



FAIRFIELD UNIVERSITY CHAPTER

11TH ANNUAL POSTER SESSION

Thursday | April 28, 2011

Barone Campus Center

3:00 p.m. to 5:00 p.m.

Sigma Xi acknowledges additional support by the Office of Academic Engagement



Roland Abichaker
Evan Apanovitch
Dana August
Kathleen Barr
Sadiah Bhatti
Kathryn Bimson
Justina Caushi
Michele Espinosa
Jessica Gilpin
Kevin Goncalves
Jennifer Haskell
Sarah Lander
Nida Malik
Russell Meister
Umar Munshi
Helen Nelson
Nancy Resparza
Patrick Shea
Thomas Smith
Katie Sullivan
Maryam Sumra
Kekoa Taparra
Matthew Tougas
Amy Tran
Jennifer White
Michael Whitley
Steven Velez

BIOLOGY

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Roland Abichaker

CLASS: 2011

MAJOR: Biology

TOPIC OF RESEARCH PROJECT:

Optimal lipid conc. of algae cells in a growth medium: Biodiesel conversion from lipids

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Joanne Choly

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM: 08/2010-present

SPONSOR: Fairfield University

DESCRIPTION OF WORK (Short Abstract):

Greenhouse gases, including CO₂ output, is an ever-growing issue the world has to deal with now and in the upcoming decades. The dwindling oil supply is another cause for concern since most of the world's energy comes from fossil fuels. Algae have showed promising results for producing lipid-based biofuels and their capability to absorb CO₂ from the atmosphere. Algae grown for total lipid bio-fuel by a photosynthetic process requires only sunlight, water with the appropriate nutrients, and carbon dioxide. In this experiment, we tested various concentrations of nitrogen and phosphorus for effect on growth and lipid concentration in *Scenedesmus* sp, by modifying a growth medium as described by Xin et al, 2010. The highest concentration of phosphorus labeled P 2.0, 0.176 g/ 400mL, and the highest concentration of nitrogen labeled N 25, 3.61 g/ 400 mL, showed the highest yield of algae growth. In one preparation method, *Scenedesmus* sp. cells were ultrasonicated and frozen to break open the cells. In another preparation method, *Scenedesmus* sp. cells were filtered, dried, weighed and frozen; these cells were later hand ground in a mortar and pestle to break open cells. Lipid extraction and lipid purification were performed to obtain triacylglycerides. A methylation procedure was performed to the fatty acids for gas chromatographic analysis and biodiesel production.

FUTURE PLANS:

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Dana August

CLASS: 2011

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: Combination of legumes and grains contributing to soil quality in Fairfield University's garden

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Tod Osier, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM: May 2010-June 2011

SPONSOR: Fairfield University Biology Department

DESCRIPTION OF WORK (Short Abstract):

Cover crops are necessary aspects of organic agriculture. They enhance soil nitrogen and carbon, decrease water runoff and moisture evaporation, potentially assist with pest management, and work against erosion which can degrade soil. In organic practices, the objective is to use minimal amounts of synthetic chemical products and utilize the naturally occurring nutrients available from the soil and additional recycled organic content. The Fairfield University campus garden project broke ground in spring of 2010. The garden was built and is maintained using organic and sustainable practices. The garden is comprised of eighteen raised beds and 275 feet of in-ground crops. In summer 2010, a variety of crops were planted including: basil, carrots, cherry tomatoes, cilantro, kale, pumpkins, summer squash, zucchini, and perennial herbs. The harvest was distributed to the student cafeteria, the Jesuit on-campus dining hall, and a local food bank (120 pounds of food). In addition to being a teaching tool to highlight sustainable practices, the garden was designed as a laboratory for student-faculty research. Rye (*Secale cereale*), an established cool season grass, Hairy Vetch (*Vicia villosa*) and Crimson Clover (*Trifolium incarnatum*), two winter legumes, can have extensive benefits in enhancing soil quality. We are testing the effects of these cover crops individually and in combination in enhancing soil nitrogen and carbon during the winter fallow when the soil would otherwise be dormant and potentially degraded.

