recording to provide functional information about the brain. While many techniques exist to study the functional organization of neurons, ranging from intracellular recording to various types of functional neuroimaging, few can provide enough resolution to isolate single neurons, as well as enough breadth to understand group neural interactions. This is a major limitation of the field, especially for *in vivo* studies, where both imaging and intracellular recording are difficult.

      Multi-sensor extracellular recording has the potential to alleviate these problems. While existing extracellular recording techniques allow signals from dozens of neurons to be isolated and studied simultaneously, current methods are limited in scope. Extracellular action potentials (APs) from many neurons can be accurately identified, but other crucial parameters such as the location, size, dendritic morphology, and type of neurons under investigation remain unknown. My work concentrates on developing a statistical signal processing algorithm that can extract these parameters for several active neurons at a time using multi-sensor extracellular recordings. The neuron characterization algorithm (NCA) can vastly improve extracellular recording as well as electrophysiological data processing.

7. Research implementation and results under the program

    Title of your research plan:

    An Algorithm for Neuron Characterization *In Vivo*

Description of the research activities:

METHODS

This study focused on testing the performance of the NCA's neuron localization feature. A novel multi-modal framework was used to monitor neural activity via both extracellular recording and functional multi-neuron calcium imaging (fMCI). Unlike extracellular recoding which collects data on local field potentials (LFPs) generated during APs, fMCI detects the flow of calcium ions into a neuron, causing it to effectively light up during an AP. fMCI can be performed on many neurons at a time with enough sensitivity to temporally resolve individual APs.

Extracellular data from several multi-sensor recording arrays was used to localize source neurons. The derived locations were compared with the corresponding fMCI data, which details the true locations of individual neuron and their times of activity. The experiment was repeated with both 4 channel (tetrode) and 7 channel (heptode) recording arrays. Likewise, both acute mouse brain slices, as well as neuron cultures were used.

RESULTS

Preliminary analysis of tetrode extracellular recordings indicates that NCA localization results are consistent with the area of active neurons recoded using fMCI (Figure 1). Notice that the fMCI data only records neuron activity in a two dimensional plane. However, there are active neurons both above and below the imaging plane. Extracellular tetrode recordings on the other hand, can pick up neural signals from a 3D volume of space. The source locations therefore represent not only the neurons pictured in the fMCI data, but also the neurons above and below the imaging plane. This makes the fMCI imaging plane difficult to identify within the localization results. A more detailed analysis will have to be performed on this and the remaining data sets to determine if active neurons identified by fMCI are accurately localized by the NCA algorithm.
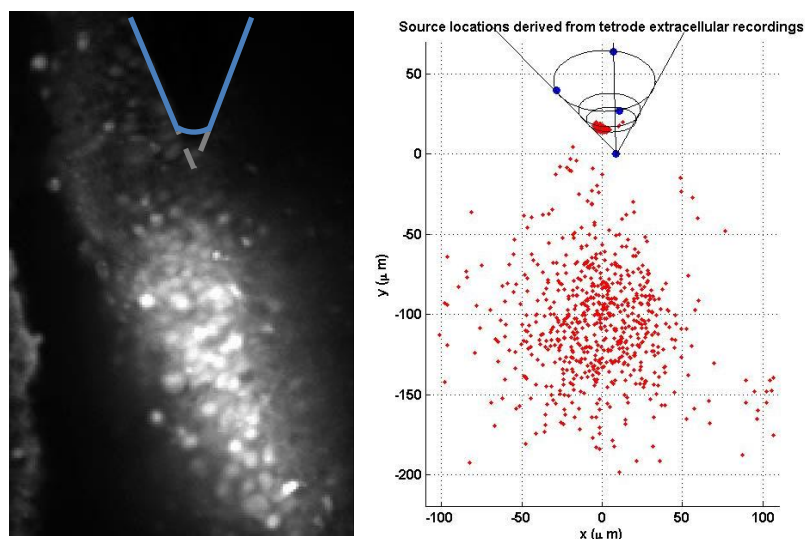

Figure 1 Left: Picture of fMCI data taken simultaneously with tetrode extracellular recording. The tetrode is outlined in blue with its tip, located deeper in the acute mouse brain slice, marked in gray. The neurons can be visible as light spherical shapes. When a neuron fires, it grows brighter. **Right:** Localization results from the tetrode recording pictured on the left. Source locations for all recorded spikes are plotted as red dots. The tetrode sensors are plotted as blue circles and outlined to better show dimensionality. Note that the general area of located neurons corresponds with the same area as the fMCI image on the left.

RESEARCH REPORT

1. Name: Evan G. THOMAS	（ID No.: SP13055）

2. Current affiliation: Virginia Tech

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: University of Electro-Communications

5. Host researcher: Dr. Keisuke HOSOKAWA

6. Description of your current research

Many critical technologies relied upon by both commercial and military users around the world are directly impacted by events occurring in the charged component of Earth's upper atmosphere, known as the ionosphere. Strong geomagnetic storms are responsible for causing ionospheric clutter in over-the-horizon radar systems; rapid fluctuations in GPS signals (scintillations); and induced electrical currents in power distribution networks. It is the goal of my graduate research to analyze simultaneous ionospheric total electron content (TEC) observations of plasma structures with data collected from SuperDARN space weather radars. One objective is to examine the extent to which small-scale plasma irregularities occur in the gradients of large-scale ionospheric features such as subauroral polarization stream (SAPS), storm enhanced density (SED), and tongue of ionization (TOI). A second objective is to gain a better understanding of the controlling role played by ionospheric convection electric fields in the large-scale redistribution of plasma from middle latitudes to the polar cap.

7. Research implementation and results under the program

Title of your research plan:

Dynamics of ionospheric plasma irregularities as measured by Global Positioning System (GPS) receivers and the Super Dual Auroral Radar Network (SuperDARN)

Description of the research activities:

With guidance from Dr. Hosokawa, I have been developing a new multi-instrument approach for imaging the transportation of localized plasma enhancements in the polar ionosphere (known as polar cap patches) by combining observations from global maps of GPS total electron content, SuperDARN radars, and a pair of all-sky airglow imagers in Canada and Norway operated by Japanese researchers. In mid-July I visited the Solar-Terrestrial Environment Laboratory at Nagoya University for 12 days to begin a joint study using new mid-latitude SuperDARN radars in Japan and the United States. Two visits were also made to the National Institute of Information and Communications Technology (NICT) in Tokyo for discussions with GPS experts.

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

This summer has been an amazing experience, both personally and professionally. From watching sumo wrestling in Nagoya, to exploring castles in Matsumoto and Inuyama, to visiting ancient temples and shrines in Kyoto and Nikko, to attending a baseball game at the Tokyo Dome – this will not be a summer I ever forget.

9. Advisor's remarks (if any):

Mr. Thomas has succeeded in visualizing dynamical nature of the plasma circulation system in near Earth space during magnetic storms by combining various ground-based observations from US and Japan. He has just started writing a short paper summarizing our collaboration this summer. I evaluate that his visit to Japan was very successful.

RESEARCH REPORT

1. Name: Patrick R. THOMAS, Jr.	（ID No.: SP13056）

2. Current affiliation: University of Missouri – Kansas City

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: Kwansei Gakuin University

5. Host researcher: Professor Kazuyoshi OGASAWARA

6. Description of your current research

My current research is centered on the application of relativistic quantum theory to condensed matter physics. At the University of Missouri – Kansas City, I have been tasked with implementing relativistic theory in the highly successful Orthogonalized Linear Combination of Atomic Orbitals (OLCAO) density functional theory based program. The goal of this research is to implement both a four component and a simplified single component relativistic description of the atomic orbitals and then to initiate a redesign of the program's calculation of the electronic kinetic energy to a much less error prone formalism. During the JSPS Summer program, I undertook a three-fold project 1) Creation of a new four-component fully relativistic Gaussian based basis set of orbitals utilizing the highly accurate atomic software package, Grasp2K. 2) Down sampling the four-component basis set to a single component basis that can be immediately implemented into the existing OLCAO program with minimal changes to the program code. 3) Understanding, adapting, and initiating the implementation of a more accurate relativistic kinetic energy calculation based on the method used by the relativistic DV-Xα method that is developed in my host researcher's lab.

7. Research implementation and results under the program

Title of your research plan:

Implementation of Accurate Relativistic Theory in the *ab initio* Orthogonalized Linear Combination of Atomic Orbitals Method

Description of the research activities:

While at Kwansei Gakuin University, I was able to write a series of programs to automate the creation of the four-component, fully relativistic Gaussian based atomic orbitals derived from Grasp2K calculations. The orbitals were checked against the DVME method's numerical orbitals and were found to be in excellent agreement. Next, I automated the selection of the large components of the spin up and spin down states and the subsequent fitting by Gaussian-type functions. Investigation of the fitting quality shows that further optimization will need to take place with regard to the exponential coefficient range and number of terms. The current exponential coefficient range has been experimentally tailored to the current OLCAO orbital descriptions based on past experience, but with this new approach we may have a more definitive way to judge the basis quality. During multiple meetings with Professor Ogasawara, we have been able to theoretically describe the necessary algorithms and data structures needed to implement a new scalar relativistic kinetic energy calculation. All that remains is to actually implement the code into the existing OLCAO structure. Lastly, Professor Ogasawara provided instruction concerning the formalism that is necessary for implementing both four component orbital descriptions as well as how to perform the necessary integrals in the kinetic energy calculation.

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

The trip to Japan was incredible, both for the excellent research progress that I made as well as for the enlightening cultural experiences that I had. I was very happy to have been able to achieve virtually all of the goals that I had set out to accomplish at the beginning of the trip. A major portion of my master's degree research was completed. I made new friends with my host's students and other EAPSI fellows. I visited the laboratories of two other researchers that are colleagues of my advisor in Nagoya and Tokyo to help stimulate future collaborations. Especially exciting was that I had the opportunity to visit ancient parts of Japan and multiple UNESCO world heritage sites such as Himeji castle and Kinkaku-ji   Finally, I have always had a love of Japanese food and I was able to extensively sample all sorts of foods, both familiar and new such as yakiniku and various sushi.

RESEARCH REPORT

1. Name: Richard VEALE	（ID No.: SP13057）

2. Current affiliation: Indiana University

3. Research fields and specialties: Biological Sciences

4. Host institution: National Institute of Physiological Sciences (NIPS), Okazaki, Aichi

5. Host researcher: Tadashi Isa and Masatoshi Yoshida

6. Description of your current research

My research centers around the question of how babies are able to learn the names for things in the world. To do this, I build computational models of parts of the human brain in order to understand how those parts of the brain process sights and sounds, and how sights and sounds are recognized and associated together. One important aspect of this involves how movement come into play, specifically eye movements. Our eyes can only point in one direction at a time, and so in order to maximize our information about the world, we move our eyes constantly. Thus, a major part of my research actually revolves around understanding how eye movements are caused by different visual experiences. How can robust word-object associations happen even though we never really focus our eyes on any part of an "object" for very long? I put the artificial neural circuits I build into robotic systems that can move their eyes. Then, I have the "artificial baby" robots participate in real experiments, just like real babies. This allows us to better understand how the interaction between the world, body, and brain of the baby causes observed behaviors to emerge.

7. Research implementation and results under the program

    Title of your research plan:

    How do small eye movements help us see things?

Description of the research activities:

My proposal centered on modifying a neural model of visually driven eye movement to account for small eye movements called microsaccades. I spent the last two months working to produce a physiologically accurate simulation of the superficial and intermediate layers of the superior colliculus. The superior colliculus (SC) is a midbrain region responsible for visual processing and eye movements. My host's lab has extensive data regarding the anatomical and physiological properties of the neurons in superior colliculus and its intrinsic connections. This includes recent data from brain slices showing the temporal and spatial dynamics of stimulation to the superficial (visual) versus the deeper (eye-movement-generating) layers. To understand how the observed dynamics emerge, we built a large spiking model of the superficial superior colliculus of the mouse, including 20,000 neurons and several million dynamic synapses. The model includes both inhibitory and excitatory neurons. These neuron types are connected in a way such that electrical stimulation to one region will cause different responses to neurons that are distant from the stimulated area. We were able to quickly reproduce the correct spatial shape observed in the brain slices. However, it proved more difficult to match the temporal dynamics. We are currently working to understand why this is the case. We hypothesize that it may be necessary to include more anatomical neuron types that are known to exist in the SC. Furthermore, our model of a certain neurotransmitter receptor, GABA(B), may need to be corrected. However, the model is still able to make some predictions that are currently being verified physiologically. By understanding the intricate spatial and temporal dynamics of the superficial colliculus, we will be able to accurately model its response during visual input. Small shifts in the activity at the center of superior colliculus are believed to be what causes microsaccades. Our model is getting us closer to understanding what causes them.

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

I had a very productive and interesting time in Dr. Isa's lab at NIPS. It is quite a large lab and the lab members are all very nice. I was able to go visit Dr. Jan Moren in Kobe RIKEN to talk about his recent spiking model of superior colliculus. I also attended the Japanese Society for Neuroscience conference in Kyoto along with the rest of the lab. The lab members were kind to invite me along to many interesting activities, such as going to eat unagi at a famous local shop, or to watch some fireworks together. I even have plans to climb Mt. Fuji with two other lab members! Overall, I have many areas of overlap with the lab members, and we are continuing several collaborative projects. I will be returning for another 4 months on a GROW fellowship next month, and we will make much more progress then!

RESEARCH REPORT

1. Name: Matthew T. WALTERS	（ID No.: SP13058）

2. Current affiliation: Johns Hopkins University

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: Kavli IPMU, University of Tokyo

5. Host researcher: Prof. Hitoshi MURAYAMA

6. Description of your current research

My current research focuses on the calculation of effects due to new particle species on various phenomena in the early universe. There are a large number of well-motivated theoretical models which contain very light particles, and measurements of cosmological observables can be used to constrain or confirm such models. Two important processes in the early universe which affect such observables are the production of residual radiation, referred to as the Cosmic Microwave Background (CMB), and the synthesis of light elements, through a process called Big Bang Nucleosynthesis (BBN).

The determination of the effects of any particular model with new light particles can be greatly simplified by dividing these models into various classes, each of which can be represented by an effective field theory (EFT) with a small number of parameters. Using this framework, part of my research consists of calculating the evolution of new light particles the early universe, and any resulting alterations to the CMB or BBN, based on these few EFT parameters. Direct measurements of the CMB or the determination of the relic abundances of light elements resulting from BBN can then be used to place constraints on these parameters. These EFT parameter constraints can be interpreted in terms of many different models, though the resulting constraints depend on the relevant details of that particular model. This research therefore provides a simple map between theoretical models and experimental or observational results.

Recently, I have worked on calculating the detailed contributions of various models containing massless particles to the CMB temperature anisotropies. These numerical calculations were then used to interpret the recent results from the Planck satellite experiment in a more general EFT framework, placing constraints which are competitive with or even exceed those placed by other astrophysical observations or collider experiments.

7. Research implementation and results under the program

Title of your research plan:

New Light Particles in the Early Universe

Description of the research activities:

During the program, my research focused mainly on two areas. The first was the use of CMB data to constrain generic models which contain particles with masses near the eV scale. Standard CMB analysis is done with the framework of a six-parameter model, commonly referred to as the ΛCDM model. I worked on an extension of this framework, which includes the effects of additional particles with light masses, which are not accommodated by the ΛCDM model. I am currently using this extension to analyze the recently released Planck observational CMB data, as well as various supplementary datasets, in order to obtain a full set of constraints on these sets of models. For the second project, I studied the details of the annihilation of light dark matter (DM) during the process of BBN. Specifically, I began to develop a detailed treatment of the hadronic annihilation of DM with masses near the GeV scale. This work involved visits to and discussions with multiple researchers in Japan, and such collaboration will hopefully continue beyond this program.

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

This program presented multiple excellent opportunities to experience Japanese culture. During the homestay, offered as part of the program orientation, I participated in meditation at a local temple and visited the area of Kamakura. Later in the program, I was also able to visit the Okinawa Prefectural Peace Memorial and attend a Bon Odori festival in Tokyo's Hibiya Park. My host institution also offered an intensive introductory course in Japanese, which presented the opportunity for me to interact with a more diverse collection of people throughout my time in Japan.

RESEARCH REPORT

1. Name: Donald C. WARREN	（ID No.: SP13059）

2. Current affiliation: North Carolina State University

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: RIKEN, Wako Campus

5. Host researcher: Shigehiro Nagataki

6. Description of your current research

When a massive star dies, it explodes in a supernova that releases as much energy in a few minutes as the Sun will over its entire lifetime (10^{44} Joules). Some supernovae release a further 10^{44} Joules in just a few seconds, in a narrow jet shooting away from the star. These latter events are seen on Earth as a short-lived burst of gamma radiation, called a gamma-ray burst (GRB). Telescope observations have shown that the GRB is followed by a long "afterglow" in X-rays. This project will simulate the X-ray afterglow of a GRB using a Monte Carlo code that tracks particle interactions with strong shock fronts. The code will simulate both the radiation and the accelerated particles produced by these shocks, using previous simulations of GRB jets as a starting point. The resultant spectra (light and particle) can be directly compared against observations at Earth, serving as confirmation of the physics involved. Furthermore, it may also constrain the nature of the central engine that powers GRBs, which is inaccessible to direct observation and still poorly understood.

7. Research implementation and results under the program

   Title of your research plan:

   Simulating the Early Afterglow of Gamma-Ray Bursts

Description of the research activities:

Over the summer it became clear that what I thought was a narrowly focused research topic was too broad for just one summer, and even for just one paper.

To obtain the initial physical data – which I feed into my Monte Carlo code to generate particle and light spectra – I have applied a mathematical approximation for GRB jets and their properties. I then used the Monte Carlo code to simulate the jet's shock structure at more than a dozen different times in the evolution. Once the shock structure is determined, a second (shorter) simulation takes the final structure and calculates the resultant particle and photon spectra.

In order to simulate the photon emission, I need both a proton and an electron energy spectrum. However, the Monte Carlo code needs revision to handle electrons correctly. So for the moment, I am using previous results from a different group to provide the electron spectrum.

This has been sufficient for preliminary results, as this summer project provides. Future work will certainly include extension of all necessary physics. In particular, the Nagataki group will soon add a new researcher with expertise in 3-D modeling of GRB jets, which will dramatically increase the quality of the data the Monte Carlo code needs.

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

The JSPS summer program has been a phenomenal experience for me. The benefits go far beyond the primary focus of doing research in Japan and starting what will (hopefully) be a career-long collaboration.

The people in the program are exceptional and diverse. At my home institution, it is very easy for me to interact only with people in my subfield (astrophysics), which can lead to a narrow view of things. The time I have spent with other JSPS fellows has significantly increased my awareness of science and the world in which we do it.

As well, the dual focus on experiencing the culture of Japan, beyond the laboratory, has made me much more likely to apply for postdoctoral or faculty positions here after I graduate. Striking a balance between work and home can be difficult for scientists, but it's much easier when there's an entire country full of amazing things to do and see.

RESEARCH REPORT

1. Name: Mathew T. WOLAK	（ID No.: SP13060）

2. Current affiliation: Tufts University

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: Okayama University

5. Host researcher: Prof. Tomoyuki KAKEHI

6. Description of your current research

I am attempting to find generators for the center of the universal enveloping algebra for Cartan motion groups. These groups are the isometry groups of symmetric spaces which have been "flattened out". More precisely, if g is a semisimple Lie algebra with Cartan decomposition g = k + p, the corresponding Cartan motion group is the Inönü-Wigner contraction of g along p. It is conjectured that for the classical Lie algebras, the invariant algebra of the contracted Lie algebra is generated by the high p-degree terms of generators for the invarient algebra of p.

7. Research implementation and results under the program

   Title of your research plan:

   Generating the invariant algebra of contracted Lie groups.

Description of the research activities:

I have been trying two main approaches. The first is via analysis: we may assume by duality that the starting algebra g is compact. An element of the invariant algebra of the contracted group g_0 can be made g-invariant by integrating over the adjoint action of the corresponding compact Lie group. Understanding this map should provide insight to the relationship between the two invariant algebras. To this end I've been investigating the effect of contraction on the Adjoint action.

The other approach relies on the classification of simple Lie algebras. This involves comparing Satake diagrams of cases where the conjecture in known to be true, and cases where the statement fails to hold (in particular, four symmetric pairs involving exceptional Lie algebras).

While at Okayama University, I've presented my progress to some of the faculty here, and received valuable advice for my current problem as well as suggestions for possible generalizations.

RESEARCH REPORT

1. Name: Charles B YEAGER	（ID No.: SP13061）

2. Current affiliation: The Penn State University

3. Research fields and specialties:

   Materials Science and Engineering

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Hiroshi FUNAKUBO

6. Description of your current research

Piezoelectric energy harvesting systems convert waste vibrations into electric energy to power wireless microelectromechanical systems. The author has recently made an experimental characterization of piezoelectric $Pb(Zr,Ti)O_3$ (PZT) thin films and demonstrated that the energy generation figure of merit increases with increases in the level of out-of-plane c-axis texture. This work has raised questions as to the maximum achievable energy generation factor of PZT films with 100% c-axis texture.

By growing PZT films by metalorganic chemical vapor deposition (CVD) at varying compositions and with systematically changing c-axis texture to observe changes in the piezoelectric energy generation coefficient as a function of composition, as well as reporting the highest possible property for this application. The c-axis texture will be controlled using substrates with select thermal expansion coefficient. It is predicted that a 100% c-axis PZT film with [Zr]=0.30 would have twice the figure of merit as the best reported PZT film grown on (100)MgO substrates by sol-gel. Also, fundamental knowledge is gained by the direct measurement of how the transverse piezoelectric coefficient changes with c-axis texture for {001}PZT films.

7. Research implementation and results under the program

Title of your research plan:
Increasing Electrical Energy Generation from Piezoelectric Thin Films

Description of the research activities:
Learning to deposit thin films via the CVD method was a key point of the research program since this technique is a new experience for the author. Successive thin films were grown with systematic changes to the growth conditions to achieve the target microstructure and stoichiometry needed for the characterization of the fundamental properties. One specific tenant of the research plan is to find if PZT films of strongly tetragonal crystal structure, e.g. [Zr]=0.30 mol%, have superior energy generation factors compared to the weakly tetragonal but highly piezoelectric compositions near the morphotropic phase boundary, e.g. [Zr]=0.52. This research was fruitful in growing {001} oriented PZT films with compositions of [Zr]: 0.30, 0.40, and 0.50, on a variety of crystal substrates with systematically chosen thermal expansion coefficients, i.e., $(001)CaF_2$, $(001)MgO$, $(001)SrTiO_3$, and silicon.

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

The opportunities for cultural experiences during this program are innumerable and daily. Fortunately we are given both time and money to see very many locations all over Japan, such as the sumo tournament in Nagoya, the temples in Kyoto, the beach at Kamakura, and many others, but even simply going to work or shopping are immersive challenges that will leave you with a different mindset about your identity as a world citizen. I am very grateful for this chance to live and work in another country while I continue my research.

RESEARCH REPORT

1. Name: Sylvia Zamudio

（ID No.: SP13062）

2. Current affiliation: California State University, Northridge

3. Research fields and specialties:

Biological Sciences

4. Host institution: Department of Coral Reef and Environmental Biology, Sesoko Station, Tropical Biosphere Research Center, University of the Ryukyus

5. Host researcher: Dr. Kazuhiko Sakai

6. Description of your current research

Coral reefs are highly biologically diverse ecosystems that provide a multitude of benefits to the countries that they surround such as coastal protection, food resources, and income from ecotourism.　Increases in seawater temperature attributed to climate change is one of the main abiotic factors driving the global decline in coral cover on tropical reefs.　To understand how climate change will impact coral reefs most research focuses on the effects of temperature on adult coral colonies.　However, the recruitment, growth and survival of young life stages can affect marine populations, community resilience and recovery.　It is unclear how climate change will affect early life stages of coral (i.e. larvae, newly settled individuals, and juveniles).

My research examines the role that the thermal environment of maternal coral colonies play in modulating the response of larvae to thermal stress.　Previous research questions have addressed whether the larvae of corals respond to thermal stress differently between maternal colonies.　Most recently I examined whether the temperature of the maternal environment impacts larval phenotype.　Results of this research showed that the thermal environment of the maternal colony affects larval phenotype through offspring energy content, with colonies exposed to thermal stress producing larvae with reduced energy content.　This summer I investigated whether this effect on larval phenotype has a significant impact on post-settlement success.　This study will lend insight into how early life stages of corals will respond to temperature changes attributed to climate change, and how this change may impact coral reefs in the future.