FUTURE PLANS:

Once final soil samples are taken in late May 2011, final conclusions will be made regarding the most suitable cover crop combination for the Fairfield University garden. The data and conclusions from this research are expected to provide guidelines for continued sustainable maintenance of the garden, and increased health of the crops produced.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Sadia Bhatti

CLASS: 2012

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: Effects on Growth and Oxidant Resistance of Articular Chondrocytes when Treated with Zinc and Steroid Dexamethasone

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Glenn Sauer, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM: 2010-2011

SPONSOR: Corrigan Scholarship

DESCRIPTION OF WORK (Short Abstract):

In this study, we are examining the effects of zinc and the steroid dexamethasone on growth and oxidant resistance in articular chondrocytes. Other studies have investigated the role of apoptotic agents on chondrocyte death and its influence on cartilage health. We are thus investigating factors that may be useful in delaying cartilage breakdown and the onset of osteoarthritis. Thus far we have observed the effects of zinc treatment on cellular protein and DNA levels in cultured cells. Now we are investigating if zinc or dexamethasone supplementation will increase the resistance to cytotoxic oxidizing agents. Our hypothesis is that when cells are supplemented with zinc or dexamethasone they will become resistance to oxidizing agents due to the induction of metallothionein and other cellular anti-oxidants. Cell cultures treated with zinc over a span of 72 hours showed increased levels of protein and DNA. Zinc was toxic to chondrocytes at concentrations above 100 μM . The toxicity of hydrogen peroxide to chondrocytes was determined using an LDH release assay. Zinc supplementation modestly increased the resistance of chondrocytes to 4 hour hydrogen peroxide treatments.

FUTURE PLANS:

The influence of dexamethasone on cell growth and H_2O_2 toxicity will also be presented.

2010/2011 STUDENT RESEARCH IN MICROBIOLOGY

NAME: Michele Espinosa & Kathleen Barr

CLASS: 2011, 2012

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: Determination of Biofilm Formation on Contact Lens Cases and the Effect of Chemical Agents on Bacterial Growth

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Olivia Harriott, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 2

DATE OF PROGRAM: January 2011-May 2011

SPONSOR: Fairfield University Biology Department

DESCRIPTION OF WORK (Short Abstract):

Multipurpose solutions are commonly used for routine contact lens disinfection. This study aimed to determine the effect of contact lens cleaning solutions and common cleaning regimens on bacterial biofilm growth on contact lens storage cases. Microorganisms associated with eye infections, as well as putative staphylococci were used to indirectly evaluate biofilm formation on contact lens cases. Antimicrobial efficacy tests were conducted on Opti-Free[®] Replenish and Biotrue[®] disinfecting lens cleaning solutions, which differ in chemical composition. Preliminary results indicate that simply soaking lens cases in cleaning solutions offered the best protection from biofilm growth compared to other cleaning regimens and that Biotrue[®] was more effective in inhibiting bacterial growth of test isolates compared to Opti-Free Replenish[®]. The results of this study demonstrate the importance of contact lens hygiene in the prevention of eye infections and the antimicrobial properties of multipurpose lens cleaning solutions.

FUTURE PLANS:

Kathleen Barr is a junior biology major planning on pursuing optometry school post graduation.

Michele Espinosa is a senior biology major who will be attending the State College of New York College of Optometry in the fall of 2011.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Kevin A. Goncalves

CLASS: 2011

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: Analyzing the differential biochemical properties of Peroxiredoxin proteins in cancerous MCF-7 versus non-cancerous MCF-10A breast epithelial cells

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Shelley Phelan, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 3

DATE OF PROGRAM: May 2009 - Present

SPONSOR: National Institutes of Health (NIH) – National Cancer Institute (NCI)

DESCRIPTION OF WORK (Short Abstract):

Peroxiredoxins are thiol-specific antioxidants aberrantly expressed in various cancers; the Peroxiredoxin family consists of six members (Prdxs1-6) that play a role in cell signaling, apoptotic activity, and cell proliferation. Notably, these proteins have been implicated in breast cancer. In this study, we sought to analyze the differences in Prdx mRNA and protein expression, the redox state of Prdx1-5 and Prdx6, and differences in protein complexes between the cancerous MCF-7 and the non-cancerous MCF-10A breast epithelial cell lines. We showed that there are significantly higher Prdx1-5 mRNA levels in the MCF-7 cells, with no significant differences in Prdx6 mRNA expression between the two cell lines. Similar differences in protein expression were also confirmed for several Prdxs. Interestingly, a higher proportion of oxidized Prdx6 protein was observed in the MCF-10A cells, suggesting that more of this protein is in an inactive, non-functional state in these cells. In addition, it has been reported that Prdx complex formation and interaction with target proteins mediate downstream signaling events and Prdx peroxidase activity in other cancers. Past research has shown that Prdx1 binds to c-Myc and c-Abl, regulating their activity in several cell types. Prdx1 and Prdx6 have also been shown to regulate JNK activity and peroxidase activity, respectively, through complex formation with glutathione S transferase (GST π) in other cell lines. In order to gauge the differential formation of complexes and provide a novel assessment of protein-protein interactions between the MCF-7 and MCF-10A cell lines, co-immunoprecipitation (co-IP) is currently being utilized. These studies are underway and conditions are being optimized. Further analysis of biochemical differences between the two cell lines will allow for greater understanding of the role of these proteins in breast cancer.

FUTURE PLANS:

We aim to complete our analysis of Prdx2-5 and Prdx-SO₃ protein expression. In addition, we aim to detect Prdx1 and Prdx6 protein complexes, which can be attained by modifying and carrying out co-immunoprecipitation experiments.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Jennifer Haskell

CLASS: 2011

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: Olive Baboons; male-infant interactions

HOST UNIVERSITY OR INSTITUTION: The School for Field Studies,
Tanzania

NAME OF SUPERVISOR/SEMINAR LEADER: Janette Wallis, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 6

DATE OF PROGRAM: April 2010

SPONSOR: The School for Field Studies

DESCRIPTION OF WORK (Short Abstract):

For eight days, olive baboons were observed in Lake Manyara National Park, the village of Mto wa Mbu and outside of Lake Manyara Hotel in Kibaoni. My study focused on different types of male-infant interactions in the two separate locations. Each bout of contact in the two places was recorded in order to help define the role males play in the lives of young. Baboons living in the national park reside in a protected area and are less exposed to conflict, while those living in the village face trouble with humans on a regular basis. Adult male and infant olive baboons living around the villages showed trends of interacting more often, on average, than baboons living in the deep forests of Lake Manyara National Park. The increased levels of protection and affiliation male baboons exhibited in the village setting suggests that they were interested in the well-being of infants, and that they play important, supportive roles for young baboons.

FUTURE PLANS:

Graduate school to study nutrition.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Mariam Iftikhar

CLASS: 2011

MAJOR: Biochemistry

TOPIC OF RESEARCH PROJECT: Multimodal monitoring of oxidative stress, proliferation and cell death with light: the role of peroxiredoxins in breast cancer

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Shelley Phelan, Ph.D.
Min Xu, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM: Summer 2010 – May 2011

SPONSOR: NIH and NSF grants

DESCRIPTION OF WORK (Short Abstract):

The proposed research project will first measure cellular reactive oxygen species levels, cell proliferation, and cell death in normal and breast cancer cells using standard molecular cell biology techniques. The next step would be to develop multimodal microscopy combining fluorescence with quantitative phase imaging to monitor ROS levels, cell proliferation, and cell death (apoptosis versus necrosis). The multimodal microscopy will enable a noninvasive real time imaging of structure and functional details of live cells. The effect of peroxiredoxin suppression on ROS, proliferation, and death in MCF-7 (cancer) and MCF10A (normal) breast epithelial cells will then be investigated using transfected siRNAs for Prdx1 and Prdx6, two distinct peroxiredoxins. The results will provide important clues to understand the paradoxical role of peroxiredoxins in breast cancer with potential applications in cancer therapy.

FUTURE PLANS:

Only the preliminary steps have been finished in this research, such as taking calibration pictures for the multimodal microscope and setting up the molecular cell biology techniques used for testing the endpoints. For the future, the cells will be transfected with the siRNA for the two peroxiredoxin proteins and then pictures will be taken for the three endpoints being tested.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Sarah Lander

CLASS: 2011

MAJOR: Biology

TOPIC OF RESEARCH PROJECT:

Isolation and Purification of Metalloproteinase Inhibitors from Small Mammal Prey of Venomous Snakes.