7. Research implementation and results under the program:

Preliminary results suggest that coral colonies placed under thermal stress (31°C) produced larvae with reduced biomass (size), reduced settlement success, and lower post-settlement growth and survival.

Title of your research plan:

The significance of temperature-induced maternal effects on the phenotype of larvae from tropical corals.

Description of the research activities:

During the first week of the program equipment was prepared and experimental systems were stabilized.   Coral colonies were then collected at Bise beach Okinawa, and incubated in temperature treatments of ambient (28°C) and high (31°C) seawater for 16 days.   This incubation ensured that larval development within the maternal colonies occurred under different thermal regimes.   During spawning larvae from each colony were collected and sampled for protein content as an indicator of biomass.   Additional larvae were settled onto ceramic tiles, and these recruits were exposed to ambient (28°C) and high (31°C) temperature treatments for 21 days.   After incubation the survival and growth of these recruits was measured.

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

Work on coral reefs almost entirely depends on international collaboration.   Through NSF and JSPS I was able to investigate a crucial research question pertaining to my thesis and field of study.   However, some of the most rewarding experiences of this summer were the personal relationships I built with local researchers, students, and others working at my host location.   This built new collaborations, provided fruitful discussions on my work, and expanded my knowledge base.   Above all these relationships provided me with amazing company with which I could explore the island and culture of Okinawa.

RESEARCH REPORT

1. Name: Geoffrey L. ZAHN	（ID No.: SP13063）

2. Current affiliation: University of Arkansas

3. Research fields and specialties: Biological Sciences

4. Host institution: National Institute for Agro-Environmental Sciences, Tsukuba

5. Host researcher: Rota WAGAI

6. Description of your current research

Beneath our feet, three fourths of the earth's terrestrial carbon is tied up in a dynamic web of microbial interactions as part of a complex ecosystem we call soil.   Soils play a critical role in the regulation of the global carbon budget and predicting the fate of this carbon in a warming environment has become a major goal of recent research efforts.   These efforts cannot hope to succeed without a detailed understanding of the complex microbial interactions present in soils.

This project was designed to investigate the influence of bacterial predators (amoebae) on the flow of carbon through terrestrial ecosystems.   Predation has been shown to strongly effect the composition of bacterial communities and their functional capacity.   This study used controlled soil microcosms to determine the role that amoeboid predators play in nitrogen mineralization and CO_2 production and the interactions with soil temperature and texture.   It was hypothesized that 1) the presence of amoebae would increase the rate or carbon and nitrogen mineralization, 2) amoebae would be more efficient predators in finely textured soils with few or no aggregates, and 3) the presence of amoebae would have a greater effect at lower temperatures.

7. Research implementation and results under the program

Title of your research plan:

The importance of microbial predation to soil carbon dynamics on a warming planet

Description of the research activities:

A three week pilot study was conducted prior to the beginning of the JSPS summer program in order to determine the most efficient methodology for conducting the actual research and to select the most appropriate levels for the factors of interest, including incubation temperatures, soil volumes, and soil textures.   During the pilot study, CO_2 production rates were measured twice a week from each possible combination of treatments with the assistance of NIAES researchers.   During this time, also, bacterial and amoeba communities were grown up in laboratory cultures for use in the main project.

At the conclusion of the pilot study, the appropriate methods were selected, in order to yield the greatest chance of detecting any significant differences between treatment groups and 84 soil microcosms were prepared.   Treatment groups consisted of three soil types (tilled agricultural soil, non-tilled agricultural soil, and a finely crushed treatment of the non-tilled soil), three microbial community types (cultured bacteria, cultured bacteria and cultured amoebae, and the natural soil community), and two incubation temperatures (15°C and 25°C).   The experiment was set up in a factorial design so that each combination of factors was investigated.

Once the microcosms were prepared, initial measurements of soluble nitrogen were made and CO_2 production rates were then measured at least twice a week for the duration of the study.   At the conclusion of the incubation period, final soluble nitrogen was measured in each of the jars.

It was found that amoebae significantly increase CO_2 production rates in soils, and that this effect interacts with temperature.   The novel contribution of this research is that the influence of predation on carbon mineralization is dependent on temperature. This information can be used to improve existing models of soil responses to global climate change.

RESEARCH REPORT

1. Name: Lauren D. ZARZAR	（ID No.: SP13064)

2. Current affiliation: Harvard University

3. Research fields and specialties:

 Chemistry

4. Host institution: University of Tokyo

5. Host researcher: Prof. Takashi KATO

6. Description of your current research

For many materials where there exists a strong structure-function relationship, directed self-assembly shows great promise as a general approach by which to influence macroscale materials properties via the control of molecular and nanoscale order. Liquid crystals, or liquid crystal elastomers, are one such class of self-assembling materials – order on the molecular scale influences the optical, thermal, responsive properties etc. seen on the micro/macroscale. An attractive feature of ordered liquid crystal elastomers in particular is thermally induced *anisotropic* macroscale deformation derived from a change of molecular orientational order following the phase transition between the isotropic state and liquid crystalline state. Such liquid crystal elastomers can also be designed to display anisotropic volume change in response to other stimuli, including light. We are investigating the assembly, polymerization, and molding of such responsive liquid crystal elastomers within 3D microscale confining surfaces. Microstructures molded out of liquid crystal elastomer with a controllable swelling response could be useful as micro-actuators, for components of responsive surfaces with dynamic wetting behavior or optical properties, or for shape-shifting "origami" materials.

7. Research implementation and results under the program

Title of your research plan: Assembly and Molding of Functional Liquid Crystal Elastomers within Deformable Micropatterned Substrates

Description of the research activities:

The original research proposal ("Self-Assembly and Responsive Reorganization of Mechanochromic Photoluminescent Liquid Crystals within Confining Nano/Microstructured 3D-Patterned Surfaces") was adapted following unanticipated results. The majority of research activities have involved investigation of incorporation of responsive liquid crystal polymers either within arrays of microstructures or molded as the microstructures themselves. Activities included chemical synthesis of two different types of liquid crystal elastomer precursors (temperature and light responsive), investigation of the assembly and direction of order of these liquid crystals within microscale confinement, molding and shape patterning of the liquid crystal elastomers, and testing of responsive properties of these surfaces by heating or light exposure.

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

Living and working in Tokyo was a remarkable experience, culturally and scientifically. Although the details would be too much for this little space, I do wish to thank the NSF and JSPS for providing this unique and amazing opportunity. I am very grateful.

RESEARCH REPORT

1. Name: Robert A Zinna	（ID No.: SP13065）

2. Current affiliation: Washington State University

3. Research fields and specialties:

  Biological Sciences

4. Host institution: Nagoya University

5. Host researcher: Dr. Teruyuki Niimi

6. Description of your current research

My current research deals with investigating the molecular mechanisms behind the origin of novel morphological traits in evolutionary history. In particular I focus on the elaborate horns of the Japanese rhinoceros beetle (*Trypoxylus dichotomus),* a large beetle in the subfamily *Dynastinae.* The horns in this beetle are used as weapons of sexual selection, and males bearing large horns will fight violently over females. My goal is to determine the degree to which existing genetic networks have been co-opted over time to produce these intimidating weapons. Previous work has implicated the limb-patterning pathway, a canonical developmental network, in the evolutionary origin of the horns in another beetle genus- *Onthophagus.* However, these genera (*Trypoxylus* and *Onthophagus)* are separated by a significant evolutionary distance, and furthermore horns in these two species are thought to have been the result of convergent independent events. Therefore, my research aims to examine whether or not the same gene networks have been co-opted multiple times, independently in different genera, to give rise to similar structure. In short, the goal of my research is to answer the question "is there only one way to make a horn?"

In addition to investigating known candidate pathways, I also am interested in discovering novel candidate pathways that could contribute to the evolution of novel morphologies. This second approach will identify to what degree other gene networks have been recruited to develop the head horns in *Trypoxylus.* My research will also discover whether novel gene evolution or genetic co-option has played a larger role in the evolution of these weapons.

7. Research implementation and results under the program

  Title of your research plan:

  Diversification of weapon form: insights from development of horned beetles

Description of the research activities:

My research activities in Japan under the guidance of Dr. Niimi fall under three main areas. One of the most significant areas is also, perhaps, the most basic. *Trypoxylus* is an easy beetle to raise, as it is a household pet in Japan, but it does pose a unique challenge. This beetle has a developmental period of approximately 200 days, which makes it difficult to use for research in most cases. However, Dr. Niimi has developed a method to halt development of the beetle at specific time points, which permit the ability to work with this organism year-round, instead of at a specific time point. My first research activity was to learn these methods for rearing this insect from Dr. Niimi.

My second and third research activities are to investigate the function of both existing and novel candidate gene pathways in the development of the head horn in this beetle. A sub aim of these activities is to determine the developmental staging of the head horn, as this is currently not well characterized. My research activities involve both in situ hybridization – a classical developmental biology technique for assessing gene expression patterns – and RNA interference. RNA interference (RNAi) is a technique that allows researchers to reduce the expression of target genes without the need for the laborious process of generating transgenic animals, and can be used in a variety of non-model organisms.

My research has successfully validated a novel player for horn development, and I have characterized the developmental stages of the head horn in this beetle.

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

My stay in Japan was very exciting. While I did not often venture outside of the city of Nagoya, I found plenty to entertain me within the city. I attended the Sumo tournament in July, which was an experience I will never forget. I also visited many izakaya bars in Nagoya, and sampled the unique Nagoya delicacy of "dessert spaghetti". I also enjoyed shopping at the many malls in Sakae, and singing karaoke with my friends.
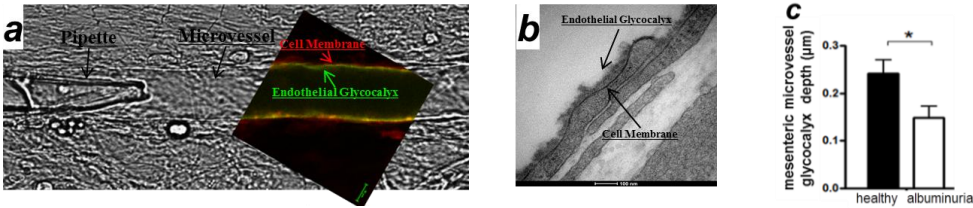My favorite experience in Japan was visiting an onsen in Tokyo with other EAPSI students. The memories I made there will last the rest of my life. It was the most relaxing experience I have ever had, which was something I sorely needed after all the hard work in the EAPSI program!
Another amazing experience was riding the subway in Nagoya and Tokyo. I may have gotten on the wrong train quite a few times, but every time was always an adventure.

9. Advisor's remarks (if any):

Robbie was a very hard worker. He was a very positive influence on the students in my laboratory, and I appreciated his contributions to our work. His time in the JSPS program has been very important for future collaboration with Washington State University.

RESEARCH REPORT

1. Name: Kai Betteridge	（ID No.: SP13101）

2. Current affiliation: University of Bristol

3. Research fields and specialties:

Medical, Dental and Pharmaceutical Sciences

4. Host institution: Kagawa University Medical School

5. Host researcher: Professor Akira Nishiyama & Dr Daisuke Nakano

6. Description of your current research

On the inner surface of all blood vessels is a functionally important surface coating called "glycocalyx" that regulates the interaction of vascular (endothelial) cells with circulating blood. As a PhD student at Bristol University I built and developed a novel *in vivo* single-photon fluorescence microscopy technique for real-time quantification of changes to the endothelial glycocalyx in rat mesenteric microvessels (Figure 1a & B). I demonstrated that glycocalyx structure is disrupted throughout the body in rat models of kidney disease (Figure 1c, d & e), which matches the widespread vascular complications seen in patients.

Figure 1. Endothelial glycocalyx can be quantified in kidney disease. a: pipette inserted in mesenteric microvessel, perfused with cell membrane label (red) and glycocalyx-binding lectin (green), and imaged with confocal microscopy (black panel). b: endothelial glycocalyx structure discerned by electron microscopy of the same vessel. In albuminuric kidney disease, endothelial glycocalyx is significantly thinner.

7. Research implementation and results under the program

Title of your research plan:

An *in vivo* investigation using two-photon microscopy into the potential beneficial effects of restoring endothelial glycocalyx in acute kidney ischemia-reperfusion injury.

Description of the research activities:

Professor Nishiyamas group at Kagawa University have been investigating an acute kidney disease caused by ischemia reperfusion – supply of blood to the kidney is halted for 25 minutes and upon its return for 24 hours an inflammatory process occurs damaging the blood vessels in the kidney and resulting in impaired kidney function. It is possible to then image the kidney using a refined two-photon microscopy technique at this time point and assess blood vessel function. Previous research has shown that treatment of mice with dexamethasone results in an improvement in kidney function. I hypothesized that this improvement was a result in the restoration of endothelial glycocalyx structure and investigated this by developing upon the technique used in Kagawa.

Using a FITC labeled tomato lectin endothelial glycocalyx was imaged structurally in vivo in 3 animal groups; Renal ischemia (n=4), Renal ischemia treated with dexamethasone (n=5) (8mg/kg), and control animals (n=4). These structural measurements were linked directly to functional measurements of plasma flow rate, red blood cell flow rate, leukocyte adhesion, single nephron function, and mitochondrial function. The kidneys were then preserved and harvested for imaging of glycocalyx using Electron Microscopy, and frozen for ex vivo analysis of glycocalyx and kidney function markers using qPCR array technology (all available back in Bristol, UK). The research project has been a complete success and quantitive analysis of the results obtained here in Kagawa will now be required to draw detailed conclusions from this research.

9. Advisor's remarks (if any):

Kai has been quite productive although he has been in the lab for only two months. He is an extremely hard worker and I expect him to have a very successful career working in his field. In addition, this program in JSPS gave an good opportunity for our lab-mate to communicate with him.

RESEARCH REPORT

1. Name: Chandrasekhar Venkataraman	（ID No.: SP13102）

2. Current affiliation: University of Sussex, UK

3. Research fields and specialties:

  Mathematical and Physical Sciences

4. Host institution: University of Osaka

5. Host researcher: Prof. Shigeru KONDO

6. Description of your current research

My research is mainly in the fields of numerical analysis and mathematical biology.

In the field of numerical analysis, I am interested in the derivation and analysis of robust and efficient finite element methods for the approximation of parabolic partial differential equations on evolving domains on surfaces. My results in this area are in the derivation and analysis of finite element methods for reaction-diffusion systems on evolving domains, in collaboration with Lakkis and Madzvamuse (both Sussex) and the analysis of time-discretisations of the evolving surface finite element method, in collaboration with Lubich and Mansour (both Tübingen).

In the field of mathematical biology my research interest are primarily focused on the modeling of biological pattern formation during growth. My results in this area are in the modeling and simulation of cell motility and chemotaxis, in collaboration with Elliott and Stinner (both Warwick) and the modeling of pigment pattern formation during organism growth, with Gaffney, Maini (both Oxford), Sekimura (Chubu, Japan) and Madzvamuse.

7. Research implementation and results under the program

Title of your research plan:

Modelling biological pattern formation on evolving surfaces

Description of the research activities:

I have collaborated with researchers in Osaka in Prof. Shigeru Kondo's lab and researchers in Chubu in the lab of Prof. Toshio Sekimura. With Prof. Kondo we are working on modeling bone morphogenesis. We have proposed a reaction-diffusion mechanism for the dynamics of growth factors promoting osteoclast and osteoblast differentiation that is coupled to an evolution law for the growth of the bone itself. Comparison with experimental data on zebrafish vertebrae morphogenesis appears promising. We are also deriving non-standard reaction-diffusion systems for the purpose of explaining eel pigment patterns. In collaboration with Prof. Sekimura we are attempting to derive a complete model for butterfly eyespot formation. The model we have derived is capable of providing a mechanism for focus point selection and the development of focus points into eyespots

I attended the Osaka University Frontier Biosciences young researchers retreat and presented a poster. I have also given talks at Osaka University and Meiji University.

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

I have had a wonderful time in Japan outside of the research setting and have enjoyed the new and exotic cuisine, the beautiful scenery, castles and shrines and most of all the welcoming kind and generous people.

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Ben Andrew Duffy	（ID No.:SP13103）

2. Current affiliation: University College London

3. Research fields and specialties:

   Medical, Dental and Pharmaceutical Sciences

4. Host institution: Tohoku University

5. Host researcher: Professor Ryuta Kawashima

6. Description of your current research

Status Epilepticus (SE) is the most common neurological medical emergency. It can be defined as a continuous seizure that persists for longer than 30 min. SE is associated with brain injury and the development of epilepsy. The objectives of my current research are to develop imaging biomarkers for treatment monitoring, the prediction of epilepsy and cognitive outcomes following status epilepticus using molecular imaging techniques alongside structural and functional neuroimaging. In the future, methods such as these can be used to test new experimental therapies for protecting the brain against such insults. One such method that we focus on here is based on the use of MRI to observe functional brain networks. This technique promises to be valuable for the prediction of cognitive outcomes following prolonged seizures or other types of brain injury.

7. Research implementation and results under the program

Title of your research plan:

The Effect of Seizures on Functional Connectivity

Description of the research activities:

In this project we test the hypothesis that prolonged seizures disrupt functional connectivity in the brain. The differences in connectivity between subjects that have undergone seizures and control subjects may provide insight into the mechanisms underlying cognitive impairments in epilepsy and could be used to predict the development of the condition. State-of-the-art 7 Tesla magnetic resonance imaging has been performed on both rodents that have undergone seizures and control subjects. Preliminary data analysis suggests that the functional network in subjects that underwent seizures is different to healthy subjects. This is the first demonstration of this technique in a systemic epilepsy model. Further analysis of these data using graph theory and supervised classification will be used to provide insight into the network level mechanisms associated with seizure-induce pathology.

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

Both I and my host researchers at Tohoku University have learned a lot from each other scientifically and culturally. Most importantly we have developed a fruitful scientific collaboration that involves the sharing of knowledge, information and ideas. This will surely continue in to the future. During my stay in Japan I was fortunate enough to visit regions of extraordinary natural beauty such as the Zaō Quasi, Nikkō and Fuji-Hakone-Izu national parks as well as experience cultural events such as the Tanabata Festival in Sendai.

RESEARCH REPORT

1. Name: Graeme Hewitt　　　　　　　　　　　　　　　（ID No.: SP13104）

2. Current affiliation: Ageing Research Laboratories, Institute for Ageing and Health, Newcastle University, Newcastle upon Tyne NE4 5PL, UK.

3. Research fields and specialties:

　Biological Sciences

4. Host institution: Department of Genetics, Graduate School of Medicine, Osaka University, 2-2 Yamadaoka, Suita, Osaka 565-0871, Japan

5. Host researcher: Tamotsu Yoshimori

6. Description of your current research

　The focus of my current research is investigating the link between autophagy and the DNA damage response (DDR) in cellular ageing. To investigate this DNA damage and cellular senescence has been induced using X-Ray irradiation. Following the induction of damage DNA repair has been tracked using both immunofluorescence against DDR proteins and comet assay. Preliminary results indicate that cells lacking autophagy have a reduced but not abolished repair capacity. Further analysis of DNA damage lesions using immunofluorescence has indicated the presence of autophagy adaptor protein p62 at sites of damage. The exact role for this protein at DNA damage lesions is unclear and will be the focus of my subsequent research.

7. Research implementation and results under the program

Title of your research plan:

DNA Damage and Autophagy in Cellular Ageing.

Description of the research activities:

I planned to further investigate the like between the DDR and autophagy adaptor protein p62 using live cell microscopy. I was hoping to express GFP 53BP1 (a DDR protein) and p62 mCherry (autophagy adaptor protein) in Atg 5-/- and Atg5 +/+ cells and induce damage using the UV laaser on a confocal microscope so that I could follow the resolution of damage in real-time. Unfortunately I was unable to optimize this system to induce damage and maintain imaging for a sufficient period of time. Additional experiments were carried out to investigate this protein interaction using H2O2 to induce DNA damage and preforming immunoprecipitation.

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

I have had an excellent time during my stay in Japan. I have been lucky enough to experience many cultural events such as summer festivals in Kyoto, Osaka and fireworks in Kobe. I have been really taken back by the kindness of the members of my lab who have always ensured I have been enjoying myself and have made me feel most welcome.

RESEARCH REPORT

1. Name: Marianne Monteforte	(ID No.: SP13105)

2. Current affiliation: University College London, London Centre for Nanotechnology

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

4. Host institution: Japane Advanced Institute of Science and Technology (JAIST)   5. Host researcher: Shinya Maenosono

6. Description of your current research: The main aim of my current research is to determine the internal structure and morphology of binary alloy nanocrystals, and to determine the structural parameters, speciation and properties of the ligand layer, surrounding these nanocrystals. FePt nanocrystals are a diverse class of magnetic nanocrystals, which exhibit attractive properties for potential applications, from high density data storage devices to biomedical applications. The surrounding acid and amine ligands facilitate the formation of the NP alloy, and stabilises the NPs in their solvent solution. The interaction of the nanocrystal with the functional group of the ligand often critically affects its properties and, in turn the performance, yet there is little known about the way ligands bind and interact with particle surfaces. Through neutron diffraction contrast measurements the atomic structure of the nanocrystal-ligand system and surface properties can be determined which is essential in order to understand and utilise the function of the ligand effectively. We have carried out these neutron diffraction measurements, on isotopic substitutions of FePt nanocrystals with D/H ligands, utilising the Near Intermediate Range Order Diffraction beamline, (Nimrod) at ISIS, Oxfordshire. Data processing of the normalised neutron diffraction data has been carried out using the GudRunN program to give the corresponding pair distribution function (PDF) of the data. The PDF provides quantitative real space information about both the inter-atomic bonding in the nanocrystal and intra-atomic bonding of the nanocrystal with the ligand layer. An advanced PDF nanostructure modelling package, DISCUS, was used to model a nanocrystal of known size and morphology. The resultant calculated PDF from this model was then compared to the PDF of the observed data set, and refined to create a model nanocrystal with an internal structure with the closest representative to the nanocrystal analysed. On completion of the data analysis, the results attained from these on-going neutron diffraction measurements are expected to shed new light on the fundamental properties of nanocrystal-ligands, notably the compositional variations within nanoscale alloys, and enable key applications in medicine and information technologies.

7. Research implementation and results under the program

Title of your research plan:

3D Quantitative Analysis of FePt Nanoparticles by Transmission Electron Microscopy Techniques

Description of the research activities:

FePt nanoparticles of a range of shapes and sizes which were synthesised at the Health Biomagnetic Laboratory. The intended outcome of the proposed research was to elucidate quantitative 3D models of small FePt nanoparticles (<100nm). This is not possible using standard high energy x-ray diffraction analysis techniques due to the limitations with the nanoparticle size, and thus requires the use of advanced TEM (Transmission Electron Microscopy) tomography and scanning TEM (STEM) techniques, available at JAIST. The technique of isolating a single FePt nanoparticle and taking a collation of electron micrographs over a tilt series of $\pm 60°$ with $2°$ increments, was adopted to obtain 61 images of the nanoparticle. 3D reconstructions of FePt octopods, Fig 1a. (20nm), nanocubes (9nm) and spheres (8nm) were successfully obtained using the Hitachi reconstruction software. From these surface and volume reconstructions of the nanoparticles the morphology, presence of surface strain, vacancies and defects within the nanoparticle can be identified. Also, complementary atomic st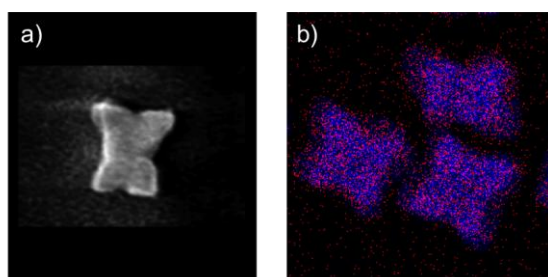ructural information on the periodical arrangements of Fe and Pt within the nanoparticles was achieved through the use of STEM-Energy Dispersive Spectroscopy (EDS) mapping. Fig.1b. Additionally, composition and chemical surface results of these nanoparticles were acquired through the use of ICP-AES (Inductively Coupled Plasma Atomic Emission Spectroscopy) and XPS (X-ray Photoelectron Spectroscopy) analysis.

Fig 1: FePt octopods a) 3D slice b) STEM elemental mapping of Fe (red and Pt (blue)

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

I am very grateful that I was given this opportunity to experience a new culture and working environment through the JSPS research program. Working alongside professionals within the field and being giving the chance to develop new techniques through the direct accessibility to the advanced equipment available at JAIST, has enabled me to further my research and enabled results of publishable quality to be achieved.

9. Advisor's remarks (if any):

Ms. Marianne Monteforte has synthesized FePt nanoparticles with unique structures (cubes, octapods, etc.), and thus, it is quite interesting to directly observe their three dimensional structures using TEM tomography and STEM techniques. Because the sizes of her nanoparticles are rather small, 3D imaging was challenging. Fortunately, however, we could successfully obtained some good 3D images and clarify 3D structures of her samples in combination with STEM analyses. She worked hard and got along fine with our members. I hope she could enjoy her stay in JAIST and be satisfied with experimental results obtained at JAIST.

RESEARCH REPORT

1. Name: James Murray	（ID No.:SP13106）

2. Current affiliation: University of Nottingham, UK

3. Research fields and specialties:

　Engineering

4. Host institution: University of Tokyo

5. Host researcher: Professor Masanori Kunieda

6. Description of your current research

Electrolyte Jet Machining is a useful technique for the realisation of features in difficult to process materials. It is particularly relevant in the field of micro manufacturing. Unlike the more established process of ECM, a pre-shaped tool is not required and material removal takes places in the electrolyte jet which is delivered by a nozzle. Since the jet can be 'scanned' over the workpiece it is possible to selectively process regions of a particular component. Under certain conditions the surface of parts produced in this way can display pore type features, which are difficult to produce under other machining or surface modification processes. To date research efforts have aimed to eliminate these but it is proposed in this work that the surface texture of components can be precisely controlled by electrolyte jet machining. These surfaces have the potential to be used for tribological and biomedical applications for example where cell ingress is required. In this study the surface morphologies of stainless steel, pure copper as well as rolled and heat-treated brass were analysed to understand their dependence on workpiece material microstructure and machining parameters.

7. Research implementation and results under the program

　　Title of your research plan:

　　Micro Textured Surfaces Created By Electrolyte Jet Machining

Description of the research activities:

This research employed a novel manufacturing process called Electrolyte Jet Machining to produce structured surfaces on a variety of metals, which are otherwise difficult and expensive to produce.

As well as using materials from The University of Tokyo, heat-treated materials from Nottingham University were brought to Japan to investigate the influence of material pre-processing on the production of novel surface structures.

A number of EJM parameters was investigated to determine their influence on the size and nature of pores and holes producible on metal surfaces. As well as highly complex surface textures able to be produced using low current densities, extremely smooth surfaces are equally possible on steel and aluminium workpieces. Specifically, roughnesses as low as 10nm Ra were achievable using high current densities– this is better than almost any other machining process.

A regular porous structure, almost impossible to produce by other continuous machining methods, was achieved on a steel workpiece. We believe the size of such pores s dependent on the grain size of the material predominantly, and therefore further work is required to clarify this relationship.

One international and one domestic conference paper were yielded from the summer's experiments, and a larger journal paper is in preparation.

It is expected that the research work will aid the Master's thesis of a student in the Laboratory in the University of Tokyo, and the study has much potential for further development and commercialization, particularly if I am able to return to the lab next year.

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

I am very grateful to the Kunieda laboratory in the University of Tokyo for welcoming me into research life in Japan. I have gotten to enjoy a very different working atmosphere compared to in England. I have a lot of respect for the way in which research is carried out here, particularly regarding the strong nature of the relationship between professor and students, and the team spirit which results.

I have also had an incredible experience living in Tokyo, since I stayed in contact with other summer program fellows throughout the summer, and therefore enjoyed many weird and wonderful experiences.

Japan is clearly a very welcoming place for foreigners, even as is my experience visiting a number of other places across the country. For this reason I would love to return here for a longer period.

9. Advisor's remarks (if any):

Professor Kunieda is currently away at an international conference.

RESEARCH REPORT

1. Name: Andrew Strangeway	（ID No.: SP13107）

2. Current affiliation: Imperial College London

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Waseda University

5. Host researcher: Prof. Martin Guest

6. Description of your current research

My research focuses on the quantum cohomology of Fano vector bundles. Quantum cohomology is a geometric structure which was born out of ideas from theoretical physics. At the heart of quantum cohomology lie Gromov-Witten invariants.   These invariants, roughly speaking, count curves in the space.

A priori there is not an algorithmic method for calculating the Gromov-Witten invariants, and hence the quantum cohomology, of a general space. As such, calculating quantum cohomology is often a difficult prospect. My work reduces the required calculation for the case of Fano vector bundle and provides the remaining data via algorithm.

In my work I make use of some function theoretic machinery: an approach pioneered by Givental.   This dense subject matter has been made approachable in expository papers by Guest. I have been using and developing computer software tools to perform vital calculations (which are not tractable without computer assistance) to implement the theory in examples. I have been in correspondence with Guest about particular computer packages and techniques to implement the machinery.

7. Research implementation and results under the program

Title of your research plan:

D-module structures and quantum cohomology of Fano bundles

Description of the research activities:

During my time in Japan I have been working closely with Guest and sharing an office with other PhD students in the geometry department at Waseda University.   We held regular meetings as well as several research seminars with other researchers at Waseda including a one day research meeting on quantum cohomology held jointly with Kyoto University. In addition I met with Professor Hiroshi Iritani and discussed aspects of my work on which he was able to make useful and insightful comments.   I deepened my understanding of the D-module techniques which Guest uses to study quantum cohomology. In particular I have gained an understanding of a particular normalisation technique which takes a D-module in some general presentation, where it is   unclear that it arises from quantum cohomology, and rotates the viewpoint in order that the quantum nature of the D-module becomes apparent. I have made steps to automate this process in order that we can tackle complex systems which are not easily solved by hand.   My studies in Japan will be very useful for my own project on Fano bundles as well as for a future collaboration with Guest exploring the D-module structures associated with an extension of the quantum cohomology which has been explored in some recent physics papers: Flat connections in Open String Mirror Symmetry; M. Alim. M. Hecht, H. Jockers, H. Mayr, A. Mertens, M. Soroush; arxiv:1111.6522v2   Opening Mirror Symmetry on the Quintic; J. Walcher; arxiv: hep-th0605162v2

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

The students at Waseda were very welcoming and ensured that I had everything I would need to commit research. They were very friendly and interested in discussing culture and language.We discussed etymology and why the word coincide was a combination of 'co' and 'incide', not 'coin' and 'side' and more generally the presence of co in various mathematical terms: co-product, co-algebra, cotangent etc.
We discovered that the Japanese pronunciation of bowl and ball can sound similar, so the distinction between おにぎり and どんぶり became unclear. We discussed the importance of not overemphasising bowl to the point that it become bowel.

RESEARCH REPORT

1. Name: Elizabeth Swanson	（ID No.: SP13108）

2. Current affiliation: University of Bristol

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: Sakurajima Volcano Research Center, DPRI, Kyoto University

5. Host researcher: Masato Iguchi

6. Description of your current research

My PhD project focuses on the infrasound generated by sustained volcanic eruptions. Recent research has demonstrated links between the signals of industrial jets and those recorded during volcanic events (Matoza et al 2009, Fee et al 2010a, 2010b).   If valid, this link offers a scaling law between the peak frequency of the volcanic signal and the plume length scale, which would be of great use in terms of hazard warning and mitigation from a large amount of volcanic ash.   However several key questions remain before such a link can be utilized.

In order to investigate these issues a combined laboratory and field approach has been adopted.   During the first two year of my PhD I performed a series of laboratory experiments, measuring the acoustic signatures of plumes with no pre-nozzle acoustic treatment applied.   Following on from these experiments my work has been focused on developing adaptive beamforming methods which have the ability to erase dominant sources from acoustic recordings and assess the variation of source location with frequency.

During the JSPS summer program my research has been focused on gathering a field dataset to compliment the experimental data.   It is highly plausible that the signals recorded during volcanic eruptions will be a composite of sounds generated by the eruption column and processes at both the vent exit and within the conduit; meaning identification of source region is needed for correct interpretation of datasets.

7. Research implementation and results under the program

    Title of your research plan:
    Insights into volcanic infrasound – A multi array study of Sakurajima Volcano, Japan.
    A minimum of 60 explosive events have been recorded on at least 2 arrays over the study period.
    Preliminary results show the dominant frequencies of these events to be below 10 Hz though higher frequencies are present during the onset phase.
    Significant propagation effects have been seen in terms of high frequency attenuation with distance and differences in amplitudes recorded depending on a stations bearing from the vent.
    For the more proximal array the acoustic onset signal does not appear to behave

according to 1/r decay theory.

Beamforming results locate the sound source at the correct back azimuth for the Showa crater.   For the initial impulse the altitude of the dominant source is below 1 km.   For the Showa crater, altitude .75 km, set into the flank of the Minami-dake peak this source location indicates the vent region as the dominant source of sound generation.

Description of the research activities:

Between the 25/06 and 13/08 infrasound monitoring elements were deployed around Sakurajima Volcano.   Array 1 located at 13.5 km from the active vent was deployed on the 25/06 and comprised of 5 infrasound microphones.   This array had a ground footprint of ~3.5 km and a total vertical spacing of ~500 m.   Array 2 was deployed on the 5/07, ~3.5 km from the vent and was comprised of 4 microbaromers.   The array footprint was ~ 300 m and total vertical extent ~30 m.   Both array's 1 and 2 had direct line of sight of the crater. Array 3 was deployed on the 29/6 at a distance of ~3.5 km from the vent, with a ground footprint ~300 m.   In order to install the array at ARM at trip was made to ASO volcano observatory to retrieve the extra sensors required.   Data have been continuously sampled at 200 Hz over the period of the study.   In addition to the infrasound data, thermal infrared, visual and meteorological data have been downloaded from the in-situ monitoring systems. Scripts have been developed for reading in and calibrating the acoustic data, and this has been done for data up to the data of currently available meteorological data.

A list of explosive events during the study period has been compiled from the email alerts generated by the SVO event warning system.

Initial analysis has focused on optimizing data processing, quality checking of signals and assessment waveform of propagation across the arrays.

An abstract relating to the field campaign has been submitted for the Volcanological Society of Japan fall meeting.

Further to the field campaign, I have attended the IAVCEI 2013 meeting in Kagoshima, Japan and participated in the Volcano acoustics, from installation to analysis workshop.

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

During my time in Japan I have been taken to several local festivals, I think me experience of these events was significantly enhanced by my attending with local people.   I have also experienced very warm Japanese hospitality and enjoyed the local cuisine at restaurants that I could not have found without the company of the workers at SVO.   I have also had the opportunity to travel the length of Japan by bicycle and seen the variation in the country across the different regions.

9. Advisor's remarks (if any):

She has done a good job and a lot of experience in the JSPS Summer program . This will be helpful for her to complete dissertation of PhD.   For further studies, analysis of coda part of infrasound is useful to understand growth process of plume. Are there any link between plume height and characteristics of infrasound? Intensity of onset part and duration of infrasound?   In addition to infrasound associated with vulcanian eruption, is it possible to detect any peculiar infrasound signals, for example, when volcanic earthquakes occur during inflation stages of the volcano.

RESEARCH REPORT

1. Name: James Henry Tutt	（ID No.: SP13109）

2. Current affiliation: The Open University, UK

3. Research fields and specialties:

   Mathematical and Physical Sciences; Engineering Sciences

4. Host institution: Osaka University

5. Host researcher: Professor Hiroshi TSUNEMI

6. Description of your current research:

I am specialist in the use of Charge-Coupled Devices (CCD) and Electron Multiplying (EM) CCDs for X-ray detection in space and terrestrial applications. My current research covers three different areas:

- The use of scintillator coupled EM-CCDs for high energy X-ray detection in medical applications

Silicon based detectors are transparent to the high energy X-rays that are used in medical applications and so scintillators are used to convert the X-ray photons into "clouds" of optical photons that can be easily detected in the silicon-based detectors. Using an EM-CCD for this type of application allows individual photons to be detected as the device can be run at a high frame-rate with small increase in noise. The EM-CCD increases the signal-to-noise ratio.

- Thin filter technology

To use a CCD is space for X-ray detection, a thin filter (made of aluminium) is deposited on the silicon to act as an optical blocking filter. This filter needs to be thin to allow low energy X-ray to pass through the Al and be detected in the silicon. Thin filters have been used in the past, but this work is designed to test the limitations of the available technology.

- Sounding rockets (Off Plane Grating Experiment – OGRE)

This is a technology development project aimed to test the performance of a proposed soft X-ray grating spectrometer instrument that would use EM-CCDs on the focal plane array. The sounding rocket mission will allow a rigorous, in environment, test of the gratings (fabricated at the University of Iowa) that will disperse the X-rays and of the EM-CCD technology.

7. Research implementation and results under the program

Title of your research plan:

Understanding the Soft X-ray Imager (SXI) Charge-Coupled Device camera system on ASTRO-H

Description of the research activities:

ASTRO-H is the next X-ray satellite that the Japanese Aerospace eXploration Agency (JAXA) will launch (2015). The goal of the mission is to understand the fundamental questions of the "hot" Universe. These goals include:

- Measuring the large-scale structure of the Universe and it's evolution
- Understanding the extreme conditions of the Universe
- Exploring the diverse phenomena of the non-thermal Universe
- Elucidating dark matter and dark energy

To answer these questions, ASTRO-H has three instruments. One of these instruments (the Soft X-ray Imager, SXI) is being developed at the University of Osaka and uses CCDs.

The SXI is made up of 4 p-channel CCDs that are controlled and read out using Application Specific Integrated Circuits (ASICs) and Field Programmable Gate Arrays (FPGAs). The CCD readout system is one that I was unfamiliar with, but I have experience of getting several CCDs and EM-CCDs working with low noise across the SXI's energy range (300 eV to 12 keV).   I have spent 2 months learning how the SXI instrument operates in order to provide a critical assessment of the readout electronics and CCD operating method to see if any incremental improvements would be possible.   I have been able to make some suggestions in the ways that the instrument could be optimised which will hopefully lead to an improved scientific yield for ASTRO-H.

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

Living in Japan for 10 weeks has been an amazing experience.   The Japanese people are friendly, welcoming and will go out of their way to help you.   I was lucky enough to travel to several locations in Japan during my stay.   Each area is slightly different but the Japanese people never fail to be friendly.   I have been amazed at the trust people have concerning their personal property with people leaving phones on tables to save seats at lunch.   I can't imagine that happening in the UK.   It has also been amusing to have random people on up to me on the train to comment on my height – "very tall!!"

RESEARCH REPORT

1. Name: Sophie Ward	（ID No.: SP13110）

2. Current affiliation: School of Ocean Sciences, Bangor University, UK

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Research Institute for Applied Mechanics, Kyushu University

5. Host researcher: Naoki Hirose and Katsuto Uehara

6. Description of your current research

My PhD is a palaeo-study (i.e. a study of past climates or of former geological time periods) of the period since the Last Glacial Maximum (LGM, ca. 21 thousand years ago). The title of the PhD project is 'The impact of past and future sea-level rise on shelf sea sediment dynamics'. I focus on the impact of the evolving tides and the hydrodynamics of the northwest European shelf seas on large-scale sediment dynamics. The aim is to enhance model/data comparisons via new data from sediment sequences from the northwest European shelf seas to constrain new palaeotidal model outputs. We are attempting to develop the first geological proxy to reconstruct tidal amplitude, tidal current velocity and dissipation output. Validated and constrained tidal models are powerful tools for predicting the evolution of the European coastline in response to future predicted sea-level change, with clear policy relevance. An understanding of shelf-scale sediment movements, from episodic (storm) events to millennia, is also important for managing coastal flood risk, minimising the impact of marine aggregate extraction and quantifying the marine aggregate resource, and has important implications for benthic and pelagic biogeochemical and biological processes.

7. Research implementation and results under the program

Title of your research plan:

Improving palaeowind datasets for the Northwest European shelf seas: a new technique.

Description of the research activities:

Through this summer project we aimed to improve existing palaeowind datasets for the northwest European shelf seas, which were previously of limited spatial- and temporal scales. We have developed a methodology for using low resolution (both temporal and spatial) outputs from palaeo global climate models as input forcing for a higher resolution regional model. We first developed and validated a present-day atmospheric model for the region. It was then possible to iteratively add the palaeo-climate factors such as ice height and changes to sea levels and finally changes to the global palaeo-winds were considered. This last step was the key progression from previous works. It is the first time that these wind datasets have been developed with the intention of using the outputs to subsequently force a wave model. The results suggest that there have been considerable changes to palaeowinds; hence it is important to consider such changes and thus the existing method of using present-day winds to model past wave climates is limited.

In addition to working with my hosting researchers at Kyushu University, I had a very informative visit with a group at the Ocean and Atmosphere Research Institute, (University of Tokyo). There I was able to communicate and with other experts in the field, through various meetings and presenting my work-in-progress. This palaeowind dataset will be used as input in a palaeowave model, which can be coupled with a palaeotidal model; development of the latter is the focus of my PhD. Palaeowave modelling techniques are in their infancy, and the outcomes of this project are fundamental to the first attempt at running palaeowave simulations with palaeowind forcing.

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

I would like to thank JSPS for the opportunities presented to me through being a fellow on the JSPS Summer Programme 2013.

RESEARCH REPORT

1. Name: Georgina M. Aisbitt	（ID No.: SP13111）

2. Current affiliation: University of Oxford

3. Research fields and specialties:

   Social Sciences

4. Host institution: Kwansei Gakuin University

5. Host researcher: Professor Sadahiko Nakajima

6. Description of your Current Research

     Associative learning theories describe how memory and learning combine to influence behaviour. There is considerable scope for explaining how individuals vary and potentially understanding when experience contributes to dysfunctional or maladaptive behaviour. My PhD is concerned with these individual differences in learning, in particular the variability in cognitions associated with psychopathy.

     Originally outlined by Cleckley (1941), Psychopathy is defined on the basis of sixteen behavioural characteristics, which include aspects of disturbed emotional processing, e.g. lack of empathy, and poor behavioural control, e.g. failure to inhibit a dominant response (Howland et al., 1993). There is increasing focus on this poor inhibition and its implication on symptoms of psychopathy; poor behavioural control and weak inhibition are even used as diagnostic markers, for example, in Hare's Psychopathy-Checklist (Revised; Hare, 2003). Newman and Kosson (1986) showed that psychopaths made significantly more errors of commission (responding when they shouldn't) then errors of omission (not responding when they should).

     The disparity in psychopaths EoC and EoO rates suggests a bias in positive association formation, meaning psychopaths might learn when to respond more easily than when not to respond. If this were true, differences would be seen in: Superconditioning, when learning is facilitated by pairing the stimulus with the outcome in the presence of a previously established inhibitor (Rescorla, 1971); and Blocking, when learning about a stimulus-outcome relationship is impaired because the stimulus has already been paired with a different outcome (Kamin, 1969).

     Therefore, my research focuses on obtaining a greater understanding of cue interaction and the role this plays in the process of inhibition, relative validity and causal judgments. The impact of other variables on these processes will be considered, with studies focusing on the role of motivational glucose, something shown to relate to self-control (Sanders et al., 2012). In addition, the research will consider the failure of inhibition in psychopaths through the associative mechanisms that underlie inhibition and self-control. It will also seek to explore potential differences in relative validity effects and causal judgments occurring in individuals with a psychopathic personality disorder. Together these studies with other work focused on attention, will explore the manner in

which altered inhibition, attention and learning might produce the behaviours associated with psychopathy.

7. Research implementation and results under the program

Title of your research plan:

Behavioural Control and Causal Judgements: Associative Explanations and Factors Affecting These

Description of the research activities:

Sixty-four University students participated in the study and completed four tasks: 1. A variant of a Go/NoGo task was developed to incorporate Superconditioning and Blocking learning procedures. This allowed assessment of behavioural inhibition and differences in the prevalence of errors of commission or omission; 2. A Contingency Judgment task to assess participants perceived effect of their actions on causing an outcome. Contingency densities were manipulated so that all participants experienced a high and a low-density outcome condition; 3. Psychopathic Personality Inventory Japanese version (PPI-R; Yokota et al., 2012), a 154 item self-report questionnaire assessing psychopathic personality disorder; 4. Empathy Quotient Japanese version (EQ; Wakabayashi et al., 2007), a 60 item self-report questionnaire that assesses cognitive empathy.

Results showed that individuals in the high PPI-R group made significantly more errors of commission than omission in the Go/NoGo task, $t(17)=2.353$, $p=0.031$. The low PPI-R group did not show this difference, demonstrating the high PPI-R group's poor behavioural inhibition. There was a significant interaction between associative process and cue type on the ratings that participants made in the Go/NoGo task, which indicated both Superconditioning and Blocking were induced, $F(1,63)=9.425$, $p=0.003$. Reaction time showed no indication of Superconditioning or Blocking, suggesting a disparity between behavioural measures and judgments. There was no significant interaction of PPI-R group with either Superconditioning or Blocking, suggesting the measure was not sensitive enough and needs to be adjusted.

There was a significant main affect of contingency density, demonstrating a clear outcome density bias, something consistent with previous research. Comparison of the Japanese sample EQ score to a previously collected British sample showed the Japanese sample had significantly lower Empathy Quotient scores, $F(1,59)=11.707$, $p=0.001$.

9. Advisor's remarks (if any):

Georgina's research provides an important bridge between basic laboratory studies on associative learning and applied fields (especially in pathological and cross-cultural psychology). Georgina has been very active not only in laboratory activities but also in soaking up Japanese cultures, leading to future success in her research field.

RESEARCH REPORT

1. Name: Robbie James Bennett	（ID No.: SP13112）

2. Current affiliation: Cambridge University, UK

3. Research fields and specialties:

    Mathematical and Physical Sciences

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

5. Host researcher: Hideyuki Murakami

6. Description of your current research

My current research aims to look at the effectiveness of metallic coatings, applied to nickel based superalloy substrates, which are used in gas turbines (jet engines). My research is sponsored by the engine manufacturer Rolls Royce.

I use many experimental characterisation techniques to try to understand the thermo-mechanical stability of these coatings, under extreme environments, where temperatures can exceed 1000ºC. Characterisation of oxide scales and coating phase transformations can be achieved through the use of XRD and SEM/EDS/WDS. Sub nanometer scale resolution can be obtained using transmission electron microscopy, which is required for probing the crystal structures of oxides that have grain sizes of a few tens of nm.

My research also contains a modelling aspect, which allows me to gain an understanding of the interaction between atoms within my material. First principles ab-anitio density functional theory calculations, using the CASTEP program, have allowed me to simulate diffusion processes within these intermetallic coating phases, in order to better understand the phenomena observed experimentally.

7. Research implementation and results under the program

    Title of your research plan:

    Sample preparation and high resolution examination of thermal barrier coatings, by Focussed ion beam lithography and Transmission electron microscopy.

Description of the research activities:

My research at NIMS was primarily aimed at achieving a reliable technique to manufacture TEM specimens, using the FIB lift out technique. As I am interested in observing the interface between a metal and oxide, FIB has so far proven tricky, as residual stresses, accumulated during cooling as a result of the different thermal expansion coefficients between oxide and metal, cause the specimen to bend upon thinning, rendering it useless for examination under the microscope.

With the help of the research technicians at NIMS, we successfully managed to manufacture four TEM specimens, using a slightly different FIB technique to the one I had previously used. I then was allowed to observe my samples using one of the world's most powerful microscopes, a multi-million dollar, spherical aberration corrected TEM manufactured by JOEL. With this TEM atomic resolution is possible, both using imaging and using elemental mapping (energy dispersive x-ray spectroscopy). Unfortunately the specimens that we had made, were not quite thin enough to achieve atomic resolution however some very useful insights into the nature of the interface between metal and oxide were gained. One of which is that there appears to be a orientation relationship between the oxide and the metal, that is, the oxide has a preferential growth direction that matches crystallographically with the substrate. While this phenomena has been previously predicted, there has been very little experimental evidence to support it.