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: James Biardi, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM: Fall 2010–Spring 2011

SPONSOR: Fairfield University

DESCRIPTION OF WORK (Short Abstract):

The purpose of this study was to isolate and purify the protein responsible in the California ground squirrel (*Spermophilus beecheyi*) for inhibiting snake venom metalloprotease (SVMP) activity. While current clinical treatment to snake bites relies on the use of antibodies harvested from inoculated domestic animals, our goal is to characterize innately expressed *S. beecheyi* SVMP inhibiting proteins as a novel alternative lead for snake venom therapy. A Bio-Rad BioLogic DuoFlow chromatography system was used in multi-step purification strategy in order to isolate and concentrate protective serum proteins from whole blood. The first phase is affinity chromatography on a HiTrap Blue column. Fractions containing inhibitory activity are further separated using anion exchange chromatography on a UNO Q1 anion exchange column. This step has isolated serum proteins from *S. beecheyi* that inhibit metalloproteinases in the venom of the sympatric northern pacific rattlesnake (*Crotalus oreganus oreganus*). We are applying this protocol to check for SVMP inhibitors in plasma samples from other small mammals subject to snake predation. We hope to better evaluate the biochemical makeup of these proteins so that innate venom resistance in mammals can be better understood.

FUTURE PLANS:

Attending medical School at SUNY Upstate Medical University in the fall 2011.

2010/2011 STUDENT RESEARCH IN MICROBIOLOGY

NAME: Nida Malik

CLASS: 2012

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: Growth inhibition and synergistic effects of Manuka honey, antibiotics, and tea tree oil upon bacteria.

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Olivia Harriott, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM: Spring semester (Jan-May)

SPONSOR:

DESCRIPTION OF WORK (Short Abstract):

The purpose of this study was to determine if natural remedies act synergistically with antibiotics to inhibit bacterial growth. Manuka honey and tea tree oil are derived from the Australian *Melaleuca alternifolia* tree and have been used historically as natural remedies. In this study, 40% Manuka honey in water was shown to inhibit the growth of *Staphylococcus aureus*, *Salmonella typhimurium*, *Enterobacter aerogenes*, *Streptococcus faecalis*, and *Escherichia coli* by a disk diffusion assay. Synergism was observed when Manuka honey was used simultaneously with ampicillin, gentamycin, and erythromycin. Tea tree oil when used at a 1-5% concentration inhibited growth of *S. aureus*, *S. faecalis*, *E. coli*, *S. typhimurium*, *P. aeruginosa*, and *E. aerogenes* in a broth assay. Work to elucidate the minimum inhibitory concentration of tea tree oil and synergistic effects is in progress. The preliminary results of this study demonstrate the broad-spectrum antibacterial effects of tea tree oil and manuka honey and the basis for their use as alternative medicine.

FUTURE PLANS:

Currently, my future plans entail working towards a Master's Degree in the Biomedical sciences after graduation. This research opportunity has allowed me to explore a field of study that I have become very fond of and I wish to pursue any related internship or research program during my senior year and post-graduation if possible.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Umar Munshi and Justina Caushi

CLASS: 2013

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: *Phragmites australis*

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Ashley Byun McKay, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 2

DATE OF PROGRAM:

SPONSOR: Fairfield University

DESCRIPTION OF WORK (Short Abstract):

Phragmites australis, or the common reed, is found in wetlands throughout the world. In North America, *P. australis* is divided up into two major types, introduced and native. The introduced form is highly invasive and has not only replaced much of the native form but also continues to expand its current distribution. The native and invasive forms can be identified using specific restriction enzymes. We are interested in understanding the molecular basis of invasiveness in *P. australis*. However, before we could begin this project, we needed to be able to positively identify *P. australis* native and invasive forms. We were able to distinguish between native and introduced haplotypes by doing an RFLP analysis on the samples we had obtained. Using restriction enzymes HhaI and RsaI, we were able to cut our PCR product at specific DNA base pairs to identify whether or not the sample was invasive.

FUTURE PLANS:

Observe methylation patterns in invasive haplotype of *Phragmites australis*.

2010/2011 STUDENT RESEARCH IN ENVIRONMENTAL SCIENCE

NAME: Helen Nelson and Steven Velez

CLASS: 2013

MAJOR: Spanish, Biology

TOPIC OF RESEARCH PROJECT: Testing the waters: A closer look at the physical chemistry of Fairfield University's storm water and stream effluent

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: James Biardi, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 2

DATE OF PROGRAM: Spring 2009–Spring 2011

SPONSOR: Fairfield University

DESCRIPTION OF WORK (Short Abstract):

The objective of this project is to monitor physical and chemical parameters of surface waters on the campus of Fairfield University. Beginning in 2009 a set of nine monitoring sites was established within the campus watershed. A database of site specific and overall water quality is continually updated with weekly monitoring of phosphorous, nitrogen, dissolved oxygen, salinity, conductivity, temperature, and pH. This database is being used to evaluate current landscaping and maintenance practices (snow management, lawn fertilization, landscape maintenance) for their effects on water quality. We are also using the database to monitor acute impacts of current construction projects on campus. This project is serving as a model of community engaged scholarship (CES) as one approach to achieve Fairfield University's strategic goal of integrating living and learning at the undergraduate level.