While also at NIMS, I had the opportunity to conduct some theoretical work , using density functional theory, to predict the site occupancy of Silicon additions to a Laves phase, a complex metallic structure, that is known for being strong at high temperatures. We previously knew that if you add Si to this phase, it strengthens it against transformation at higher temperatures ,which is otherwise a problem. However, we did not know where the Silicon likes to 'sit' within the structure. Using DFT I could show that the Si atom interacts with the neighbouring Cr atoms in the structure, forming what is known as orbital hybridization, a phenomena often seen in Carbon. This hybrid orbital actually raises the energy of the Si and makes it unfavourable in this position. This argument was put forward to back up the results of experimental work that my co-author had obtained.

8. Please add your comments, including any cultural experience during your stay in Japan (if any):
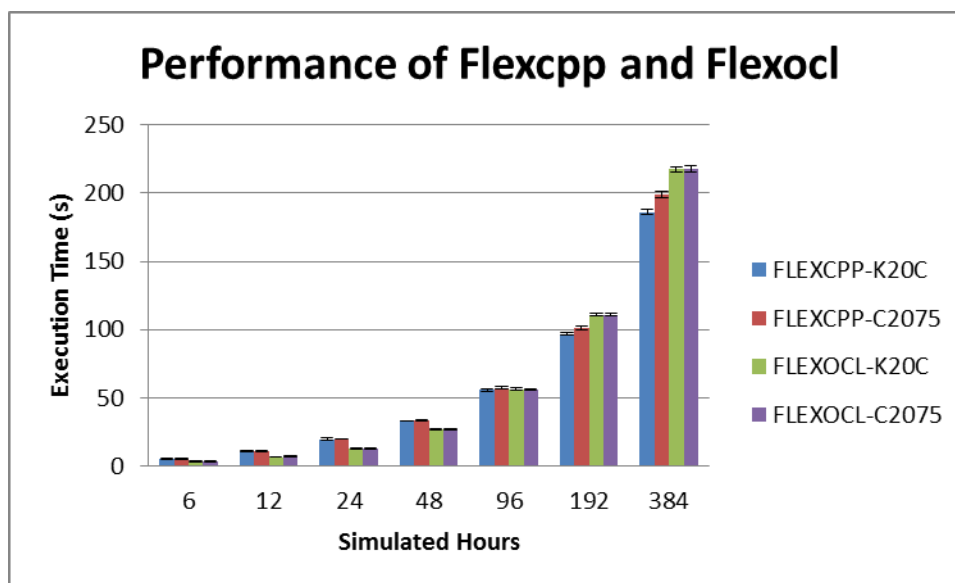
During my stay in Japan I found that the Japanese people are incredibly friendly, polite and helpful. They are a model for the rest of the world to follow in that regard. I also visited Tokyo on many occasions, and find it a beautiful and very interesting city. Hakone and the natural onsen there are also very nice and if you are lucky on a clear day you can see Mt. Fuji!

RESEARCH REPORT

1. Name: Paul Harvey	（ID No.:SP13113）

2. Current affiliation: University of Glasgow

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: University of Aizu

5. Host researcher: Prof Saji Hammed

6. Description of your current research

I am currently exploring linguistic approaches to parallelisation, distribution, and adaptation of software

7. Research implementation and results under the program

   Title of your research plan:

   Performance Increase and Extension of Existing Particle Dispersion Model

   Description of the research activities:

   It is currently possible to simulate the movement of particles through an atmosphere using mathematical models. These simulations are computationally intensive, highly repetitive, and take a long time to run.

   During my time at the University of Aizu, I have been rewriting an existing simulator known as *Flexcpp* to use a new software technology known as *OpenCL*. Flexcpp currently uses *CUDA* to run certain calculations on an external accelerating device –e.g. a graphics card. CUDA is only compatible with a single company's hardware. Conversely, OpenCL enables many different companies computing devices to be used with a single piece of software, thus enabling greater use of the simulation software in the climate research community. The new simulator is known as *Flexocl*.

   Flexocl also includes the ability to model radioactive decay. This means that the

relative concentrations of radioactivity of released particles can now be calculated as the simulation progresses, as well as visualized, in addition to the particle's position
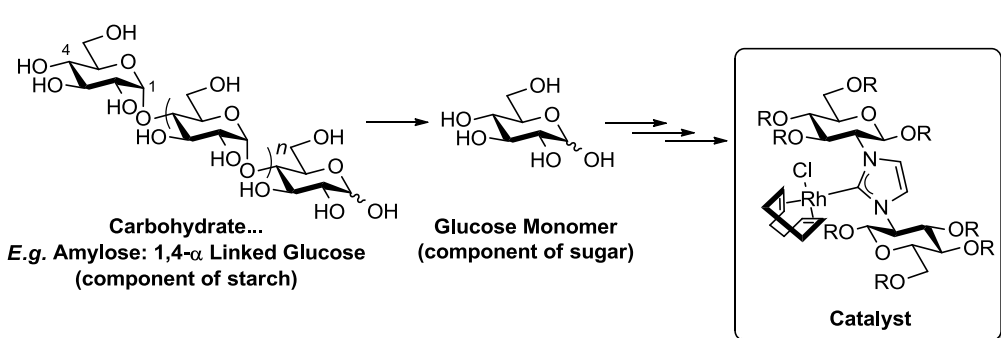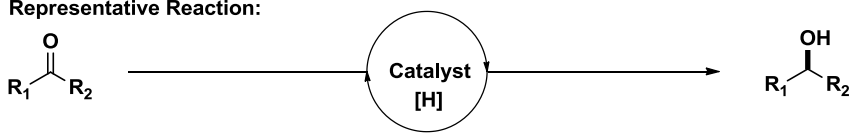
.

By comparing the relative performance of Flexcpp and Flexocl on the same simulation we see that for smaller simulations Flexocl performs better, however for larger simulations, Flexcpp performs better. Further work is required to explore this issue, and optimize further. Additionally, further features can now be added to the simulator to increase the realism offered by the simulator. One such feature, *dry deposition of matter*, is currently half implemented.

Performance of Flexcpp and Flexocl

Execution Time (s) vs Simulated Hours

Legend:
- FLEXCPP-K20C
- FLEXCPP-C2075
- FLEXOCL-K20C
- FLEXOCL-C2075

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

During my stay in Japan I have been lucky enough to sample many cultural delights. Apart from the varied and delicious mix of foods, I have visited many temples, and onsen. I have been taken by friends to Izakaya, matsuri, and tea ceremonies. I have travelled around the Fukushima area, and now plan to travel in the more southern areas of Japan with my partner. I am very grateful to JSPS for the opportunity to do interesting research, and explore Japan.

RESEARCH REPORT

1. Name: Alexander Henderson	（ID No.: SP13114 ）

2. Current affiliation: The University of Bristol (UK)

3. Research fields and specialties: Chemistry

4. Host institution: Kyoto University

5. Host researcher: Professor Seijiro Matsubara

6. Description of your current research

Carbohydrate Based Nitrogen Heterocyclic (NHCs) Carbenes for Asymmetric Catalysis

Carbohydrate...
E.g. Amylose: 1,4-α Linked Glucose
(component of starch)

Glucose Monomer
(component of sugar)

Catalyst

Representative Reaction:

Carbohydrates are ubiquitous throughout nature and all biological systems, and are involved, not only as a source of sustenance for most living organisms, but for immensely complex interactions on the biochemical level. From an organic chemist's perspective, individual carbohydrate monomers (known as saccharides *e.g. glucose* - see above), contain precisely defined atomic structure that is seldom seen in other molecules. Their abundance and diversity - many glucose related scaffolds exist - make them a desirable resource to control 3D environments in synthetic chemistry. My project involves employing saccharides to create transition metal NHC catalysts *via* a short synthetic sequence to stabilise and modulate various properties (see above *catalyst* for an example). We can take these catalysts and subject them to a broad range of reactions to see how they compare to other protocols in aspects such selectivity *i.e.* control of 3D environment, or otherwise known as asymmetric induction (see "*Representative Reaction*"). In the future novel reaction development will be a major goal.

7. Research implementation and results under the program

Title of your research plan:

Studies Towards an Asymmetric [2+2+1] Nickel Catalysed Cycloaddition of an Alkyne, Acrylate and Isocyanate for the Synthesis of Enantioenriched γ-Lactams.

Description of the research activities:

In 2010 Mutsubara and Kurahashi and co-workers published an efficient method for the expedient construction of γ-lactams. This one step procedure to afford complex pharmacological type heterocycles (**4**) from simple unsaturates, would be greatly enhanced by having an asymmetric variant.

Representative Reaction
(Matsubara and Kurahashi *et al. Chem. Commun.*, **2010**, *46*, 8055)
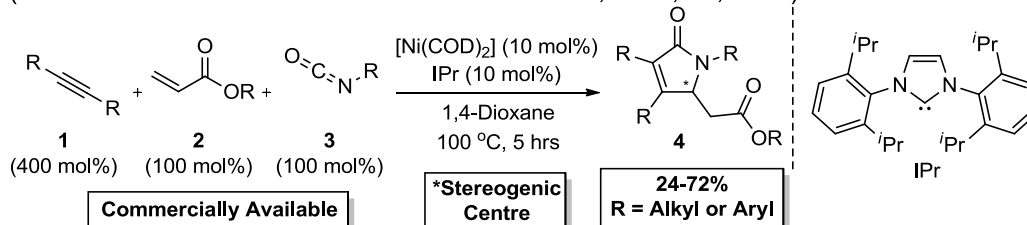
Eleven easily accessible (commercially available or several synthetic steps) NHCs were screened. The results of the two homochiral NHCs to prove active in the target reaction are displayed.

3.9%, e.r. 43.5:56.5   5.7%, e.r. 45.3:54.7
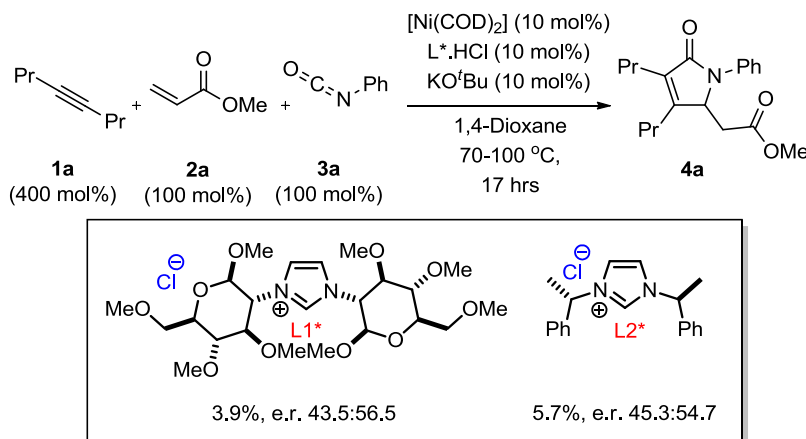
The isolated yields of **4a** are poor and the asymmetric selectivity (enantiomeric ratio, e.r.) is low, however it is possible to slightly bias the ratio for a particular enantiomer. To the best of our knowledge no enantioselective Ni NHC catalysed transformations have been reported. These results serve as proof of concept.

RESEARCH REPORT

1. Name: Michelle Montgomery	（ID No: SP13115）

2. Current affiliation: University of Bristol

3. Research fields and specialties:

   Chemistry

4. Host institution: Kyoto University

5. Host researcher: Professor Fumiyuki Ozawa

6. Description of your current research

The biaryl moiety is a ubiquitous structural frame in many pharmaceuticals, agrochemicals and materials, e.g. Celebrex, an anti-inflammatory drug used for the treatment of arthritis; Boscalid, a commercial fungicide; and polythiophenes, conjugated polymers with potential applications in photovoltaic cells.

Celebrex   Boscalid   Polythiophene
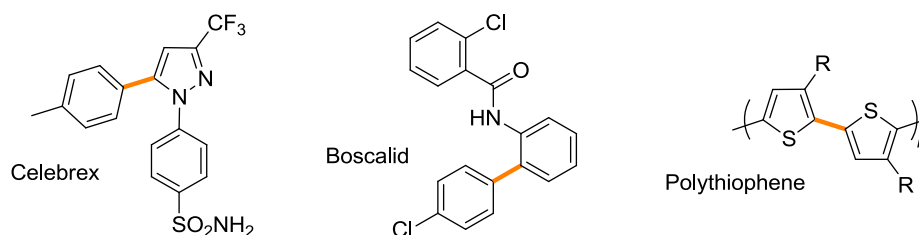
Currently, these compounds are made via transition metal catalysed cross coupling reactions, however, these methods necessitate the use of organometallic reagents. This generates toxic, often avoidable, waste. An efficient, atom economical alternative strategy is to couple the parent hydrocarbon directly with an alkyl halide (so-called direct arylation).

Traditional Cross-Coupling

M = metal
e.g. magnesium, boron, tin   X = halide   MX

Direct Arylation

Unactivated hydrocarbon   HX
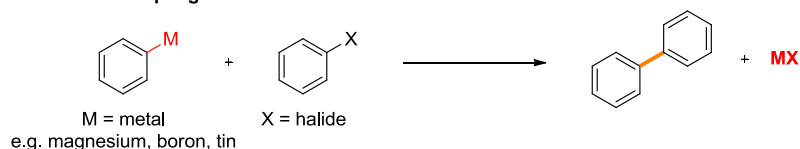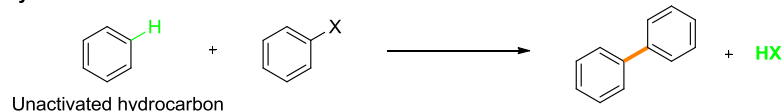
My focus at Bristol University has been on developing new ways to control the selectivity of C-H functionalisation (of which direct arylation is a subsection) in order to synthesise complex molecules with potential pharmaceutical activity in an efficient, elegant manner.

7. Research implementation and results under the program

Title of your research plan:

Investigation into the effects of phosphine ligands in palladium catalysed direct arylation polymerization. (Once the mechanism and driving forces behind the reaction are understood the system may be modified to remove current limitations and make it more applicable to real life targets e.g. the synthesis of organic solar cells.)

Description of the research activities:

Arylpalladium acetate complexes **I** and **II** were synthesised and crystals suitable for X-ray structural determination were sought. A suitable system to measure the rate of direct arylation using complexes **I** and **II** was established and results indicate that **I** was not only faster but also more selective than **II**.

I

II
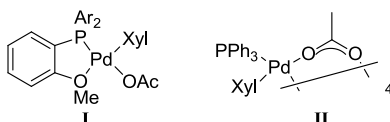
The behaviour of **I** in solution was investigated using infrared spectroscopy. It was found that in solution there exists an equilibrium between the complex bearing monodentate acetate (**Ia**) and the complex bearing bidentate acetate (**Ib**). The position of the equilibrium is not yet known thus both are potential starting points for the catalytic cycle.

Ia (unidentate acetate)   Ib (bidentate acetate)
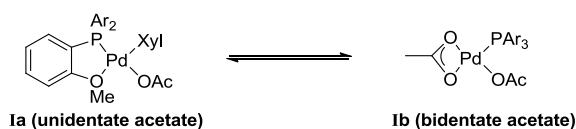
Lastly, computational calculations to help elucidate the reaction mechanism and help identify the catalytically competent species (**Ia** or **Ib**) were initiated.

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

The summer programme has been both academically and culturally rewarding. My personal highlight was staying in a traditional Japanese inn with my group members and being able to experience tradition and customs alongside natives. Additionally I was able to attend both Gion Matsuri and Tenjin Matsuri which were spectacular to witness.

RESEARCH REPORT

1. Name:Neil Venables	（ID No.: SP13116）

2. Current affiliation: University of Warwick

3. Research fields and specialties:

Biological Sciences

4. Host institution: RIKEN Quantitative Biology Centre (QBiC)

5. Host researcher: Yasushi Okada

6. Description of your current research

The microtubule cytoskeleton is essential for establishing and maintaining the dynamic architecture of all Eukaryotic cells. Perhaps foremost among these processes is its role in the assembly and function of the spindle, a complex microtubule machine that is responsible for the separation of chromosomes during mitosis. Individual microtubules are polar, helical polymers composed of the protein tubulin. Microtubules explore the intracellular space of cells by undergoing alternating phases of elongation and rapid shortening. In cells, the growing plus-end of microtubules binds a large number of plus-end tracking proteins (+TIPs) that regulate microtubule dynamics or mediate interactions with other cellular structures. +TIPs are crucial for the ability of microtubules to rapidly reorganise in relation to events such as cell division, polarisation and differentiation.

My PhD research seeks to understand the molecular mechanisms by which TOG-family microtubule polymerases influence the exchange of tubulin subunits at the dynamic tips of microtubules. These proteins have diverse roles in regulating microtubule assembly and organization, with characterised members in all major Eukaryotic kingdoms. We have purified Alp14, a +TIP protein in *S. pombe*, that accelerates the on-rate of GTP-tubulin heterodimers at the growing microtubule plus-end by up to 10-fold. We find that the polymerase activity of Alp14 is specific to *S. pombe* microtubules and it does not accelerate the growth of mammalian brain microtubules *in vitro*.

7. Research implementation and results under the program

Title of your research plan:

Catalysis of microtubule growth at the single-molecule level

Description of the research activities:

The laboratory of Cell Polarity Regulation at RIKEN QBiC focuses on *in vitro* studies of single molecular motors. Using a combination of single-molecule imaging, gene manipulation and structural biology techniques they seek to understand the intracellular functions and regulatory mechanisms of these proteins.

During my time at QBiC in Dr. Okada's lab, my time was focused on learning the single-molecule imaging techniques necessary to measure the molecular properties of my purified +TIP proteins. Initial work involved establishing the conditions necessary to re-constitute microtubule dynamics *in vitro*. This involved learning new techniques for glass preparation of flow cells and the immobilisation of microtubules to a variety of surfaces. With the help of the Okada Lab, many practical issues such as non-specific binding and protein aggregation where overcome during this stage.

The imaging of single molecules of protein also presented many further practical challenges. Optical signals from single molecules or labels are extremely weak and thus can be easily drowned out in a noisy background. I was given the opportunity to explore a range of probe types and labeling strategies for each of my proteins. The lab provided invaluable help and advice on labeling, methods and instrumentation calibration. Furthermore, I received training in the use of their in-house software for the analysis of single-molecule trajectories and guidance on their statistical analysis.

Although all my experiments are not complete, I was successful in learning the technique of single-molecule imaging and have confidence that I can recreate the assay back in the UK.

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

I am grateful to the opportunity provided by the JSPS to participate in this program. The experience of working in a foreign laboratory has been a unique and challenging experience. I have learnt a lot about Japanese laboratory culture both it terms of its values and practices. I particularly enjoyed making many new Japanese friends and learning about their culture. I have fond memories of the many meals we shared.

During my weekends I visited many cities and historical sites: Nagoya, Kobe, Osaka, Nara, Kyoto, Awaji-Island, Todai-ji, Kofuku-ji, Kinkaku-ji, Gion Festival, Tenjin Maturi festival.

I have thoroughly enjoyed my stay in Japan. I am particularly grateful to the members of the Okada Lab for the generous hospitality and I hope to get the opportunity to collaborate with them again in the near future. I look forward to returning to Japan!

RESEARCH REPORT

1. Name: Michael Whiteley　　　　　　　　　　　　　（ID No.: SP13117）
2. Current affiliation: Loughborough University
3. Research fields and specialties: 　Engineering Sciences
4. Host institution: University of Yamanashi, Fuel Cell Nanomaterials Centre   5. Host researcher: Prof Hiroyuki Uchida / Prof Donald Tryk
6. Description of your current research Hydrogen fuel cells are becoming more and more feasible to commercialise in automotive applications. The only remaining hurdles are; Infrastructure, Cost and Reliability. My research is looking into developing accurate reliability models of Polymer Electrolyte Membrane Fuel Cells (PEMFCs) to try to predict lifetime, and ascertain key areas of improvement in a PEMFC system. Current efforts in fuel cell reliability are under-developed and require improvement. As such, a full reliability study has been commenced from scratch. Failure Mode and Effect Analysis (FMEA) and Fault Tree Analysis (FTA) were conducted to logically map out the possible degradation and failure phenomena that can affect a PEMFC. After this analysis, it was found that there are numerous intricate relationships and interactions between components, failure modes and operating conditions in a PEMFC. Therefore different reliability modeling techniques need to be assessed, such as Markov Modeling, Petri-net analysis and Monte Carlo simulation. These methods will be analysed for their feasibility of use to construct an accurate reliability model of a PEMFC.
7. Research implementation and results under the program 　　Title of your research plan: 　　Fact checking and further development of proposed failure logic, with experts from each PEMFC physical component area (Catalyst, Gas Diffusion Layer, Bipolar Plate, Membrane, Gaskets/Seals).

Description of the research activities:

My current research involves the reliability analysis of polymer electrolyte membrane fuel cells. Techniques used previously have included; FMEA & FTA. The results of these previous efforts were checked over with experts in hydrogen fuel cell degradation analysis in the Clean Energy Research Center and the Fuel Cell Nanomaterials Center of the University of Yamanashi (UY). Recent findings by these Centers have proven invaluable to the modification of my work to make it more accurate in predicting lifetimes of PEMFCs.

Additional work has included a detailed shadowing of researchers in the Centers. This involved learning how the Centers construct their fuel cells; from catalyst ink preparation, to single cell fabrication. JARI cells were constructed, and performance analysis was undertaken, such as cyclic voltammograms (CVs) and polarization curves. It was learnt that the very act of taking CVs degrades the fuel cell.

Working in a small research group has opened up an opportunity for future collaboration with the theoretical physical chemists at UY. Discussion has been had regarding a joint research project using a Professor at UY's polarization curve-fitting modeling approach in reliability simulation by myself, or future PhD/RA's at Loughborough University.

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

The Japanese cultural experiences from the home-stay were invaluable, with visits to shrines, temples and traditional food shops proving very enjoyable. Socialising with university students was also a great opportunity to experience Japan and its culture.

9. Advisor's remarks (if any):

Michael Whiteley has carried out very interesting work regarding the reliability analysis of fuel cells. I hope that future collaboration work between scientists in Loughborough University and our research group certainly contributes to understand the degradation mechanism of fuel cells.   Hiroyuki Uchida, Professor, University of Yamanashi

Members of the Fuel Cell Nanomaterials Center MEA (membrane-electrode assembly) Division and Theoretical Division have had several good discussions with Michael regarding areas in which our interests overlap, particularly in analyzing degradation and failure of the polymer electrolyte fuel cell.   He has also had several laboratory sessions with researchers and students in which he has observed first hand how various fuel cell components are prepared.   Of particular interest to me is the opportunity to collaborate with Michael and other members of the Loughborough University group, making use of our model-independent performance curve analysis technique, which can provide a means to obtain more detailed information on the degradation and failure processes.

Donald A. Tryk, Professor, University of Yamanashi

RESEARCH REPORT

1. Name: BERTHOUX Karine	（ID No.: SP13201）

2. Current affiliation: Jean Moulin Lyon 3 University

3. Research fields and specialties:

   Social Sciences

4. Host institution: Keiô Gijuku University

5. Host researcher: Professor NAKAJIMA Keiichi

6. Description of your current research

    Popular literature directly addresses messages to the mass population and, in the case of Japan, specifically to workers: *sarariman*. The *Ninpô shôsetsu* (Cécile Sakai, 1987), novels centered on *ninja*, met a big success to adults from 1956 to the 70s.

    Even if *ninja* are still present in roman and *manga* today, all the productions were mainly intended for children and teenagers since the 70s. So why during 15 years were *shinobi*'s novels as such success to Japanese adults? SHIBA Ryôtarô lately said about his novel that it's not a "jidai shôsetsu" (period fiction) but a "gendai shôsetsu" (contemporary fiction) which talks about the 50s. Which messages and representations do they give to readers, to make them deeply loving those stories, at a time of society changed and what does it teach us on Japanese Showa's history?

    For that research, I am using 4 novels, published in magazines and newspaper, from Gomi Kôsuke, Shiba Ryôtarô, Yamada Fûtarô and Shibata Rensaburô. At this level of study, some important points, topics can be seen.

    At first, depending on writers and their messages s*hinobi's* image differs but we can still find common points. In each story, the borders which define *ninja* are not clear, between humans and monsters, and although among *ninja* and *samurai, which* wrap personages of mystery.

    Furthermore, those stories show an important marginalization which clearly passes by Marxism ideologies and classes struggle. *Ninja* also represents less a kind of warrior than a group, outlawed from society. More than martial arts masters, they are firstly described as a group of people leaving on their own and apart of the world, as a marginal group. But do they choose to be so or is it the society which excludes them?

    Another point is that the world of those shadows warriors is characterized by violence and contestation, which is more obvious since we approach the 70s. The main idea is the refusal of "sacrifice", whether it is economic, political or societal, in a more and more individualistic world. That gives us ideas onto the concerns of the society and the growing will of violence in the mass population.

    Finally*, Shinobi* constitute an important part of Japanese History that authors deeply studied before writing. All stories take place around the *Sengoku* area (end of 16th)*,* known for its big societal changes and its wars. We can easily see the link between both societies. Besides, we can find plenty of Japanese symbols and traditions willingly describe in those stories. All of that shows an important nationalism which seems to be rather nostalgic than ideological.

7. Research implementation and results under the program

Title of your research plan:

Sources and documents' search

Description of the research activities:

These two months gave me the opportunity to fine important information about writers, readers, novels' publications and modern history. Almost every planned searches were done.

My main work was to find sources about 1955-1965's readers and there point of view. I contacted current director of magazines and newspaper as well as museums but unfortunately, nobody had such documents. However, I was still able to obtain other information about writers and publications.

I went in the Shiba Ryôtarô memorial museum in Osaka where I found good documents.

I also pursued the list of all the *shinobi*'s novels and all the articles published using the term of "*ninja*" in another context to understand the importance of the *ninja*'s image.

Studying the <u>*Shisô no Kagaku*</u> revue allowed me to discover a lot of important information on the contemporary area, the popular literature at that time and on *ninja*'s novel.

To finish, Keiô university library provided me a lot of references books on all the topics I needed. I found information on History, writers, Japanese cultural and tradition symbol…

Finally I obtained more precious documents and sources than I expected. It was a very precious time for the good realization of my thesis.

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

Even if it was not for me the first time to come and live in Japan, I still was able to enjoy new cultural experiences. Since I had to travel for my research, I visited Kanazawa. I also went to Gion Narita Festival, A-Bon Odori Festival in Hibiya and appreciated Japanese fireworks with the Odaiba Hanabi. I deeply enjoyed Japanese summer, culture and tradition.

9. Advisor's remarks (if any):

Thanks to my advisor I was able to meet important people who gave me information I needed for my research. He helps me a lot and made me confortable since the first day. I'm really grateful to him for these two months. It was an honor and a pleasure.

RESEARCH REPORT

1. Name: Aude DELAGARDE	（ID No.: SP13202）

2. Current affiliation:

LAAS-CNRS, Toulouse, France

CIRIMAT, Toulouse, France

3. Research fields and specialties:

   Chemistry   Engineering Sciences

4. Host institution: RIKEN Quantitative Biology Center (QBiC), Kobe

5. Host researcher: Dr. Urs FREY

6. Description of your current research

Sensors and actuators are important to allow machines to communicate with the environment. New applications, such as continuous, real time medical diagnosis need highly sensitive sensor devices. Nanotechnology can be used to improve the sensitivity and enlarge the domain of possible detection schemes. One of the most promising nanomaterial is carbon nanotubes (CNTs). CNTs are cylindrical molecules consisting of only carbon atoms with the dimensions in the nanometer (10^{-9} m) scale. They combine interesting physical and chemical properties and can be used for sensing purposes.

The goal of my PhD work is to develop gas and biological sensor devices based on double walled nanotubes (DWNTs), a kind of CNTs with two walls, one inside the other. To enhance the sensibility of DWNTs, they can be functionalized with e.g. amino-groups and oxidized groups. Then, by a combination of top-down and bottom-up fabrication technologies, arrays of nanosensors using DWNTs devices can be fabricated. By an electrical measurement of the conductance of the differently functionalized DWNTs devices, target molecules in the gas and liquid phase can be detected.

At the Frey Initiative Research Unit at RIKEN QBiC, my research focuses on a strategy to use and integrate DWNTs that were synthetized and functionalized in France. The aim of the project is to integrate thousands of DWNTs nanosensors into an integrated chip fabricated in complementary metal oxide semiconductor (CMOS) technology. Typical problems with CNTs nanosensors are the high variation in the sensing properties due to the nanoscale fabrication process. The CMOS system is capable of screening the properties of each individual nanosensor, choosing the functional ones and excluding the defected ones. Ultimately, this system will be used for the detection of specific molecules.

7. Research implementation and results under the program

Title of your research plan:

Integration of Carbon Nanotubes for Next Generation Electronic Sensing Devices

Description of the research activities:

The goal is to integrate functionalized DWNTs between two electrodes using a dielectrophoresis protocol coupled with capillary assembly (DEP-CA). Basically, an alternating electric field gradient is created between two electrodes with a waveform generator. A droplet of DWNTs suspension is then pulled in the direction of the field and over the gap between the electrodes.

First, several parameters for the DEP-CA were investigated. For the DWNTs suspensions, we focused on the concentration and the way of dispersion (combination of sonication and centrifugation). We adjusted also the frequency and the voltage of DEP, the speed of CA, etc.

After the assembly by DEP-CA, the samples were characterized by scanning electron microscopy (SEM) and atomic force microscopy (AFM). With these techniques, we have access to the topography of the sample's surface at the atomic scale, i.e. we can see where the DWNTs are localized, if they are dirty (with a lot of surfactants on it) or not, and measure their diameter and their length.

Finally, we were able to start conductance and current/voltage (I/V) measurements of the samples.

The project between RIKEN, LAAS-CNRS and CIRIMAT will continue.

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

I met wonderful people in Kobe, and together we enjoyed visiting cultural and historical sites (Kobe, Himeji, Osaka, Kyoto, Nara), eating amazing food (Natto, Akashiyaki, Shabu-shabu, Okonomiyaki, and so on), and seeing gorgeous fireworks!

I felt my first earthquake at the lab but it was brief and not strong (luckily).

Everyday was an adventure! I hope I will return soon!

RESEARCH REPORT

1. Name: GAUVIN Cécilia	（ID No.: SP13204）

2. Current affiliation: Laboratory of Mechanics and Civil Engineering, UMR5508, Montpellier University 2

3. Research fields and specialties:

Mathematical and Physical Sciences, Engineering Sciences, Interdisciplinary and Frontier Sciences

4. Host institution: Laboratory of Biomaterials Engineering, Graduate School of Life and Environmental Sciences, Tsukuba University

5. Host researcher: Eiichi OBATAYA

6. Description of your current research

Many wooden objects from cultural heritage consist in wooden panels, painted on one face. Nowadays some of these panels show permanent cupping, micro-cracks of the painted layer, cracks of the painted support itself…

Different physical and mechanical phenomena are at the origin of these damages: wood is a hygroscopic material (its dimensions vary with humidity), it is highly anisotropic, the painted layer on one face has properties of permeability different from raw wood of the back face, a rigid frame may restrain the deformations of the panel…

Thermal treatments often used to improve wood durability thanks a reduction of its hygroscopicity. They usually performed at high temperature (>180°C) and are accompanied by a degradation of post-linear properties (more brittleness, reduction of transverse strength). They have been considered as means to reproduce the physical properties of ancient wood, with procedure validated for properties such as color [3], However as shown by Obataya [2] thermal treatments in ovendry state fail to reproduce some important mechanical properties (anisotropy, viscoelasticity…), while recent results [1] suggest that mild temperature levels (<150°C) are preferable to reproduce the chemical changes observed in ancient wood.

For my PhD, I intend to model the mechanisms involved in mechanical and chemical effect of wooden painted panels, exposed to climatic variations; and to contribute to develop (in collaboration with curators and restorers) new techniques for conservation of wooden objects.

To develop such conservation tool I need to work on mock-up witch replicate panel painting, to master every sample properties. So I will investigate the process of hygroscopic ageing and compression set generation on the back of painted panels, to explain their permanent cupping and replicate their ageing state. Then, I will develop 3D image correlation (stereo correlation) to measure the deformations of painted panels and I will simulate the hygromechanics behaviour of the panel.

References:

[1] Froidevaux, J., "Wood and paint layers aging and risk analysis of ancient panel painting", Thesis, Montpellier 2 University, 2012.

[2] Obataya, E., "Characteristics of aged wood and Japanese traditional coating technology for

wood protection", Actes de la journée d'étude Conserver aujourd'hui : les « vieillissements » du bois – Cité de la Musique, 2007.

[3] Matsuo, M., and al., "Kinetic analysis of color changes in cellulose during heat treatment", Journal of Wood Science, 58(2), 113-119, 2012

7. Research implementation and results under the program

Title of your research plan:

Effect of hygrothermal treatments on the physical properties of wood.

Description of the research activities:

My activities in Japan were to apply different hygrothermal treatments on wood in order to introduce different physical properties. For that, I experimented a new devise for hygrothermal treatments. This machine is a close devise which can reach mild temperature (120°C) and high relative humidity (100% RH).

We applied a 24-hours-treatment at 120°C at four different relative humidities. We used two sets of pre-conditioning: the first one was a dry-state, and the second one was pre-moisture at the same relative humidity of the treatment.

We wanted to find a treatment which is able to reproduce the physical properties of aged wood. In order to find these properties, we will focus on vibrational test, equilibrium moisture content (mass) and shrinkage (dimension) changes. Indeed, vibrational test is a non-destructive test which allows us to access to the Young Modulus in different direction of the wood (orthotropic base). Data before and after treatment will be compared to quantify the modification (mechanical and physical) added by the treatment, and also to compare to aged wood.

Because the closest treatment – to aged wood characteristics – has not been found yet, it should be difficult to conclude with a "good" set for this measurement campaign. This work – new set up and new treatment- has to be performed other times to hope to find conclusive results.

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

This experience was positive for me even for my scientific knowledge than my private experience. This was one of my best enterprise. I will come back not as the same person I was before coming in Japan.

This fellowship allows scientific foreigners to "enter" in Japanese life and culture in good conditions and advises. This introduction to Japan makes me looking forward new collaborations and new experiments in Japan through a postdoc, for example.

9. Advisor's remarks (if any):

Cecilia Gauvin has worked very well in our laboratory. Unfortunately 2 months was not enough to complete her job, but she has initiate fruitful collaboration between Japan and France. Not only her research activities, her open-minded behavior was quite impressive for all students in our laboratory.

RESEARCH REPORT

1. Name: GRANIER Benoit	（ID No.: SP13206）

2. Current affiliation: Institut d'Asie Orientale – Université de Lyon

3. Research fields and specialties:

   Social Sciences

4. Host institution: Institute of Social Science, the University of Tokyo

5. Host researcher: Prof. Akira SUEHIRO

6. Description of your current research

Citizen's acceptance and participation in Smart Cities in Japan

Recently, Japan's METI has been fostering smart community demonstration projects, aiming at reducing energy consumption and carbon emissions (i.e. in Yokohama City, Toyota City, Kitakyushu City and the Kyoto Keihanna District). The purpose of my thesis is to evaluate their success in terms of changing everyday behaviour so as to foster sustainable ways of life, and to identify the policy tools implemented. It will be necessary to determine the nature of citizen participation and to assess people's acceptance of the operating devices. Indeed, changing human behaviours is anything but an easy task, particularly when technology is involved. Firstly, since research in behavioral sciences enables to highlight levers of action, it would be appropriate to find out to what extent smart communities use them and to assess the efficiency of the policies implemented. Secondly, given the fact that participation allows better understanding and involvement of the population, it would be interesting to examine the forms and effectiveness of citizen participation.

In brief, I would like to answer these questions: what policy tools are used and implemented in order to change users' awareness and behaviour in regard to energy? How is the acceptance issue taken into account? Do people accept the technologies and behaviour change requests? Do they also take part into defining the objectives of the smart city, the tools to reach them, so as one can call their involvement "participation"?

7. Research implementation and results under the program

    Title of your research plan:

    Preliminary on-site survey

    Description of the research activities:

    The purpose of this 2 months stay in Japan was to visit the smart cities (often called "smart communities" in Japan) in order to have access to data and to be able to conduct further interviews with planners and policy makers. This summer, I could visit the projects of Toyota City, Yokohama Smart City and Kashiwa-no-ha Smart City, as well as meeting people who would introduce me to Kitakyushu Smart Community and Kyoto Science City next time.

    I could also make many interviews with professors and researchers from various Universities (Kyoto, Tokyo, Yokohama), working on issues such as Smart Cities, Eco-towns, Social Acceptance and Behavioral Change, Energy Policy, etc.

    In total, 15 interviews where done and will greatly help for my next stay in Japan.

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

9. Advisor's remarks (if any):

RESEARCH REPORT

1. Name: Raphaël LANGUILLON	（ID No.: SP13207）

2. Current affiliation: Lumière Lyon 2 University

3. Research fields and specialties:

Social Sciences

4. Host institution: Chuo University

5. Host researcher: Prof. Sukehiro HOSONO

6. Description of your current research

My current research articulates three main topics developed in recent works by economists and sociologists: global cities, sustainable cities, smart cities. I chose Tokyo because Tokyo is an advanced city in the process of mature city, which is still a under-studied process. Tokyo is indeed qualified of mature city by the agents of urban management. The main question of my research is: how revitalize a global city in a context of urban maturity? In that context, my research focuses on three main points:

1. To measure the urban maturity of Tokyo.
2. To analyze the strategies and redevelopment plans of the agents of urban management and urban planning.
3. To measure the impacts of those redevelopment plans on the dynamism and the evolution of the urban profile of Tokyo as a mature city.

I had three aims during this summer program:

- To better understand the internal recompositions inside of a mature global city, in a context of low economic growth and slow demographical expansion.

- To better understand the economical effect of major urban projects on a mature global city concerning the international competition of global city.

- To better understand the strategical uses of smart city and sustainable city models in the revival of a mature global city

7. Research implementation and results under the program

Title of your research plan:

Urban renaissance policy in a mature global city: the revival of Tokyo

Description of the research activities:

Thanks to my host teacher, I was able to make the following research:

- a survey about mature city image

- a survey about shôtengai dynamism

- meetings with important urban agents (Tokyo Sky Tree, Kashiwa no ha smart city, Keidanren, Minato-ku local government, shôtengai people, vice-president of Toshiba, Nuclear Security Center of Japan...). During those meetings, I collected data, and I got important documents, informations and effective suggestions.

- Two field trips : one in Kobayashi city (Miyazaki-ken, Kyushu), another in Yonezawa and Yamagata (Yamagata-ken, Tohoku).

I also made two presentations: one in the Maison franco-japonaise, in Ebisu (Tokyo), another in Kyoto during the congress of the international union of geographers. I met scholars, and I planned to make a Japanese session with Japanese colleagues and international researchers next year during the Annual Congress of Sociology held in Yokohama (project with Prof. YUI, from Hiroshima univ, and Dr. KUMO, from Gifu univ).

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

I lived with my host researcher and his wife during almost all the summer program. I really enjoyed my life with them. They treated me like a family member, and I was very touched by their kindness. Thanks to them, I was able to experience true Japanese life.

9. Advisor's remarks (if any):

The researcher, M. Languillon, worked so hard and challenged the new academic field (urban economics and statistics) in order to perform the research activity, being more extended and sophisticated. I absolutely certify that he will complete his research activity with high scored level.

RESEARCH REPORT

1. Name: MALLET-LADEIRA Philippe　　　　　　（ID No.: SP13208）
2. Current affiliation: CEMES-CNRS
3. Research fields and specialties: 　Mathematical and Physical Sciences
4. Host institution: Institute of Carbon Science and Technology, Shinshū University   5. Host researcher: Prof. ENDO Morinobu.
6. Description of your current research Pyrolytic carbons are carbon materials obtained by cracking hydrocarbons usually in the form of gas and deposited onto a substrate. They are used in various applications involving composite materials generally subjected to high temperatures and/or mechanical stresses such as in space propulsion, F1and aircraft brake discs, thermal shields, etc. My work is part of a program which aims to understand the physical properties related to the pyrolytic carbon structure at different scales of the material. To do so, we need to image and carry out chemical analyzes of the materials using Transmission Electronic Microscopy tools.

7. Research implementation and results under the program

Title of your research plan:

Understanding pyrolytic carbons structure by Transmission Electronic Microscopy

Description of the research activities:

My activities in the laboratory were oriented to the usage of the Transmission Electronic Microscope dedicated to the observation of carbon materials. The equipment was different from the ones I was used to use so it was interesting to get familiar with it. I learnt a lot from the Professor in charge of the equipment and he was very patient with me. The measurement I had to do needed some calibrations which has never been made before in the laboratory so we had exchanges with my home laboratory to know how to perform them. I hope it would be useful in the future for my host laboratory.

We also tried to prepare some sample I bring with me from France. My sample was a bulk carbon material which is not usual in the laboratory so it was a challenge to prepare it. The preparation succeed but unfortunately I was not able to observe it before it brakes. I also performed some Raman measurement whose results will be analyzed after my come back in France.

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

I was in an international laboratory so I was daily in contact with foreign people and seldom with Japanese people. I only practiced my (poor) Japanese in class lessons and with my host family which I met again on some week-ends, but I did not speech in daily life.

I tried to travel each week-end of my stay to discover Japan. If you like trekking, walking in the mountains near Nagano is very nice. From a cultural point of view, I was present to a Nō representation in Kanazawa, a maiko dance in Kyōto. I went to a Ninja house in Togakushi in which you have to find in each room the hidden door which permits you to get out and I assisted to some matsuri (local festivals). I ate lots of (delicious) dishes, but the most specials things was: bee larvas, roasted grasshopper and raw horse meal. I enjoyed pretty well life in Japan and I spent very good times with my host family and my colleagues.

RESEARCH REPORT

1. Name: Camille NDEBEKA-BANDOU	（ID No.: SP13209）

2. Current affiliation: Laboratoire Pierre Aigrain, Ecole Normale Supérieure de Paris

3. Research fields and specialties:

Mathematical and Physical Sciences

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

5. Host researcher: Prof. Kazuhiko HIRAKAWA

6. Description of your current research

The terahertz (THz) region of the electromagnetic spectrum is a frontier area for research in fundamental physics, chemistry and medicine. However, this frequency range has been unexplored until recently due to the lack of efficient sources and detectors. Among the good candidates for THz applications, the Quantum Cascade Lasers are optical coherent sources based on quantum confinement and tunneling in semiconductor heterostructures. These are unipolar devices where the lasing action takes place between two conduction subbands of a biased multi-quantum well structure. Nowadays, these innovative lasers are one of the most promising photonic sources because they can achieve an efficient emission in the THz range. Since their invention in 1994, various possible applications such as chemical detection, telecommunication, medical and astronomy imaging, security, have been identified and the research of improved structures is being pursued worldwide. Nevertheless, there still exist numerous loss phenomena that limit their performances and their operating temperature range (especially for those emitting in the THz range). Thus, progress in this area is related to the development of structures based on new materials and new designs, but also to a better theoretical understanding of the loss mechanisms.
As a PhD Student at the Laboratoire Pierre Aigrain of the Ecole Normale Supérieure of Paris, my current research consists in the design of theoretical models and numerical computations of these quantum phenomena that jeopardize the lasing action in QCLs. In particular, I am interested in the Free Carrier Absorption, a second-order loss mechanism that occurs in the active region of the laser and consists in the disorder-assisted absorption of the laser photon by the electrons. I also develop numerical approaches, such as exact diagonalization of perturbed systems, for the estimation of the electronic scattering rates in disordered two-dimensional heterostructures.

7. Research implementation and results under the program

Title of your research plan:

Nanofabrication and Investigation of Single Semiconductor Quantum Dot Transistor

Description of the research activities:

Self-assembled InAs quantum dots (QDs) have unique atom-like properties and the investigation of their inter-sublevel structure is a key step for future device applications such as photonic detectors, QD lasers and quantum information processing. Terahertz (THz) spectroscopy has so far been performed on ensembles of QDs to probe their electronic structure. Nevertheless, the measured THz absorption spectra were strongly affected by inhomogeneous broadening. Prof. Hirakawa's group demonstrated a new and successful method for inter-sublevel spectroscopy on single QD. The principle is to use a Single Electron Transistor (SET), which consists in a single QD and nanogap metallic electrodes, as a sensitive THz detector, and to detect the inter-sublevel transitions as photocurrent induced in the SET.

First, I participated in the fabrication process of the SETs, including the crystal growth of the InAs QDs by Molecular Beam Epitaxy and the nanofabrication of the metallic electrodes by Electron Beam Lithography and Metal Evaporation. Secondly, we conducted the experimental measurement of the Coulomb Stability Diagram of the SET that allows the estimation of the charging energy and the energy level spacings of the QD and also the photocurrent spectrum measurement by Fourier transform spectrometer. The obtained photocurrent peaks are attributed to intersublevel transitions and display interesting features such as shifts of the transition energy from the bare one in varying the number of electrons in the QD. In order to explain these effects, I finally designed a theoretical model for the computation of the inter-sublevel energy transition as a function of the number of electrons. I also calculated numerically the electronic wavefunctions of the QD and the inter-sublevel matrix element. My theoretical results were in good agreement with the experimental data: the trends and the magnitude of the photocurrent shifts were well reproduced.

The next step of this theoretical work would be an exact self-consistent calculation of the many-body states of the system. This would provide a good description of other interesting features that can play an important role in QDs such as depolarization and Auger effects.

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

The JSPS Summer Program allowed me to discover a fascinating country and culture, meet new friends and establish contacts with collaborators. I had a really nice research environment in Prof. Hirakawa's Lab and this research experience in Japan will be very useful for my personal and professional development. I really enjoyed my living experience in this beautiful country.

9. Advisor's remarks (if any):

It has been very enjoyable for me to work with Ms. Ndebeka-Bandou. She has a very good knowledge on solid state physics and is a bright young researcher. I would like to add that Ms. Ndebeka-Bandou has a very nice personality, which also makes working with her very pleasant. It was also very useful that we frequently communicated with her supervisor in Paris and could hear his comments/advice on the theoretical treatment of the problem. I think this internship program is a good starting point of our future international collaboration.

RESEARCH REPORT

1. Name: Thibaud PINTIAUX[a,b,c]　　　　　　　　　　　（ID No.: SP13210）

2. Current affiliation: [a]　Université de Toulouse, INP-ENSIACET, LCA (Laboratoire de Chimie Agro industrielle), Toulouse F 31030, France. [b]　INRA, UMR 1010 CAI, Toulouse F 31030, France. [c]　The Green Factory, 27 rue Chanez, Paris 75016, France

3. Research fields and specialties:

Chemistry, Engineering Sciences, Agricultural Sciences

4. Host institution: [d]　National Institute of Advanced Industrial Science and Technology, 2266-98 Anagahora, Shimo-shidami, Moriyama-ku, Nagoya, Aichi 463-8560, Japan

5. Host researcher: Dr. Tsunehisa MIKI[d]

6. Description of your current research

My PhD study concern the evaluation, discovery, and optimization of high pressure molding of natural fibres material without the use of any additives as glue, binders, polymers.

Alpha cellulose was selected as a convenient model for starting the studies, considering it as the most common polymer present on earth and in any plant materials. First results concerning the mechanical properties of alpha cellulose samples were published recently [Pintiaux et al., *Materials* 2013, *6*, 2240-2261]. Some elements of microstructural changes have been worked in our laboratory and recently published, but only the effect of temperature could be determined.

The effects of other parameters, such as moisture content, pressure and time remained unclear. Also the nature of the chemical changes on the compressed alpha cellulose remains unclear.

In parallel, 2D and 3D moldings of different raw materials are being evaluated, shapes of molds, types of molding (compaction molding or injection molding), nature and chemistry of raw materials, particle size, and the above cited parameters are being studied.

7. Research implementation and results under the program

Title of your research plan: High pressure molding of lignocellulosics as a potential technology for producing bio-based materials.

Description of the research activities:

Based on previous research on WPC composites made at AIST, Nagoya by T. MIKI et al. the rheology study of alpha cellulose was considered. The moisture content had to be adjusted to finally measure flowing, due probably to restrictions on the pressure (max 285 MPa). The method was run first on different dies of different length and diameters, but pressure was too high on too restrictive dies that is why some experiments were run at different extrusion speeds from 1.5 to 50 mm/s. The results were compiled, but could not lead to calculations because the behavior of extrusion was too different from models.