FUTURE PLANS:

Student researchers have received additional training to expand monitoring to include coliform bacteria, protist diversity, and C/BOD that will begin in fall 2011.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Nancy Resparza

CLASS: 2013

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: Lead bullet's effect on venison health and consumption

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Tod Osier, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM:

SPONSOR: N/A

DESCRIPTION OF WORK (Short Abstract):

It is widely known that lead poses a health risk to humans. Effects include: cognitive and developmental problems in children, impairment of motor skills, and attention problems. Recently, there has been an interest in understanding the role of hunter-killed wild game as a source of lead exposure. The source of lead in venison from hunter-killed deer is lead fragments from the bullets used. Research, to date, has investigated the impact of the direct consumption of lead fragments in venison from hunter-killed deer. It is common to find high lead levels in venison due to lead fragments unseen in processing. We were interested in understanding the risks associated with the consumption of venison from deer that carry a retained bullet from a healed gunshot wound. Although it is rare to encounter a deer carrying a retained bullet, there is potentially a high risk associated with consumption of venison given the great extent to which lead can be mobilized within an animal and the potentially very high surface area of the expanded or fragmented lead core of the bullet within the deer. We have obtained tissue samples from a deer carrying a highly fragmented retained bullet and although a number of factors point to the potential of high tissue lead levels, we found no elevated levels in tissues samples when compared to controls.

FUTURE PLANS:

We have sent in samples to another lab with better detection limits, and we plan to keep on investigating the effects of invisible fragmentation in human and venison health. This could possess a great risk, as it would be an invisible hazard due to the minute fragmentation and the direct and detrimental health effects associated with lead consumption.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Patrick Shea

CLASS: 2011

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: Temperature differences of translocated vs. in situ nests of the loggerhead turtle (*Caretta caretta*).

HOST UNIVERSITY OR INSTITUTION: Fairfield University and Universidade Estadual do Norte Fluminense

NAME OF SUPERVISOR/SEMINAR LEADER: Jorge Assumpção, Ph.D.
Ashley McKay, Ph.D.
Brian Walker, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM: 1/5/11-1/16/11

SPONSOR: Fairfield University, Universidade Estadual do Norte Fluminense, Projeto TAMAR

DESCRIPTION OF WORK (Short Abstract):

Loggerhead turtles, like the vast majority of all turtle species, undergo temperature-dependent sexual differentiation, with warmer temperatures producing largely female clutches and cooler temperatures producing largely male clutches. Of the many conservation programs in Brazil, Projeto TAMAR aims to protect marine turtle populations via public outreach, educational efforts, and nest enclosures, the latter of which shelter nests that would otherwise be in danger by way of a number of environmental threats. In January 2010, I recorded and compared egg incubation temperatures translocated and untranslocated (in situ) nests. Over 4 days of recording temperatures during the nesting season in Farol de São Tomé, translocated nests were found to have a higher temperature than in situ nests. Due to the already overwhelmingly skewed sex ratio in loggerheads (females outnumbering males roughly 9:1), any furthering of such a ratio could drastically impact the worldwide population. Moreover, this preliminary study suggests the need for follow-up studies and calibration of this enclosure.