A full set of experiments was run in order to investigate the microstructural changes due to pressure, temperature, moisture content, time of molding, triplicates DRX diffraction, SEM observations cut and surface, and FTIR measurements were run.

3D moldings were performed on endemic Japanese species, and attention was put on the observable difference of behavior of nature of plants and their moldability in injection transfer molding and compaction modling.

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

Difficult to describe these feelings in this very tiny space. Japan was a fantastic human experience. Japan culture, Japan as a country, Japanese langage and people are all connected in a very specific way it is really enjoyable to spend time with Japanese, learn the language, enter the gigantic machine as a little gear and observe it from the inside (or at least try). 100% positive stay, also for the scientific aspects.

RESEARCH REPORT

1. Name: Damien VEAU	（ID No.: SP13211）

2. Current affiliation: Université de Toulouse, France

3. Research fields and specialties:

Chemistry

4. Host institution: Hokkaido University

5. Host researcher: Pr. Masaya SAWAMURA

6. Description of your current research

As a PhD student in medicinal chemistry, I focused on the synthesis of new molecules for their biological activities against whether cancer or tuberculosis. The main part of that synthetic job consisted on the constitution of small libraries of compounds related to natural products using short reaction sequences.

The synthesis of natural products and their analogs for biological purposes requires an organic chemist not only the expected skills but also a broad know-how in various part of organic chemistry

As a young PhD, I am looking to extend my field of competences by taking part in highly ambitious research projects focusing on the development of new methodologies, specifically in catalysis and in the controlled-generation of stereocenters. Learning such methods may contribute in the future to access to very potent new drugs whom synthesis by other means would be too tideous.

Being in Japan with this fellowship allows me to begin on that path.

7. Research implementation and results under the program

Title of your research plan:

"Copper-catalyzed enantioselective conjugate-addition of alkylboranes"

Description of the research activities:

The controlled generation of quaternary stereogenic carbons remains a challenge in modern organic chemistry and their generation *via* the addition of organometallic species has attracted much attention in last decades.

Prior to my arrival, the host researchers reported the first catalytic enantioselective conjugate additions of alkylboron compounds *via* a catalytic copper mediated transmetallation leading to the *in situ* formation of alkylcopper species.

My research project in Japan was to study the unprecedented construction of quaternary stereogenic carbon centers through the copper-catalyzed conjugate addition of alkylboranes to β,β-disubstituted enones.

This tasks consists in the multistep synthesis of the starting β,β-disubstituted enone and asymmetric *N*-heterocyclic carbenes (NHC) ligands as well as the screening of the coupling reaction conditions, including the screening of three different classes of chiral ligands (phosphines, phosphoramidites and NHCs) .

The coupling reaction has to be set up in very drastic conditions inside a glovebox. This was actually my first time using a glovebox and the skills I learned here are very precious for my future as a chemist.

Unfortunately, none of the conditions tested led to the formation of the desired quaternary center and we decided to switch to a different enone with also unfruitful results. This project might have been a little too optimistic for such a short stay and would require some more time to find suitable conditions.

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

I had the opportunity to take part in two main events of the host group. First, they kindly integrated me in the lab team for the "annual chemistry department baseball tournament" where we did quite good and had a lot of fun before going out for Hokkaido's traditional jingisukan. Secondly I took part to the summer group seminar where everyone exposed his work progresses and which was held in a small University-owned mansion on the Sea of Japan shore. This seminar was also a good occasion to be initiated to Japanese traditional barbecue and hanabi. I am very thankful to everyone in the group for their warm welcome.

RESEARCH REPORT

1. Name: Anja Batram	（ID No.: SP13301）

2. Current affiliation: Ruhr-University Bochum

3. Research fields and specialties: Humanities

4. Host institution: International Research Center for Japanese Studies (Nichibunken)   5. Host researcher: Prof. John Breen

6. Description of your current research
The research I intendet to do during my stay in Japan focused on Shinto and the administration networks of Shinto shrines during the Early Modern Period (Edo-Period 1605 – 1868). When seen from a historical perspective, Shinto, one of the main religions in nowadays Japan, is not defined as easily as one may guess. Since the arrival of Buddhism during the 7th century until the official definition of State and Shrine Shinto in the course of the modernization during the early Meiji-Period (1886–1912), the religious landscape in Japan was formed by various degrees of amalgamations between Buddhism and the indigenous ritual practices. In my research at the Nichibunken I wanted to focus on analyzing legal texts as well as manuscripts concerning administrative offices and practices at larger local prefectural shrines and its subordinated shrines during the Edo-Period (1600-1868). By gaining a deeper insight into the self-concept that is reflected in these official texts as well as into possible structures on an administrative level I hoped to get closer to being able to trace a broad concept of Shinto on a locally limited scale that could serve as a foundation for a later countrywide concept of Shinto later during my PhD studies.

7. Research implementation and results under the program
Title of your research plan: The Development of Shinto-Shrines in the Edo-Period with a Focus on Shrine Organizations in the Periphery

Description of the research activities:

After discussing my research topic with my host researcher and first recherches in the library of the Nichibunken I quickly realized that I have to change the approach of my thesis. At the current state of my research it seemed not to be possible to decide which area or shrine to focus on, so the I changed my research plan from visiting archives and gathering sources to revise the basic research I had done so far by finding out which shrines and areas work has been done on during the last few years that I couldn't access from Germany, which turned out to be a lot.

Most of my time I spent gathering monographies and articles that were publishes recently. Based on those materials I could compile a broader overview over the current state of research. Researchers seem to focus on the area around Edo (nowadays Tokyo) and Kyoto, and also on some provinces in Kyushu. Sources seem to be avaible for this areas, so a possible focus for my research might be found here. But not only the availability of sources and the resulting limitation to the shrines and therir networks I can chose from turned out to be the weak spot of my approach but also the general perspective I tried to approach the topic from.

Concerning this I got further inspiration during a Symposium my host researcher held that focused on the development of the Ise-Shrine through history, one of the most important shrines in Japan. Not only through the discussions, but also by talking with main researchers in the field of Religious Studies and Japanese Premodern History I decided to change my approach and focus on Shinto as a concept in a later stage of my PhD research.

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

The stay here in Japan with the JSPS Summer Program was a very necessary step for the development of my dissertation research topic. I could get materials and inspiration I could never have gotten in Germany and also was able to extend my international network as a researcher. Thanks to this I now have a good base to work on to come back to Japan next year to search for sources.

Personally it was very enriching and motivating to be able to visit shrines and temples that are of historical importance to get a better feeling for the object of my research. Kyoto was the perfect place to do so because many important events concerning my research topic happened there and still influence nowadays life of people here, like the Gion matsuri, one of the largest Shinto festivals in all of Japan that happened to be held during my stay here. Also this was the first time for me to stay in Japan while being able to communicate in Japanese, so I could deepen my insight into the current everyday life of Japanese people and the culture of Japan and make friendships that will definitely prolong my stay here.

RESEARCH REPORT

1. Name: Melanie BOECKMANN	（ID No.: SP13302）

2. Current affiliation: Leibniz Institute for Prevention Research and Epidemiology – BIPS, Bremen, Germany

3. Research fields and specialties:

    Medical, Dental and Pharmaceutical Sciences

    Interdisciplinary and Frontier Sciences

4. Host institution: National Institute for Environmental Studies (NIES), Center for Environmental Health Sciences, Environmental Epidemiology Section, Tsukuba, Japan

5. Host researcher: Dr. Hiroshi NITTA, Director

6. Description of your current research

Climate change will likely increase the frequency of extreme weather events. Heat waves and extreme heat days are a health risk, particularly in densely populated urban areas (McMichael et al. 2012). To protect human health from negative effects of heat, adaptation strategies have been planned by local governments in Japan and in other high-income countries (Honda et al. 2010). However, current adaptation measures have not yet been thoroughly evaluated. Their effects on mortality and heat stroke incidence reduction are unknown. This research project aims at contributing to this knowledge gap by conducting a feasibility study on evaluation.

This dissertation research project is based on previous research on health in climate change adaptation strategies in Europe. As part of my Public Health degree, I examined climate change adaptation strategies in the UK and Germany on their commitment to health protection. Results of this policy-oriented research project were published as a BA-thesis. In addition, my results served as the basis for an article on public health aspects in European climate change adaptation strategies (submitted).

I have previously presented preliminary results from my research at the NSF-DFG joint research conference "Reckoning with the risk of catastrophe" in Washington DC in late 2012. Results from a systematic literature review on adaptation effectiveness will be presented at the European Public Health Association Annual Meeting in November 2013 in Brussels, Belgium. I am additionally involved in a joint research paper on climate change and infectious diseases with a colleague from Louisiana State University, USA.

7. Research implementation and results under the program

    Title of your research plan:

    Heat, health, and urban climate change adaptation: a feasibility study on adaptation evaluation

Description of the research activities

At NIES I worked on two projects related to the topic of adaptation to heat and human health, advised by Dr. Kayo UEDA and Dr. Chris Fook Sheng NG.

In the first project I investigated the current status of climate change adaptation planning in Japanese local governments. I conducted four exploratory expert interviews in Japanese (with the help of an interpreter) and English at three prefectural governmental offices and one public health agency. Questions included plans for evaluation of measures and specific heat stroke mitigation strategies. Prior to the interviews I had the opportunity to engage in informational discussions with leading climate change impact modeling researchers at NIES.

The second project aims at assessing long-term changes in summer mortality in ten Japanese prefectures. To that aim we used Poisson regression time series analysis to examine the relationship between temperature and mortality in large Japanese urban areas. As I had little previous experience with this statistical method, I was trained by Dr. Ueda and Dr. Ng in time series modeling using the software R.

Preliminary results of the quantitative analysis will be submitted to the 2014 Japan Epidemiological Association Research Conference. Dr. Ueda, Dr. Ng and I will continue to work on the mortality data and plan to publish the results.

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

During the research stay I was able to participate in the ISAP 2013 International Forum for Sustainable Asia and the Pacific in Yokohama. I was kindly introduced to other researchers in my field by my colleagues and spoke with leading experts in heat and health research. In addition, I was able to participate in an Open House event where I acted as English tour guide and was able to visit the various departments operating at NIES. I presented my current research at the institute as well.

Cultural experiences at the research institute included a departmental lunch at a traditional soba restaurant, a BBQ party, the annual summer fest wearing a Yukata and a visit to the Sumida River Fireworks festival with my colleague.

9. Advisor's remarks (if any):

During the stay, Ms. Boeckmann worked so hard on her projects. She brought our lab and prefectural office a question how to evaluate the (specific) adaptation measures. It is worth exploring this challenging issue. We will continue the collaboration with her.

RESEARCH REPORT

1. Name: Sarah Dölle	（ID No.: SP13303)

2. Current affiliation: Otto-von-Guericke-Universität Magdeburg

3. Research fields and specialties:

Mathematical and Physical Sciences

4. Host institution: Waseda University

5. Host researcher: Prof. Yuka TABE

6. Description of your current research

Nearly everyone has encountered the beauty of soap bubbles, which are one example for freely suspended liquid films. Smectic liquid crystals are ideal materials for the investigation of freely suspended fluid films. In contrast to soap films, smectic films are stable from a thickness on the order of nanometers up to several micrometers. Due to their intrinsic layered structure, they are unique systems to study fluid dynamics in 2D. The current research deals with the movement of immiscible, micron-sized droplets on freely suspended fluid films. If and how the motion of these inclusions in the film can be considered as a two dimensional dynamic system is the main goal of this research.

7. Research implementation and results under the program

Title of your research plan:

Interaction of two droplets moving on a freely suspended film

Description of the research activities:

The first month was dedicated to build the experimental setup. The first trials with a normal microscope were unsaticfactory, because the field of view was much too limited. Thus, we built up a reflective observation system to detect the droplet motion over a wider area. The droplets were produced with a capillary that could be positioned precisely. The capillary was put into the film and a small amount of liquid was released. Then the capillary was quickly pulled out. The whole experimental system had to be shielded from air drag. Additionally the film holder was adjusted by a goniometer, thereby the droplets would not move due to gravity.

After the film was drawn onto the film holder, it was given time to relax. Droplets were put on the homogeneous part of the film. The observation was realized with a color CCD-camera. At times, two droplets were attracted by each other and infrequently a droplet fusion could be observed. If a simple attracting force would drive the droplet motion, the droplet velocity should increase with decreasing distance. But the approaching speed of the droplets decreases exponentially with the distance between the droplets. Thus, we expect additional unknown forces to act on the droplets, resulting in this exceptional behavior.

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

The atmosphere in the lab was very kind, giving me the opportunity to be productive. The Professor was available every time I had a question and the students in the lab were very helpful, too. Everybody was doing the best to make my stay enjoyable.

RESEARCH REPORT

1. Name: Niklas Friedrich	（ID No.: SP13304）

2. Current affiliation: University of Hamburg

3. Research fields and specialties: Social Sciences

4. Host institution: University of Tsukuba   5. Host researcher: Shinichiro Watanabe

6. Description of your current research   The employee organization relationship is theorized to be important for employee wellbeing. However, research has focused mainly on outcomes as performance, therefore knowledge is still limited. Moreover, many studies assess wellbeing at one point in time, which cannot be a good representation of such indicators of wellbeing as mood, emotion or sleep quality that are likely to change on a daily basis. My current research focuses on the effects of commitment and justice, which can be construed as a representation of employee-organization relations, on wellbeing, such as affects.

7. Research implementation and results under the program   During the Summer Program, we attempted at operationalizing the construct of emotional labor in two different ways. First, the questionnaire of Diefendorff and Colleagues (2005) with its dimensions of surface acting, deep acting and expression of naturally felt emotions were carefully translated into Japanese and modified to fit the context of our study. Second, the conceptualization of Glomb and Tews (2004) where people have to report concerning specific emotions. In addition, we translated the Bern Illegitimate Tasks Scale (2010) into Japanese. This construct , covering unnecessary and unreasonable tasks, is hypothesized to function as a strong stressor for nurses. The data will be collected in University of Tsukuba Hospitals in autumn. Since Japanese society is growing older at a faster speed than anywhere else in the world, a higher need for, and a shortage of, nurses need to be dealt with at the same time. Therefor it is very important to identify important stressors to preserve nurses' health, wellbeing and their willingness to continue to stay in the nursing profession. This study will contribute to these purposes. Moreover Professor Watanabe introduced me into an international comparative study concerning conceptualizations of trust in different cultures hosted by the University of Windsor, Canada. For this, Japanese and German versions of different questionnaires were created during the course of the summer. The data collection will be completed by the end of this year. I

also attended the weekly seminar of Prof Watanabe for his final year MBA students. In this I learned how students are taught in Japan, and discussed with them about theoretical models and ideas covering such topics as team performance, team conflict, team commitment, and emotional labor.

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

Since the students at Tsukuba University are very international, I worked with students from Japan and all over the world. In my leisure time I enjoyed travelling to places such as Nikko, Fujiyama, Sapporo, Tokyo and Izu Island which were very impressive. I enjoyed not only the rich nature but also the interesting culture and the good food as well. Although, I used not to eat any fish, I like sashimi a lot now. I have to thank my host professor and my tutor Igor for providing me with a warm welcome, nice evenings and assistance in every day life.

9. Advisor's remarks (if any):

Mr. Niklas Friedrich is a conscientious and open-minded Ph.D. student from Germany. Although two months is too short for us to start and finish a study together, we tried our best and designed two studies, one about emotional labor and one about trust. He also actively participated in my MBA seminar and helped me guide my students by providing constructive advice for them. He has been a good asset to us, and I welcome him again in the future if he wishes to visit Japan again.

RESEARCH REPORT

1. Name: Friederike A. GREB	（ID No.: SP13305）

2. Current affiliation: Georg-August-Universität Göttingen

3. Research fields and specialties:

Mathematical and Physical Sciences/ Agricultural Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Prof. Naoki MASUDA

6. Description of your current research

Agricultural economists refer to the propagation of price shocks between markets in different locations as spatial price transmission. To give just one example why studying price transmission is important, consider the recent surges in prices on world agricultural markets (e.g. the price of maize increased by 80% between 2005 and 2007). As poor people spend a large proportion of their income on food items, such price changes can have a huge impact on poverty. To assess this effect, it is essential to know to what degree price spikes on world markets are transmitted to local markets in developing countries. When examining price transmission processes, the focus is typically on pairs of markets. However, in reality a market is linked to more than just one other market, and the diffusion of price changes between two markets may be influenced by a third market. My current research tries to understand the effect of these complex networks on price transmission processes. This involves finding an answer to various questions. Are there markets that have a stronger impact on price transmission within a network than others? Which criteria determine them? How do transportation costs affect the spread of price changes within the network? Is it possible to manipulate the network or markets (e.g. by reducing the transaction cost for trade between two particular markets) so as to facilitate price transmission? Is it adequate to analyze price transmission separately for isolated pairs of markets even though they are embedded in a network?

7. Research implementation and results under the program

    Title of your research plan:

    Spatial price transmission and network structure

Description of the research activities:

My research activities in Japan consisted mainly in reading and running some small simulations. My project is interdisciplinary; it involves both agricultural economics and network science, the latter of which is new to me. Hence, it was extremely valuable to get recommendations from Prof. Masuda, a network scientist, on how to familiarize myself with networks in general and the specific techniques necessary to investigate the model used in price transmission analysis in particular. He also pointed out that a closely related model has been studied intensively in the context of opinion formation. This model, which is only slightly simpler, is well understood and it is, thus, possible to draw on existing knowledge. As it was only towards the very end of my stay at the lab that I felt that I had acquired sufficient background on networks to start analyzing the model employed to study price transmission, I have yet to obtain concrete results.

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

I truly enjoyed the two months in Japan, especially due to very welcoming and open-minded people both inside and outside the university, willing to discuss topics ranging from the love of mayonnaise to the impact of the 2011 earthquake on Japanese society. Tokyo has been a fascinating place to explore, especially after I realized to better google map every place and remember that it might be above or below me as well. I have been amazed by the obvious differences of Japanese as compared with Western culture, as well as by the beauty, care and thoughtfulness put into the tiniest details, the very respectful treatment of others, of space, of food, by the level of organization.

9. Advisor's remarks (if any):

She intended to incorporate network components, in which I am specialist, into the model she has been examining. She worked intensively. We discussed from time to time. I believe we mutually benefited from her stay. Her presence was also a plus for my lab members. They enjoyed interacting with her, both academically and non-academically.

RESEARCH REPORT

1. Name: Maximilian HANSINGER	（ID No.: SP13306）

2. Current affiliation: Technische Universitaet Muenchen

3. Research fields and specialties:

Engineering Sciences

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

5. Host researcher: Prof. Taikan OKI

6. Description of your current research

My current and previous research was not directly linked to the project I conducted here in Japan. It mainly focused on water resources assessment and management, environmental hydrology and numerical simulations on two-phase flow through porous media.

7. Research implementation and results under the program

Title of your research plan:

Comparison of different water stress indicators

Description of the research activities:

Water stress indicators (generally: WSI) provide a way to show and assess how the anthropogenic consumption of renewable fresh water resources is exerting a pressure on ecosystems, (irrigated) agricultural production, industry and domestic water supply. A lack of the limited resource leads to conflicts and competition between the different user groups and might result in drawbacks for one (or several) of them, which thereby leads to a degradation of the condition of water dependent ecosystems and societal problems, as fresh water is the most essential resource for mankind, in terms of direct consumption as food but also for economic development and agricultural production. This kind of vulnerability towards fresh water availability is generally known as water stress or water scarcity. Here, indicators are needed to 1) characterize different levels of water stress in a certain region or area and 2) to compare the levels of water stress with other regions around the world. The latter point is probably the more difficult one, as indicators only use a few input parameters which do not describe the complex relations between demand, supply and actual scarcity and often do not take into account regional differences when assessing the impact scarcity is causing (exception: Vorosmarty, 2010). The underlying input data regarding water availability and consumption is either obtained from measurements (measured data on runoff, precipitation, etc.) and estimations

(water demand estimates by FAO, UNEP, etc.) or from the output of global hydrological simulations (e.g.: MATSIRO, WaterGAP).

The first step was getting familiar with the different methodologies in global hydrological simulations to obtain data on water consumption and availability. Later on I conducted data analysis and applied several different water stress indicators (e.g.: Falkenmark, 1989; Alcamo, 2007; Hanasaki, 2008; Pfister, 2009; Wada, 2011) on historical data sets (1981-1999) which had been simulated at my lab. This makes a direct comparison possible, as usually only one index is applied using different data sets. In a next step the codes are applied to data sets describing future water demand and availability (until 2100) which were simulated under forcing data of the newest IPCC AR5 scenarios. This will help to get an insight into uncertainties about predicting future water scarce areas. It is intended to contribute to a publication with the results.

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

I really had a great stay in Japan and had also a very enjoyable time at my lab. The atmosphere was always very welcoming and nice among the lab members, certainly also due to the relaxed and easy going relation between Professors and students (at least I as a foreigner got that impression!). Professionally I could gain a lot of new input, through my project which was a rather new field for me, and also learn about other research projects through the weekly lab meetings. Culturally, the home stay was a great experience, as it provided me an insight into the 'normal' life of a Japanese family. Beside of all that, of course I enjoyed just being in Tokyo, to live close to Shibuya and Shimokitazawa, going to izakayas, sightseeing, etc. and having Japan daily in all its facets around me.

 9. Advisor's remarks (if any):

He dedicated himself to his research and accomplished the development of his research capacity in both scientific and technical ways. I see a lot of achievements even though 10 weeks is not long enough but still worth. We are expecting continuous collaboration for wrapping up the results of his research as an article in a scientific journal. It was one of good examples which soothed my concerns how such a short-term exchange program can be further connected to a research-wise individual development.

RESEARCH REPORT

1. Name: Stefan M.KUECHLER	（ID No.: SP13307）

2. Current affiliation: University of Bayreuth

3. Research fields and specialties:

   Biological Sciences

4. Host institution: Symbiotic Evolution and Biological Functions Research Group, Bioproduction Research Institute, National Institute of Advanced Industrial Science and Technology (AIST) / Tsukuba

5. Host researcher: Prof. Takema FUKATSU

6. Description of your current research

The order Hemiptera is, with approximately 82.000 described species, one of the most species-rich insect groups. This diverse order includes the following major clades: Sternorrhyncha (scale insects, aphids, whiteflies, etc.), Auchenorrhyncha (planthoppers, leafhoppers, spittlebugs and cicadas), Heteroptera (true bugs) and Coleorrhyncha (moss bugs). Most species in these taxa are associated with obligate, symbiotic microorganisms. In my recent research studies, I analyze the endosymbiotic systems of different species of Heteroptera and Coleorrhyncha using molecular methods. Above all, most attention was focused on the superfamily Lygaeoidea (Heteroptera: Pentatomomorpha), in particular species that offered a bacteriome-associated symbiosis.

I was able to demonstrate for the first time that the endosymbioses of the analyzed families and subfamilies were distinct from each other. The structure and localization of the bacteriomes as well as the endosymbionts therein exhibited striking variations. Overall, six different symbiotic systems were identified and described within the Lygaeoidea (Kuechler et al., 2010, 2011, 2012). Such a variety of different endosymbioses in such closely related insect hosts seems exceptional.

Most of the analyzed endosymbiont strains had not been described and they were designated for the first time with new candidate names according to their morphological, genetic, phylogenetic and histological properties. The phylogenetic diversity of the endosymbionts indicates that the endosymbiotic systems of the Lygaeoidea have developed independently of each other.

The endosymbionts were detected in all stages of larvae and adults both in bacteriomes as well as in ovaries of the adult females using fluorescence in situ hybridization (FISH) with specific fluorescent probes. It was demonstrated that the endosymbionts were transferred

directly from several small bacteriocytes within the ovaries, forming the so-called infection zone, into the oocytes, and therefore a vertical form of transmission to the next generation takes place.

7. Research implementation and results under the program

Title of your research plan:

Analysis of symbiont movement during embryonic development of selected lygaeoid bugs using whole mount fluorescence in situ hybridization (wFISH)

Description of the research activities:

The transmission of endosymbionts is accomplished by vertical transfer mechanisms from mother to offspring via an "infection zone" of the ovarioles. Symbionts are circularly arranged in specific bacteriocytes in the germarium surrounding the developing oocytes. Subsequently, they are integrated central to the anterior or proximal pole end of the oocytes forming a "symbiont ball". Starting from this symbiont ball in the fertilized eggs, new symbiont organs (bacteriomes) will be formed again during the embryonic development. However, the molecular and cellular mechanisms underlying this process are largely unknown. For this reason, the proceeding mechanisms of symbiont movement in developing embryos were examined in three different heteropteran species (Heteroptera: Lygaeoidea), whose symbiotic systems are distinct from each other: Arocatus longiceps (Lygaeidae: Lygaeinae), Chilacis typhae (Artheneidae) and Ischnodemus sabuleti (Blissidae).

By using whole mount fluorescence in situ hybridization (wFISH), we were able successfully to detect and track the movement of the symbionts (symbiont ball) in different stages of embryonic development in all three analyzed species. As a result, we observed that the position of the symbiont ball as well as the relocation of the endosymbionts from the symbiont ball to specific bacteriocytes is quite different in all three species, indicating different kinds of cellular mechanisms of symbiont translocation. Additionally, it was demonstrated in at least one species that the differentiation in the "main bacteriome" and the bacteriocytes, associated with female ovaries, already takes place during early embryonic development.

Furthermore, specific marker genes, which are useful for a molecular revision of the lygaeoid phylogeny, were successfully amplified.

9. Advisor's remarks (if any):

Stefan did quite a good job in the relatively short two months period of his stay.

RESEARCH REPORT

1. Name: Martin Levihn   （ID No.: SP13308）

2. Current affiliation: Georgia Institute of Technology

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: National Institute of Advanced Industrial Science and Technology (AIST), Digital Human Research Center

5. Host researcher: Koichi Nishiwaki

6. Description of your current research

My present research focuses on integrating perception and planning for complex systems, such as humanoid robots. Robots need to be able to accomplish a given task despite only being able to perceive the world through sensor systems, resulting in belief distributions over possible world states rather than exact knowledge.

As a concrete example domain, I am focusing on the domain of Navigation Among Movable Obstacles (NAMO). The NAMO domain encapsulates the idea that a robot should, if necessary, be able to autonomously decide to move environment objects out of its way on its path to a goal, just as humans frequently do. This is critical for the successful deployment of robots to human environments where they have to reason about environment clutter such as chairs blocking the path.

My previous work introduced the first decision theoretic planning framework for the NAMO domain and an object detector for partially occluded objects in 3D point clouds. In addition, I incorporated strategies typically used by humans into a hierarchal planning and execution framework to allow it to be deployed to NAMO domains. These strategies included foresight, the concept of taking ones future intentions into account when making decisions and reconsideration, the idea of abandoning once current plan of action if new information becomes available that could drastically influence ones decision making. The framework was successfully employed on an actual robot system which successfully reached a goal configuration despite being blocked in by chairs and having no prior knowledge of its environment. The robot actively reasoned about its uncertainty and decided autonomously where to look, where to move to and which objects to manipulate, if any.

7. Research implementation and results under the program

Title of your research plan:

Autonomous Environment Manipulation to Assist Humanoid Locomotion

Description of the research activities:

In my previous research I saw the environment as something hostile, which can typically at most prevent the robot from reaching its goal. However, we humans don't just always see the environment as a hindrance, but rather we frequently also actively try to use or modify the environment to have it help us overcome our inherent constraints. For example if we want to reach something that is too high for us, we grab a box to stand on or if we can't cross over something because we can't step that far, we might get a board and place it on the ground as a bridge. In my research during the JSPS Summer Program I gave a humanoid robot similar capabilities. If the robot is given a task of reaching a specific goal configuration, it will first check if it can easily do that or if it would need to step higher or further than it actually can. If that is the case, the robot checks if there is an object in the environment that it could use to modify the environment to its benefits and, if so, where it would have to place it. It then plans in detail how to reach the object, grasp it and place it. I have successfully implemented and executed this on an actual humanoid robot.

RESEARCH REPORT

1. Name: Thomas Ludwig	（ID No.: SP13309 ）

2. Current affiliation: Ilmenau University of Technology

3. Research fields and specialties:

Engineering Sciences

4. Host institution: Kobe Institute of Computing

5. Host researcher: Prof. Dr. Sandor Markon

6. Description of your current research

Modern high-rise buildings use safe and energy efficient traction elevators. However, this technique has two drawbacks: (1) Traction elevators are not space efficient and (2) not flexible. The impact of a linear motor elevator (LME) system is huge, because it allows a much more efficient utilization of the expensive urban land space. The elevator can work not only in a straight line, but also in an arbitrary trajectory. Conventional elevators use traction drives, that is, wire ropes wound on steel sheaves, driven by friction due to the tension between the elevator and the counterweight. In case of high-rise buildings, elevator shafts require a huge amount of space. In order to reduce the space, more than one elevator could be share the same shaft; such systems are called "multi-car elevators". Such autonomous elevators can be moved independently of each other in the same shaft, and large-scale multi-car elevator systems become practically feasible. LME drives are being developed and built at Sabanci University in Turkey, in order to obtain experimental data about energy consumption, efficiency and control issues.

European Union as well as U.S. Department of Energy and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) have defined their vision for 2020 with the target of net zero energy for buildings. In order to reach this objective, LMEs could be a good solution to minimize energy peaks. In addition to its use in transportation, the potential energy that is stored in LMEs can be utilized as an energy storage device in buildings. In other words, the LME is able to store energy by moving elevators up, or regenerate energy by moving down. In large buildings where a numerous number of elevators are installed, this technique could help to minimize peaks of the total energy consumption. Most of the time, elevators are not used in large buildings and so they are operating in an idle mode. In this case, some LMEs could be moved according to the power requirements of the building. Therefore, LME-Systems have to be realized, where elevators are not only respond by the traffic. In contrast to batteries, this technique has an unlimited life time and needs no extra costs.

My present research in Japan is focused on the simulation of a large building, which involved the developing of a simulation model that includes a linear motor elevator model in order to optimize the energy peaks of the power consumption.

7. Research implementation and results under the program

Title of your research plan:

Power Optimization of Large Buildings using Linear Motor Elevators

Description of the research activities:

The starting point was a literature research and the analysis of buildings energy aspects. This involves the developing of a simulation model by using EnergyPlus. This software is a building performance simulation package, which enables energy analysis and thermal load simulation and is based on high-fidelity physical models in combination with real weather data. The U.S. Department of Energy has developed over 16 benchmark buildings that represent most of the commercial building stock, across 16 locations for energy analysis research, where we used the large office benchmark building model. The advantage of standardized benchmark building models is the possibility to compare energy consumption or specific building technologies for simulation models. By using Matlab in combination with the open source simulation toolbox MLE+, the LME model from Prof. Dr. Markon as well as several smoothing filters like Savitzky-Golay-Filter, we minimized successfully the energy peaks in our first tests. Based on these results, an optimized control system for multi-car elevators will be developed.

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

Always driven by the challenge to meet other cultures and mentalities, I have gained a lot of experience about Japanese culture and science policy. Prof. Dr. Markon spent a lot of time to show me the cultural background and lifestyle in Kyoto and Osaka. He guided me to Museums, Temples, Festivals, Shrines, old Tea Houses and traditional restaurants. I visited Hiroshima and Tokyo as well as Okinawa where I could see the beautiful and spectacular nature of Japan. I also found Japanese and International friends from several research areas, which we want to keep in touch.

9. Advisor's remarks (if any)

Mr. Thomas Ludwig has contributed to our joint research with his ideas and his hard work. His presence at Kobe Institute of Computing has proven the importance of the exchange of people in international cooperation. We are grateful to him; to JSPS and DAAD for providing this opportunity; and to our colleagues in Germany for their support.

RESEARCH REPORT

1. Name: Christian MUELLER	（ID No.: SP13310）

2. Current affiliation: Humboldt University of Berlin

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

4. Host institution: National Institute for Agro-Environmental Sciences (NIAES),Tsukuba   5. Host researcher: David SPRAGUE Ph.D.

6. Description of your current research

Large scale land use change has become one of the most challenging issues of our time with regard to global social equity, sustainability, environmental protection, biodiversity and climate change. In order to allow for proper managing strategies with respect to this issue, land use change mapping and modeling is crucial for a better understanding of its spatial scope and mechanisms.

With regard to land use change in Japan and in the Kanto plain in particular, land use transitions constitute vanishing grasslands on upland plains, loss of "traditional" rice farming, *yatsuta*, in narrow valleys and urbanization in general. These transitions are especially concerning with regard to biodiversity and ecosystem diversity protection, as grasslands and "traditional" rice farming are considered particularly valuable for this matter. What is more, soil erosion and landslides on abandoned rice paddy terraces and loss of cultural landscapes are a concern associated with this issue. Furthermore, intensive rice farming might be reasonable for large fields due to its high profitability and labor efficiency. However, "traditional" rice farming is presumably the more reasonable land use for small fields in narrow valleys, typical for *yatsuta* farming, as it is considered highly energy and cost efficient. Especially in a country like Japan, where available arable land area is highly limited, policies should consider these types of efficiencies and environmental sustainability in an integrated manner.

In order to facilitate decision making a comparison between historical land use in 1881 and modern land use in 2006 was conducted. Additionally a spatial model was created, which was able to explain a considerable part of historic and modern land uses in their respective locations and topography. Landscape planning policies should especially be conscious about the fact that cost distance to towns and to water are highly significant in the model for the type of land use in place and should therefore include infrastructure and water management into the decision making process.

7. Research implementation and results under the program

Title of your research plan:

Approaching historical and recent land cover and land use change in Japan, namely the Northern Chiba prefecture region, using (1) Random Forest Classification of an Alos satellite image from 2006, (2) digitizing historic Rapid Survey maps from 1881, (3) Post-Classification Change Detection and (4) Spatial Multinomial Logarithmic Regression Modeling, in order to identify areas where transitions in terms of land use has occurred or where "traditional" land use is still in place. Description of the research activities:

Historic Rapid Survey maps from 1881 were georeferenced to modern vegetation, road and topological maps. Therefore ground control points were assessed on site. Using raster mosaicking, the georeferenced map images where attached to each other. Roads, rivers and land use boundaries were digitized to line features, which were spatially adjusted to match previously digitized Rapid Survey maps. After rubbersheeting the line features to modern maps, they were converted to polygon features and populated with land use attributes. In order to identify modern land use, an Alos satellite image was classified with the Random Forest Classification algorithm calculating 10000 trees. Post-Classification Change Detection was conducted with raster calculation. Additionally a spatial multinomial logarithmic regression model was created using cost distance to town, to water, elevation, slope and field size as independent variables. Interestingly, no socio-economic or ecological parameters were necessary and only few topographic and topological parameters were sufficient for modeling land use with satisfactory results.

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

Before I came to Japan I thought that this would be a short stay, and it is. However, during my stay it grew to something much bigger than I expected, a lifetime experience. Not am I only absolutely amazed by Japans cultural richness and dynamic, I'm also lastingly moved by honest encounters with its endearing people and by their hospitality and kindness.

9. Advisor's remarks (if any):

Mr Mueller has shown great enthusiasm and attention to detail in adapting his knowledge of geographical information systems (GIS) to the analysis of Japanese historical maps. We expect he will be able to continue to improve his understanding of the historical geography of Japan, and apply his experience to research on Japan in the future.

RESEARCH REPORT

1. Name: Christoph SCHAAL	（ID No.: SP13311）

2. Current affiliation: University of Stuttgart

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: Tokyo Institute of Technology

5. Host researcher: Prof. Masayuki FUJITA

6. Description of your current research

Like all mechanical and civil structures, overhead power lines and the cables of cable-supported bridges have a finite life span. Damages in these structures can lead to catastrophic failure, causing severe harm to people and the surrounding environment. To this day, regular sight inspection from the ground or by helicopter is the common way to detect damages in the aforementioned cable structures. However, this expensive practice is hazardous and limited only to the detection of surface flaws. Therefore, automated Structural Health Monitoring (SHM) schemes have been developed. SHM schemes automize damage detection (existence, location and severity) and prediction of the structure's remaining life. The successful application of a SHM concept involves understanding of diverse disciplines, including materials, modeling, sensor technology and signal processing.

In the project, elastic ultrasonic waves are excited in the monitored cables and are partially reflected and transmitted at defects. Reflections are measured and used by the damage detection algorithms to determine whether or not a defect exists. Wave actuation, propagation and detection are studied theoretically, numerically and experimentally. A fuzzy arithmetical framework is used to investigate the influence of uncertainty caused by insufficient knowledge of complex wave propagation phenomena in multi-wire cables. Moreover, newly developed models are verified with this novel methodology.

7. Research implementation and results under the program

Title of your research plan:

Control for Ultrasonic Structural Health Monitoring

Description of the research activities:

In order to simplify signal processing and increase reliability and precision of ultrasonic SHM concepts, wave actuation in the investigated cable structures was optimized by implementing a controller. An existing optimal feed-forward controller was automated and the numerical efficiency was improved. This control concept, however, only partially fulfilled the design requirements and also proved to not be very robust. Therefore, several other available control concepts, such as feedback control and adaptive filters, were studied. However, most conventional concepts have proven to be infeasible for generating the desired ultrasonic waves. In the end, a relatively new methodology, namely Iterative Learning Control, was found to be the most suitable. A first implementation of the concept in numerical simulations showed very promising results. Hence, further studies on this concept were performed, which led to a very successful and robust controller for different actuators, enabling very precise generation of the desired ultrasonic waves in cable structures.

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

Exploring Japan's rich culture with its historic temples and shrines, as well as experiencing daily life in Japan, has been very exciting. Throughout my studies here and during my short trips to Kobe, Kamakura and Beppu, for example, Japanese people have always been incredibly polite and helpful, making my stay very comfortable. Even though the time with my host family was quite short, it was definitely one of my favorite experiences in Japan and I'm very grateful for how they treated me like part of their family.

RESEARCH REPORT

1. Name: Christiane SCHWAB	（ID No.: SP13312）

2. Current affiliation: Ludwig-Maximilian-University, Munich

3. Research fields and specialties: Humanities (Cultural Anthropology)

4. Host institution: University of Tokyo   5. Host researcher: Tadashi YANAI

6. Description of your current research

My current research project investigates the patterns and forms of representation of the lower and/or rural classes in their social contexts in an unprecedented interdisciplinary and transcultural perspective. Between 1780 and 1830, many regions within the geographical space we nowadays vaguely call Europe experienced crucial social, technological, political, economic and cultural transformations. These changes engendered altered views of the social role of the lower classes and an increasingly aestheticized gaze on their forms of life. These (mainly bourgeois) views differed significantly from the Enlightenment-influenced perceptions of society, which saw the lower classes primarily as a legal entity within a social contract. As a result of this change and among other semantic resonances, the lower classes were stylized as a cultural group and they were frequently exploited as a national category.

In exploring this phenomenon of cultural history, the research project proposes to contribute to an interdisciplinary and transnational or transcultural perspective within the Humanities. Consequently, departing from a transcultural and an interdisciplinary point of view it inquires how the cognitive and ideological (re-)discovery of the lower classes was semantically charged, and how it was shaped in different cultural media, from bourgeois magazines and novels, songs and operas, genre paintings, to fairy tales and ballad collections. The romantic turn to the life-forms of the lower classes was not a geographically defined affair. The Ossianic cult spread throughout Europe, the writings by Madame de Staël were translated in numerous languages, and in 19th-century-London Latin-American activists met European intellectuals fleeing French occupation and figures of English Romanticism. In order to grasp the phenomenon in its wide-ranging impact, its apparition in several media and its social continuities in an appropriate way, the project will break up with disciplinary and geographical frames, and it combines intensive analysis of the sources with context-analysis to investigate the new ideas of the folk in their social circumstances.

I will choose several foci to gain access to the broad field of research. One main focus

will deal with the diverse semantic associations connected to the concept of folk, which differed significantly within particular ideological and geographical contexts, ranging from anti-rationalist criticism, nationalist or regionalist claims, the cultural amusement of a growing bourgeoisie and the claim for human purity to the restoration of traditional values, such as religion, obedience or feudal orders. A second focus will concentrate on particular systems of media within their transnational linkages, such as the constantly growing newspaper market or the collections of popular ballads, songs and fairytales. The third point aims to explore the imagination of certain regions, which, due to their peripheral location, were transformed into romantic places, where an authentic and pure folk life was supposed to be treasured. The fourth perspective proposes to examine the continuity of concepts, such as people, folklike and authenticity, which emerged during the period of investigation and which have been affecting academic work and political debates until today.

7. Research implementation, research activities and results under the program

The goal of the stay in Japan was to conduct discussions with Japanese colleagues in order to evaluate the project and to define key categories of research. Furthermore, it aimed to become acquainted with the academic system in Japan, about anthropological research within Japan and to establish contacts with colleagues and students. Professor Tadashi Yanai was an excellent host. Apart from the content-related discussions we used to have, he made everything possible for me to get a profound impression of academic life at the University of Tokyo. He invited me to seminars, he provided literature and bibliographical hints, and he introduced me to several researchers. Among those was Michiya IWAMOTO, the current Head of the Folklore Society of Japan. With professor IWAMOTO and one of his students I had enriching discussions on the development of Japanese folklore studies, a field which was completely new to me before coming to Japan. Michiya IWAMOTO in turn established a contact to Seijo University. Seijo University is conducting one of the most renowned folklore programs within Japan and owns the very important library of Yanagita KUNIO, one of the first folklorists in Japan. The visit at Seijo University was especially fruitful, since there I could meet researchers whose have important overlaps with my actual research project and we agreed upon exchanging ideas in the future.

Apart from the academic exchange, during my stay at the University of Tokyo I could progress significantly with the written elaboration of my research project, benefitting from the excellent working conditions that the University of Tokyo is offering to students and researchers. In conclusion, the stay at the University of Tokyo made my research advance in a substantial way and I expect that the academic exchange, which was started during my stay, will be continued in the future.

RESEARCH REPORT

1. Name: Verena Zuerbig	（ID No.: SP13313）

2. Current affiliation: Fraunhofer IAF / IMTEK, University of Freiburg, Germany

3. Research fields and specialties:

    Engineering Sciences

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

5. Host researcher: Dr. Yasuo Koide

6. Description of your current research

Wide-bandgap semiconductor based micro-opto-electro-mechanical systems (MOEMS) have attracted much interest for the development of prospective tunable micro-optical devices. The performance of modern tunable micro-optic components is rather limited by their mechanical and tribological properties, often not applicable to fast moving micro- and nanoelectromechanical (MEMS, NEMS) devices. Nanocrystalline diamond (NCD) elastic layers combined with aluminum nitride (AlN) piezo actuators allow for microfabrication of ultrathin, mechanically stable micro lenses designed to operate at high repetition rates. NCD thin films demonstrate exceptional mechanical properties including high Young's modulus (E~1000 GPa) and sound velocity along with p-conductivity via heavy boron doping.

My current work is carried out in the course of the German Research Foundation (DFG) Priority Program 1337 in collaboration with the Technical Universities of Ilmenau and Kaiserslautern. Within the project, optical MEMS components for the adaptive scanning imaging system, imitating the complex functions of the human eye, are under development. The mechanical properties of AlN- and NCD-based single- and multi-layer circular membranes have been studied. The elasticity in such AlN/NCD bilayer systems is mainly determined by the advanced mechanical properties of NCD. In these mechanically stable devices, when applying a voltage to the AlN actuator, the strain induced perpendicular to the electric field changes and leads to a spherical bending of the membrane resulting in focus length variation of 44 – 52 mm. Furthermore tunable piezo actuated diamond lenses comprising radially segmented actuators for aspheric deformation of the lens surface have been fabricated and investigated. These features are quite beneficial for the optical components either to be used as wave front filter or for correction of aberrations induced in complex optical systems. A maximal aspheric surface deflection amplitude of ~100 nm was obtained by applying the AC bias on one quarter segment, proving the independent functionality of multi-sector actuators.

7. Research implementation and results under the program

Title of your research plan:

Thin Diamond/PZT unimorph structures for tunable micro-opto-electro-mechanical systems

Description of the research activities:

The integration of $Pb(Zr_xTi_{1-x})O_3$ (PZT) thin films with NCD elastic layers offers the possibility of low voltage piezo-actuation (≤ 10 V) due to the high d_{33} piezoelectric coefficient of PZT ($d_{33} \sim 130$ pm/V) which is much higher than the d_{33}-coefficient for AlN ($d_{33} \sim 4.50 - 5.53$ pm/V). The fabrication of perovskite PZT thin films on diamond substrates has been demonstrated to be difficult due to the high thermal expansion mismatch between PZT and diamond and the stress issues in the PZT layers. To overcome this problem an ultrathin transparent dielectric buffer layer (CaF_2) was included between diamond and the PZT film. For these structures we observed high-quality ferroelectric PZT films as evidenced by X-Ray diffractometry, ferroelectric hysteresis measurements and high resolution transmission electron microscopy. Finally, a lot of PZT/NCD samples were prepared for fabrication of high-performance piezo-actuated micro lenses.

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

I want to thank Dr. Yasuo Koide, Dr. Meiyong Liao and all the other group members for the warm welcome and integration and for their continuous support during my stay at NIMS. It has been one of the greatest experiences in my research career. I had the opportunity to visit many different places in Japan (Kyoto, Hiroshima, Osaka, Okinawa) to get a background on Japanese history and culture. In addition, I spent unforgettable days with my host family. I really enjoyed the time in Japan and I am looking forward to coming back.

9. Advisor's remarks (if any):

I certificated that Ms. Verena Zuerbig stayed in Wide Bandgap Materials Group of Optical and Electronic Materials Unit in National Institute for Materials Science (NIMS) for two months from July 19 to August 19, 2013. Her major work was in the preparation and characterization of ferroelectric Pb(Zr,Ti)O (PZT) films deposited on nanocrystalline diamond (NCD) layers by using a sputter-deposition technique. She fabricated more than as many as 70 samples and found out the best condition to obtain high-quality ferroelectric PZT films on NCD, and had gained experience for deposition and photolithography techniques, x-ray diffractometry, transmission electron microscopy, and polarization properties.   Y. Koide

RESEARCH REPORT

1. Name: Florian Knall	（ID No.: SP13314）

2. Current affiliation: University of Ulm

3. Research fields and specialties: Surface chemistry and catalysis

4. Host institution: Toyota Technological Research Institute   5. Host researcher: Hisato Yasumatsu

6. Description of your current research   Current research focuses on catalytic activities of small metal clusters consisting of only a few atoms which are supported by insulating metal oxides and semiconductor surfaces. In detail, sophisticated techniques are applied like low energy electron diffraction (LEED), Auger Electron Spectroscopy (AES) and Temperature Programmed Desorption (TPD) as well as Photoelectron Spectroscopy (PES) including two photon photoelectron emission (2PPS) in order to gain a deeper understanding of electronic states of these catalytic systems.

7. Research implementation and results under the program
 	
    For the period of the summer program a special system consisting of platinum clusters with a size of 30 atoms which are deposited on a silicon substrate, in detail Si(111)-7x7 surface, was investigated. To gain a deep understanding of electronic states of this system photoelectron spectroscopy was applied. Therefore an adequate analyser had to be assembled and attached to a built-up ultra high vacuum chamber. Furthermore a measurement setup had to be constructed consisting of a second and third harmonic generator for femtosecond laser pulses. For further time-resolved measurements also a setup has been created which is capable of providing reliable beam paths for two color pump-probe measurements with a delay and a compressor stage.
 	
  Finally photoelectron spectra could be obtained of bare Si(111)-7x7 structure which seem very reasonable compared to former measurements that have been published. Then Pt-30-clusters were deposited and the photoelectron spectra were compared to those of bare silicon. Also laser intensity dependencies were recorded for this catalytic system. The results of this work may be published after further calculations and comparison.

By that, a very reasonable basis was created for a further collaboration between the Cluster Research Laboratory (TTI) and the group of the Institute for Surface Chemistry and Catalysis of the University of Ulm.

Also I was invited to the weekly progress report talks given by the members of the laboratory which were very interesting and providing a lot of information on measurements regarding catalytic activity of metal clusters and the experience of cluster deposition.

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

During my stay in Japan the members of the research institute gave me many welcome and great recommendations not only of various spots I could visit. By that I could not only experience Tokyo but also Okinawa and Nikko and due to the flexibility of JSPS regarding the return date I will travel through Japan for another two weeks. So I am planning of going to Sapporo, Sendai, Kyoto, Osaka and Hiroshima.