FUTURE PLANS:

Specifically, TAMAR aims always to properly maintain enclosures so that nature may more closely take its own path; this pilot study may act as a starting point to ensure that the sex ratio is maintained within natural, biological standards and parameters. My own future plans may coincide with this effort, as it was personally an extremely engaging experience, or may otherwise lead in the direction of graduate school and research in the fields of ecology, environmental physiology or psychology, or environmentalism and conservation.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Thomas Smith and Evan Apanovitch

CLASS: 2011

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: Effects of temperature and disturbance on weight and corticosterone stress response in captive house sparrows (*Passer domesticus*)

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Brian Walker, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 4

DATE OF PROGRAM: September '10 –May '11

SPONSOR: Fairfield University

DESCRIPTION OF WORK (Short Abstract):

Animals respond to stressors in a variety of ways, including modifications in the behavior and physiology of individuals. These modifications can include changes in body mass and/or in physiological responses such as changes in the expression of stress hormones (i.e., the glucocorticoids, cortisol, or corticosterone). Captive experiments examining how different species respond to stressors can be informative in understanding how able those individuals will be in dealing with changing conditions in their natural habitat. Here we examine changes in body mass and the corticosterone stress response in captive House sparrows (*Passer domesticus*) subjected to either warm and calm conditions or colder and disruptive conditions. A total of 24 female birds were captured from the wild in Bridgeport, CT. The birds were split into two groups randomly and allowed to habituate to the environmental chambers in which they were placed. Following 2 months of habituation, while all animals were in their initial warm (21°C), calm conditions, we collected body mass and corticosterone measurements in response to a capture stress (Birds were sampled at 0, 15 and 30 minutes while restrained in an opaque bag – the classic 'stress series protocol'). Subsequently, one chamber was cooled to 12°C, and random disturbances were given to the birds in that chamber. After approximately 2 weeks, all birds (control and experimental) were then reweighed and a second corticosterone stress series was collected to compare how individuals in the colder, disturbed conditions compared to the warmer, less disturbed group. We report the findings of this experiment and discuss implications for survival in House sparrows – a non-native species – in their non-captive habitat.

FUTURE PLANS:

Future experiments will include how juvenile house sparrows also respond to differences in stressors. This is particularly important in juveniles, as stress has been known to affect such characteristics as molt. In house sparrows, juveniles molt into adult plumage, and sub-par plumage (possibly affected by molt) could affect the success of males in obtaining mates.

Evan Apanovitch plans to continue his education in the near future by entering graduate school in order to obtain his PhD. Thomas Smith plans to obtain a Masters in Social Work .

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Katie Sullivan

CLASS: 2011

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: Investigating the Interaction of ROS Levels and Peroxiredoxin 1 and 6 Expression in MCF7 and MCF10A Cells.

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Shelley Phelan, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 3

DATE OF PROGRAM: Summer 2009-Summer 2011

SPONSOR: NIH Grant #1R15CA133740-01A1, from the National Cancer Institute

DESCRIPTION OF WORK (Short Abstract):

Peroxiredoxins are a family of antioxidant proteins that function to protect the cell from reactive oxygen species, and as a result prevent cell damage and death. In addition, this group of proteins has been implicated in diseases like cancer in which the cell accumulates high levels of oxidative stress. We examined the expression and effect of suppression of Prdx1 and Prdx6, two members of the peroxiredoxin family, on two breast epithelial cell lines: the cancerous MCF7 cell line, and the noncancerous MCF10A cell line. We wanted to examine this suppression and its effect on ROS levels in the cell. We hypothesized that the overexpression of these peroxiredoxins in the cancerous line may be due in part to the higher levels of ROS in cancerous cells as compared to noncancerous cells. We also hypothesized that suppression of prdx1 and prdx6 would increase the levels of reactive oxygen species in these cell lines. Suppression of these proteins was completed through transient siRNA transfection via a Lipofectamine reagent, and relative expression levels were measured at the mRNA level via RT-PCR. The MCF7 cells were found to express higher levels of these proteins as compared to the MCF10A cells. The expression of Prdx1 and Prdx6 mRNA was reduced to 10% of its normal expression in the presence of the siRNA. To determine the ROS levels in the cell, a ROS detection kit was used which allows cells to be stained with a fluorescent dye indicating the presence of ROS in the cell.

FUTURE PLANS:

I am planning on further optimizing our system, so that pictures can be taken using this same fluorescence dye in the presence of the siRNA transfections. I am also working on using a Tecan plate reader to obtain quantitative fluorescence values using the same dye (488 nm is the absorbance wavelength). I am then planning on examining the upregulation of the peroxiredoxin genes in the cancerous cell lines by using an antioxidant, N-acetyl-cysteine and examining the peroxiredoxin gene expression levels with a reduced level of ROS.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Maryam Sumra

CLASS: 2011

MAJOR: Biology Major/Mathematics Minor

TOPIC OF RESEARCH PROJECT:

Understanding MAPK Signaling Cascade in MCF7 and MCF10A Cells

HOST UNIVERSITY OR INSTITUTION:

Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER:

Shelley Phelan, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM:

3

DATE OF PROGRAM: Fall 2010 to Spring 2011

SPONSOR: NIH Grant #1R15CA133740-01A1, provided by National Cancer Institute

DESCRIPTION OF WORK (Short Abstract):

Many cancers exhibit high concentrations of reactive oxygen species (ROS) such as hydrogen peroxide (H₂O₂). Peroxiredoxins (Prdxs) are antioxidant proteins produced by organisms to reduce the high levels of toxic peroxides. In cancer cells, these proteins have been shown to be overexpressed, as a possible adaptation that promotes cancer cell survival. There is some evidence that Prdxs may do this by regulating downstream MAPK proteins and the protooncogene c-Abl. The ERK1/2 and JNK1/2 MAPKs are linked to cell proliferation, growth, and survival, whereas the MAPKs, p38 and the protooncogene c-Abl, are connected to apoptosis. In this study, the total and phosphorylated levels of MAPK proteins and c-Abl were investigated in the normal MCF10A breast epithelial cell line and MCF7 breast cancer cell line. We hypothesized that total and phosphorylated protein levels would be higher in the MCF7 line compared to the MCF10A line. We also predicted that peroxiredoxin suppression may differentially affect these downstream targets in these two lines. A model of the MAPK and c-Abl pathways was generated to predict the roles of the kinases in cancerous and non-cancerous cells. Cell lysates were prepared and proteins were quantified. Western blotting was used to detect total and phosphorylated protein levels. Results showed two c-Abl isoforms in MCF10A, two ERK isoforms in MCF7, and overexpression of JNK and ERK in the MCF7 cell line. Results showed one phosphorylated p38 isoform in MCF7 cell line.

FUTURE PLANS: Currently we are investigating the other activated kinases to determine the levels in MCF7 and MCF10A cell lines and analyzing the effects of Peroxiredoxin suppression on these downstream targets.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Kekoa Taparra

CLASS: 2012

MAJOR: Biology (Molecular) & Psychology

TOPIC OF RESEARCH PROJECT: Development of RNA Interference as a tool to study genes required for regeneration in the planarian *Dugesia tigrina*

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Anita Fernandez, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM: Fall 2011

SPONSOR: N/A

DESCRIPTION OF WORK (Short Abstract):

Genetic analysis requires disrupting a gene and studying the resulting phenotype in the affected organism. RNA interference (RNAi) is an effective technique to perturb gene function. In order to perform RNAi, double-stranded RNA is introduced to the subject resulting in suppression of the targeted gene's activity. The initial goal of this research is to generate double-stranded RNA to be used in an RNAi protocol in the planarian species *Dugesia tigrina*. RNAi has been performed successfully in related planarian *Schmidtea mediterranea*, but *D. tigrina* is easier to obtain and care for and is thus a better model system for student labs. Although the two species are both planaria, they are sufficiently diverged such that RNAi clones derived from *S. mediterranea* are ineffective in *D. tigrina*. The three genes of interest we chose to isolate from *D. tigrina* are the genes encoding β -catenin, Piwi-2, and Sine oculis. β -catenin is heavily involved with axis formation due to its involvement with the Wnt signaling pathway, Piwi-2 is connected to proper stem cell function, and Sine oculis is a transcription factor required for eye development. Through observations of RNAi of these genes in *S. mediterranea*, these genes are required for proper regenerative abilities of planaria, which can ultimately be observed as a change in phenotype. In order to perform RNAi of these genes in *D. tigrina*, we sought to isolate the DNA sequences corresponding to Sine oculis, β -catenin, and Piwi-2 using reverse transcription followed by PCR. Currently, we have isolated the genes encoding β -catenin and Sine oculis, however we are still working on isolating the Piwi-2 gene.