RESEARCH REPORT

1. Name: Stefan Krämer	（ID No.: SP13315）

2. Current affiliation: PhD Student

3. Research fields and specialties:

    Mathematical and Physical Sciences

4. Host institution: Kyoto University

5. Host researcher: Prof. Koji Fujiwara

6. Description of your current research

Currently we are calculating modular forms for arbitrary arithmetic subgroups of the modular group $PSL_2(Z)$. Whereas basically everything is known for congruence subgroups, very little is known for the non-congruence subgroups. A powerful tool for investigating these non-congruence subgroups was introduced by Kulkarni in 1991 and is now known as Farey-Symbols. Thanks to the work of Prof. Monien, a complete and efficient implementation become available recently.

We decided to attack the problem of calculating modular functions with the help of numerical calculations.

Hejhal proposed an algorithm for the numerical calculation of Maass wave forms. This was modified to find approximations of the q-series of a generator of the field of modular functions, called the hauptmodul. To deduce the exact values of these approximations of the coefficients, we need to apply further techniques. Up to now, we found two different ways. The first one is to use the theory of Belyi-functions and Dessin d'Enfants: When relating the hauptmodul of an arithmetic subgroup to the hauptmodul of $PSL_2(Z)$, namely the Klein-J-function, one finds a Belyi-function. This can be used to deduce the exact values of the coefficients of the q-series of the hauptmodul.

The second approach is based on an idea of Prof. Monien: The inverse hauptmodul maps the whole complex plane to the fundamental domain of the arithemtic subgroup, which can be choosen to be bounded by straight lines and arcs. If the same is true for the restriction to the upper half plane, the theory of conformal mappings applies. Here, we need to find and solve a certain third order differential equation. To write down this differential equation, we have to determinate its so called accessory parameters. In general is can be very complicated to do this, but with the help of the numerical approximations it is possible. From the solution of this differential equation, we can again deduce the exact values of the coefficients of the q-series of the hauptmodul.

7. Research implementation and results under the program

Title of your research plan:

Farey – Symbols and the calculation of modular functions

Algorithms based on Belyi-functions

Description of the research activities:

In order to be able to find new algorithms and test their implementions a good pool of examples is needed. But especially examples of non-congruence groups with known modular functions are very rare. My research goal for my visit at Kyoto university was to find algorithms to construct new examples and extend this pool of examples.

To do this, we used the theory of Belyi-functions and Dessin d'Enfants. On the one hand, we found a way to construct a Farey-Symbol, hence an arithmetic subgroup of $PSL_2(Z)$, from a given Dessin d'Enfant with certain restrictions. On the other hand we were able to calculate the q-series of the normalized generator of the field of modular functions from the Belyi-function.

Combining these two constructions, we are now able to construct an arithmetic subgroup including its modular functions from a Belyi-function and its Dessin.

In the article "Belyi-functions for hyperbolic hypergeometric-to-Heun transformations" by van Hoeij and Vidunas a very large list of such pairs was presented. We sucessfully applied these constructions to their list and produced in this way more than 500 new examples of non-congrunce subgroups, including their modular functions.

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

During my stay at the Kyoto university, my host was organizing a conference about geometric group theory. I had the possibility to attend and it was a beautiful and exciting experience, from a mathematical point as well as from a cultural one.

RESEARCH REPORT

1. Name:Daniel LIEBEHERR	（ID No.: SP13316）

2. Current affiliation: Karlsruhe Institute of Technology, Karlsruhe

3. Research fields and specialties: 　Humanities (European Studies)

4. Host institution: University of Tokyo

5. Host researcher: Guido RAPPE, Shinji KAJITANI, Kohji ISHIHARA

6. Description of your current research My current research project investigates the age of 32-bit personal computers, starting in the late eighties of the last century going on to the present time. This research is for my master thesis. I will point out the development of home computer systems, especially how and why they became accessible to a wider range of people. Therefor I will show how the hard- and software changed compared to 16- and 8- bit computers. Graphical User Interfaces (GUIs) changed the ways of operating computers from text based input methods to icon based input methods using a computer mouse, so home computers were easier to handle because less knowledge of the functionality of computers was necessary. The rise of the internet, starting in the middle/late nineties and its impact on society will also be one of the topics of my thesis. I will show these developments in the changes of used hard- and software and the development of both parts. Ubiquitous computing, the change of the form factor, from tower based computers, over notebooks toward netbooks, tablet computers, smartphones and even Google's "Glass" will show that computers got more miniaturised in general so that we are now able to "wear" computers. How that was made possible will be explained. As a historian of technology I will not go to deep into technical details. From my point of view I will show clearly visible changes easy to understand from the position of a computer user. I also will show technologies, which did not make it into the market and also alternative or niche computer technologies. My research led me to my stay here in Japan, because common computer technologies can be used to help disabled people to manage their daily life in better ways. Text to speech, speech to text, text to braille software technologies on one side and special hardware devices on the other side help nowadays disabled people to access media and participate in life more easily and independent.

7. Research implementation, research activities and results under the program 　　The goal of the stay in Japan was to find out how disabled people stand in society in our days and what the historical development was, starting in 1918. Therefor I decided to compare the development of both 1st world nations Germany and Japan in a direct way. First I took a look at the definitions of disability in both countries. The

decision starting with the end of world war 1, which had a huge impact to Germany because of the, at this time so called, "war cripples" who came back from the front into society, after the war was lost in late 1918. Japan itself, also a participant of world war 1, had not to deal with that masses of disabled ex-soldiers like Germany did, because Japanese soldiers did not experienced the trenches warfare which was typically for the war in Europe.

The first German law, which took care of disabled persons was the "Prussian Law on Cripples Welfare" in 1920. During the Weimar Republic disabled people were able to work through the advances in prothesis technology. During the period oft he Third Reich mental and physical disabled people were killed in the so called "T4" program. On the other hand disabled ex-soldiers were organized within the regime and had the respect of the political leaders. Even the Hitler Youth had own special "Banne" (banners) for disabled youths.

After the war Germany and also Japan for the first time had to deal with huge numbers of disabled people as a result of the bombings during the war. The development of both nations depending disability was quiet similar in both countries. I also showed the differences between East-Germany (GDR) and West-Germany (FRG). Japan and Germany are nowadays two of the best developed countries depending disability. Barrier-free accessibility is seen as an important political goal.

I learned during my stay here in Japan that only very few English literature is available on disability in Japan. My main source was the book written by Carolin S. Stevens, named „Disability in Japan", published in New York in 2013. It gives only a few historical facts on disablity. Most oft the topics are about raising a disabled child (the daughter of the author) in Japan.

I also visited the labs of Professor Mamoru IWABUCHI and Professor Kenryu NAKAMURA at the Komaba campus, who showed me their actual research objects. I learned that common technologies like smart phones, laptops and even gaming devices like the Microsoft Kinect are used to help disabled people managing their lifes in a better way. This is possible through open programming interfaces and free accessible software development kits.

On my last day at the Komaba campus, the August 19th, I held a presentation at Professor ISHIHARA's lab and presented my research results.

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

I experienced Japanese cultural life in many ways. During my home-stay at my guest family I got to known to daily Japanese life. Also I visited museums and historical sites in Tokyo like temples, shrines or the Emperor's palace. I learned about the Japanese board games of "Go" and "Shogi". I got first hand information about Japanese religious life and the political system. Now I have a good feeling about living in Japan and the knowledge that I would be able to manage daily life. I also made some Japanese friends.

RESEARCH REPORT

1. Name: Heiko Moossen	（ID No.: SP13317）

2. Current affiliation:

Birmingham Molecular Climatology (BMC)
School of Geography, Earth & Environmental Science
University of Birmingham

3. Research fields and specialties:

Chemistry - Organic Geochemistry/Paleoclimatology

4. Host institution: Institute of Low Temperature Science; University of Hokkaido

5. Host researcher: Dr. Osamu Seki (Associate Professor)

6. Description of your current research

An estimated precipitation reduction of 25 - 40 % has been shown to have lead to the demise of the Mayan high culture 1200 years ago (deMenocal, 2001; Medina-Elizalde & Rohling, 2012). As a result of climate change, models suggest that UK winters will become 30 % wetter, while UK summers will receive 50 % less precipitation by the 2080s, resulting in a 20 % net reduction of annual precipitation (Fowler *et al.*, 2007; references therein). Such a reduction of precipitation will likely have adverse economical effects in the UK. However, the modeling of precipitation is still associated with large uncertainties (Blenkinsop & Fowler, 2007).

By placing contemporary precipitation observations into a geo-historical context of precipitation variability it will be possible to better understand the forcing mechanisms driving precipitation change today. This can be achieved by producing paleo-precipitation records covering the Holocene (the last 11,500 years). The better understanding of precipitation change throughout the Holocene will ultimately improve the model parameters used for modeling precipitation in the future.

My research focuses on using organic geochemical fossils (biomarkers) as proxies for changing climatic variables such as precipitation, and on the quantitative and qualitative analyses of biomarkers in marine sediment cores to produce paleoclimatic records.

7. Research implementation and results under the program

Title of your research plan:

North Atlantic precipitation variability throughout the Holocene

Description of the research activities:

The aim of my research visit to Japan as part of the JSPS funded summer program 2013 was to complete a record of the hydrogen isotopic (δD) composition of the C_{29}-n-alkane, a component of terrestrial land plant leaf wax, found in a sediment core from Northwest Iceland (Figure 1). During my stay in Japan I analysed 78 samples that, combined with the previously analysed pilot data, form a precipitation record covering most of the Holocene. This record complements two further precipitation records and confirms the results obtained from them. The combination of all three records enables a detailed look at how precipitation has changed throughout the Holocene in the central North Atlantic Ocean.
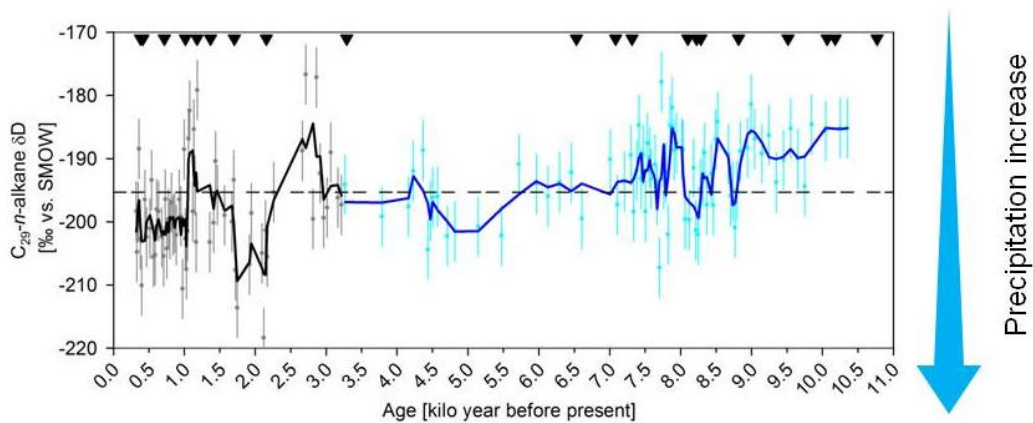

Figure 1: High resolution precipitation variability in the central North Atlantic throughout the Holocene using the hydrogen isotopic signature (δD) of the C_{29}-n-alkane, a biomarker for higher terrestrial land plants, from a sediment core from Northwest Iceland. Preliminary data (dark gray dots including analytical error bar) and 3-point moving average (black line), and data points analysed during the JSPS 2013 summer program (cyan dots and analytical error bars) and the 3-point moving average (blue line) make up the complete dataset (n=142). The dashed black line indicates the mean Holocene precipitation. Black triangles indicate the ^{14}C-AMS dated sediment horizons of the sediment core.

RESEARCH REPORT

| 1. Name: Johann NICOLAI | （ID No.: SP13318） |

2. Current affiliation: PhD-Candidate, University of Potsdam, Germany

3. Research fields and specialties:

Humanities

4. Host institution: Sophia University, Tokyo

5. Host researcher: Professor Sven SAALER

6. Description of your current research

My present research is concerned with a German-Jewish organization involved in the defence against antisemitism: the "Central Association of German Citizens of Jewish Faith" (C.-V.). The foundation of this organization was initiated by the German-Jewish theatre director Raphael Löwenfeld, who wrote an essay in a period of political success of antisemitic candidates in German general elections throughout the 1890s. Löwenfeld's concept in his essay "Protected

Jew or Citizen?" was that German Jews should take the defence of their civil rights in their own hands instead of asking the German Emperor for protection. On the basis of this idea, the Central Association was created in 1893 and continued its work through the turmoils of time until 1938.

The time of Nazi rule in Germany marks a drastic change not only to German history but also to the Central Association as an organization believing in the values of enlightenment, liberalism and a legal state. In my dissertation on the Central Association I will trace the changes for German Jews relying on their rights a German citizens and constantly expressing their love for their homeland in a German society, which first excluded them, then deprived them of their rights and possessions and finally moved to the extermination of German Jewry. For the Central Association this historical situation remained a challenge

it could not master, though it tried its best to improve the situation of at least some individuals by legal and economic consulting and was even able to succeed in about 200 cases from 1935 to 1938. However, the organization was dissolved after the November Pogrom of 1938 in Germany. The institution of the Central Association failed – nevertheless its spirit is much alive in the ideals of democratic postwar Germany.

7. Research implementation and results under the program

Title of your research plan:
Antisemitism in Japan

Description of the research activities:

I was able to intensively study Japanese attitudes towards the Jews utilizing the facilities of Sophia University Library, the German East Asiatic Institute (OAG) as well as scholars of Japanese-German relations at other institutions. Access to the databases of Sophia University allowed me to analyse articles of newspaper such as the Washington Post and the New York Times. Additionally, two recent monographs, "Jews in the Japanese Mind" (Goodman/Miyazawa, 2000) and "The Russian Protocols of Zion in Japan" (Kovalo, 2009) served as a reliable historical sources for my research.

Beyond the research of written resources, I established contacts with the OAG and got acquainted with the work and history of the 140 years old institution. I also participated in lectures organised by the OAG. Furthermore I had the privilege to meet Professor Tajima of Seijo University and exchange views about Japanese history in the 20th century with him. Finally I also attended lectures at the German Institute for Japanese Studies (DIJ) on recent Japanese politics and economy by Professor Ellis Kraus as well as lectures at the Institute of Comparative Cultures (ICC) at Sophia University.

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

I experienced the introduction week in Japan a bit as an overload of information: Studies in Japanese language should be more intense and focussed. The home-stay was a highlight and should definitely remain an essential part of the orientation week as well as the poster presentation.

9. Advisor's remarks (if any):

The participation in the JSPS's summer program allowed Johann Nicolai to get important insights into Japanese historical science, as well as into networks of organizations and individuals dealing with Japanese-German relations in Tokyo. He was able to identify a large body of literature and sources, which will allow him to include a non-European angle into his dissertation, or pursue the problem of the Jews in Japanese-German relations in a later project, maybe on the postdoc level. I am convinced that the program gave him valuable insights and was a source of inspiration, which will help him pursue more meaningful studies in the future.

RESEARCH REPORT

1. Name: Anke WEIDENFELDER	（ID No.: SP13319 ）

2. Current affiliation: Clausthal University of Technology

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: The University of Tokyo

5. Host researcher: Prof. Takeshi MORITA

6. Description of your current research

Single crystalline lithium niobate ($LiNbO_3$, LN) is well known for its electro-optic properties. It is commonly used in its lithium deficient congruent composition where the defect chemistry is accepted to be dominated by lithium vacancies. The applicability of congruent LN (cNL) is limited up to 300 °C due to a degradation of the material. In contrast the stoichiometric composition has a lower concentration of lithium vacancies and a high-temperature stability is expected up to at least 900 °C due to previous studies.

The objective of my work at the Clausthal University of Technology is to get a better understanding of the defect model and of the piezoelectric properties of stoichiometric LN (sLN). Therefore, electrical and electromechanical investigations as well as diffusion experiments are done at high temperatures. A series of samples with different lithium content are investigated. As a result at ambient air lithium ions are confirmed to be the main charge carrier in sLN diffusing via lithium vacancies. The activation energies of the conductivity and of the electromechanical losses are determined and compared. This indicates that the measured losses are not affected by the electrical properties. Further, the investigation of the resonance frequency (f_R) of the fundamental mode and the inverse Qf product of X-cut samples shows a clear temperature dependence. However, for cLN the determination of f_R was feasible only up to 600 °C while samples with higher lithium concentration could be investigated up to 900 °C.

Additionally, the high-temperature stability is determined by investigating the influence of different metal layers. For X-cut cLN a lithium loss within the first 300 nm could be determined whereas for sLN no influence could be observed.

7. Research implementation and results under the program

Title of your research plan:

Direct investigation of the piezoelectric behavior of stoichiometric and congruent lithium niobate

Description of the research activities:

The objective of the research is the determination of the vibration velocity of sLN and cLN crystals as function of excitation voltage. The velocity is affected by the piezoelectric behavior of the material and is dependent on the crystal orientation. The investigated samples are made of 36° Y-cut LN plates. First, bars with a length of about 10 mm in X-direction and about 1.5×0.5 mm² surface are prepared. As electrodes gold layers are sputtered on the 36° Y-surfaces of this bars and additionally wires are connected to the sample using a conductive paste. The applied voltage along the 36° Y-direction causes different vibration modes of the sample. In this study the vibration along the X-direction is investigated using a laser-Doppler-vibrometer. Due to the requirements of the measuring conditions a sample holder with an individual design had to be prepared.

Prior the velocity measurements, the fundamental resonance frequency of the LN bars has to be determined. This is done by using an impedance analyzer. The detected frequency is applied as AC voltage to the samples with varying amplitudes ranging from 5 to 100 V (0-peak).

The investigation of two cLN and two sLN samples shows a difference in the velocity for the two compositions. For the cLN samples a linear behavior is observed up to an excitation voltage of 40 V (0 to peak). Above 40 V the slope becomes lower. In contrast the sLN sample exhibits a linear dependence of the velocity on the excitation voltage up to 80 V and saturates at higher excitation voltages.

RESEARCH REPORT

1. Name: Kelly He	（ID No.: SP13401）

2. Current affiliation: University of British Columbia

3. Research fields and specialties:

   Engineering Sciences

4. Host institution: Ritsumeikan University

5. Host researcher: Konishi Satoshi

6. Description of your current research

Segmented flows of droplets in microfluidic channels separated by gas slugs have numerous applications including high-throughput chemical and biological assays. Among different approaches, the pressure driven T-junction mechanism has been used extensively. However, using this method, droplets are formed continuously when the pressures at the two inputs are maintained. As a graduate student at the University of British Columbia, my research focuses on the development of a device that implements electrowetting on dielectric (EWOD) droplet breakup in a T-junction geometry to create droplets in a digitally controlled manner.

7. Research implementation and results under the program

Title of your research plan:

DIGITAL ALIQUOT GENERATION IN A MICROFLUIDIC T-JUNCTION USING EWOD

Description of the research activities:

At the cleanrooms of Ritsumeikan University, we have fabricated new devices using the processes developed at UBC with the techniques developed by the Konishi Lab. New devices were fabricated with a different hydrophobic material SiCx with a patterning technique that was developed by the Konishi Lab.　With the new devices, we were able to show that liquid can be moved into the carrier channel from the dispersed channel using EWOD.　This shows the possibility of using EWOD in microfluidic channels as a digital switch for liquids.

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

During my stay in Japan I had a chance to experience Japanese life and enjoy many cultural events.　From the ancient bells at the Gion matsuri, to the extremely "ganki" music and dances at a maid café in Akihabara, I love everything about Japan and I would love to come back here again.　I can totally see myself settling down in Japan someday.

RESEARCH REPORT

1. Name: Yingli Rao	(ID No.:SP13403)

2. Current affiliation: Queen's University, Canada

3. Research fields and specialties:

   Chemistry

4. Host institution: Department of Chemistry, the University of Tokyo

5. Host researcher: Prof. Nishihara

6. Description of your current research

    Smart materials are those that change either their properties or their functions in response to change in some external conditions, such as light, heat, mechanical force or passing an electric charge through them.

    Smart materials such as electroluminescence and photochromism materials are of particular interest here. Electroluminescent organic compound is widely used as emissive layer in OLEDs (Organic Light Emitting Diodes). Photochromism is defined as the reversible color and structural change of a compound upon light.

    My research concerns the design and development of novel classes of organoboron materials for applications as smart materials. My research achievements focused on the bluish-green phosphors in OLEDs based on triarylboron containing Pt(II) complexes, and exploration of photochromic boron compounds.

7. Research implementation and results under the program

Title of your research plan:

Smart Materials Based on Organoboron Compounds

Description of the research activities:

I worked on ferrocene modified photochromic organoboron compounds at the University of Tokyo. The combination of redox-active ferrocene and photosensitive organoboron molecules might afford a "lock-unlock" system with multi-addressable and gated photochromic properties.

During these two months, I have successfully synthesized and characterized the target molecule I proposed. We then monitored the photochemistry of the ferrocenium-borane species via chemical oxidation. However, the instability of ferrocenium species was a big problem during this project. Computational chemistry to simulate the electronic transition before and after oxidation was conducted to fully understand such system.

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

This two-month exchange has greatly enriched my life! The kindness and welcome from all the Japanese people I have met both inside and outside the lab are the most precious gifts I could have ever received. The patient guidance from the professor and students in the lab has profoundly broadened my research view. Words cannot describe how grateful I am to everything I have experienced here.

RESEARCH REPORT

1. Name: Daniel J. Rea	（ID No.: SP13404）

2. Current affiliation: University of Manitoba

3. Research fields and specialties:

   Mathematical and Physical Sciences

4. Host institution: University of Tokyo

5. Host researcher: Dr. Takeo Igarashi

6. Description of your current research

The creation of interactive character behaviours in video games is a difficult task that is generally relegated to programming, and this is not always accessible to game designers who may have backgrounds in digital animation, writing, or design. We propose to investigate a new user-centered method for shifting the authoring process away from programming paradigms, based on the idea of user-centered behaviour primitives; we will show how common interactive behaviours can be described in terms of easy-to-understand primitives such as visibility (hidden, or peeking around a corner) or relative position (stay behind the character), and that this is sufficient to enable the generation of convincing results. Finally, we will explore various user interface designs that will aid designers in authoring behaviours with our behaviour primitives.

The behaviour primitives will be found by analyzing game developers and designers about what kind of behaviours they normally create, as well as their design process. We will analyze these results with an iterative, qualitative approach which we hypothesize will result in a small set of primitives that can be combined to describe a wide range of behaviours.

To keep the design process quick and intuitive, we will experiment with different kind of sketching interfaces.   For instance, if the designer sketches interactions by drawing the path of movement of both the player and the computer character. We will investigate what kinds of interfaces will create data that can be generalized into a robust behaviour while at the same time keep things simple for non-technical users.

7. Research implementation and results under the program

Title of your research plan:

Behaviour Primitives for End-User NPC Behaviour Creation

Description of the research activities:

After analyzing the interviews with game designers, we had a set of *behaviour primitives*—a set of parameters we can use to computationally model movement in video games. We would set a *target state* by giving a value to each of these parameters.   For example, a *chase* behaviour would have a low distance from player, and a high speed.   The computer character would try to match this state by moving closer to a spot that better matches this target than its current position.   We validated these primitives by controlling this target state in real-time, and found we could produce understandable movements.

Next we investigated different interfaces to create behaviours with our parameters. Many were unsuitable for our *behaviour parameter* system. Finally, we created a painting interface where the user paints a goal colour for the end goal of a behaviour, a green colour for places where the computer can move in, and red for places the computer should not go. The input does not have to be precise and is very simple to control. These are fed into a machine learning algorithm which predicts, from the input paintings, what colours a new scene should have, and then the computer picks a goal space as a *target state* and uses green-painted areas to get there. Our system can react to dynamic situations, reacting in real time to player movements.

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

During my stay, I was able to experience summer in Tokyo. I Lived in a share-house that had a mix of Japanese and non-Japanese people, and we had many adventures such as a weekend trip to Hakone, as well as watching fireworks and Japanese Matsuri.
I was also able to attend a conference in Sapporo and present a poster of my research under the JSPS program. Every city in Japan has a wonderful and different feel.