FUTURE PLANS:

Once all three genes have been successfully cloned, we hope to create RNAi constructs of each gene, produce double-stranded RNA from each construct, and perform RNAi in *D. tigrina* to confirm the developmental and biological functionality of the genes within the new model organism.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Matthew Tougas, Jessica Gilpin, Kathryn Bimson

CLASS: 2011/2012

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: Green Crab Population Dynamics

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Diane Brousseau, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 3

DATE OF PROGRAM: September 2010-April 2011

SPONSOR: Fairfield University

DESCRIPTION OF WORK (Short Abstract):

It has been suggested that resource competition from the Asian crab (*Hemigrapsus sanguineus*) would result in population declines of the European green crab (*Carcinus maenas*) along the east coast of North America. From September 2008 to December 2010 we studied a green crab population in Milford Harbor, CT to determine abundance and population structure. CPUE (crabs per trap per day) estimates ranged from 0.2 to 2.3 during the sampling period. Male crabs were larger than female crabs, and approximately twice as many males as females were caught during the study. The population size structure was unchanged during both annual periods for which data was available (Sept. 2008 – Aug. 2009 and Sept. 2009 – Aug. 2010). Ventral carapace color varied between green and orange-red, with an overall higher proportion of red morphotype crabs. Red coloration has been associated with prolonged intermolt periods and is thought to confer an advantage when mating since red phase individuals have thicker carapaces and more robust chela (Kaiser et al. 1990). Females carrying eggs were caught from December through September and monthly estimates of berried females in the population ranged from 4- 32 %. Preliminary results of this study suggest a stable, reproductively active population and do not support the hypothesis that the green crab population in Milford Harbor is in decline. Field data generated by this work provides a foundation for the continued study of the population dynamics of *Carcinus maenas* in Long Island Sound.

FUTURE PLANS: Continued research into this topic

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Amy Tran

CLASS: 2012

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: *Optimizing hepatocyte viability/cell transplantation*

HOST UNIVERSITY OR INSTITUTION: Virginia Commonwealth University

NAME OF SUPERVISOR/SEMINAR LEADER: Dr. Robert A. Fisher, Melissa M. Thompson

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM: June-August 2010

SPONSOR: National Institutes of Health STEP-UP

DESCRIPTION OF WORK (Short Abstract):

Human hepatocytes have been used clinically to stabilize patient conditions, eliminating the need for whole organ transplant. This study explored methods to enhance cryopreserved human hepatocyte product. The addition of fructose and Didox to thawing medium of previously cryopreserved hepatocytes has been shown to increase cell viability and plating efficiency. (1, 2) Fructose is a monosaccharide readily broken down by the liver and used for energy by the cells. Didox, a water-soluble antioxidant, has been shown to eliminate potentially cancerous free radicals that result from the body's natural oxidative processes (2). Thawing mediums were prepared for four experimental groups: control (C), fructose (F), fructose and tocopheryl succinate (FTS), and fructose and Didox (FDi). The control thawing media consists of Eagle's Minimum Essential Media (EMEM) and 5% human albumin. The fructose group consists of 0.3 M fructose in EMEM media and 5% human albumin, the FTS group consists of 0.3 M fructose in EMEM media, 5% human albumin, and 0.25 M TS, and the FDi group consists of 0.3 M fructose in EMEM media, 5% human albumin, and 0.25 M Didox in water. Cells were placed in the thawing media, centrifuged, and their supernatants were discarded. They were brought up in fresh aliquots of their thawing medias and a trypan blue assay was performed to assess cell viability. Hepatocytes were then plated and incubated for the first 24 hours in their thawing medias, then were changed daily with fresh media and 10% human albumin. Their plating efficiencies were determined within the first week after plating. Within all cell groups, there were no significant differences ($p>0.05$) for the effects of these additives on cell viability. However, cells plated with Didox had a significant increase ($p<0.05$) in plating efficiency which might translate to a higher success rate with clinical trials. These results seem to indicate that Didox benefits hepatocytes by creating the mitotic stage of G1, in unison, for all of the cells treated. In turn, it creates a thawing environment less precarious for the cell group where viability and plating efficiency may optimize.

FUTURE PLANS:

Amy plans to pursue a MD/PHD.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Jennifer White and Russell Meister

CLASS: 2009 and 2010, respectively

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: Where do you stem from: A Survey of Human HV1 Haplotypes at Fairfield University.

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Olivia Harriott, Ph.D.

NUMBER OF PARTICIPANTS IN PROGRAM: 3

DATE OF PROGRAM: Spring 2011

SPONSOR: Olivia Harriott, Ph.D.

DESCRIPTION OF WORK (Short Abstract):

Our project focused on the extraction, amplification, sequencing, and analysis of the mitochondrial hypervariable region one (HV1). This region occurs within the D-loop of mitochondrial genome, and is represented by bases 16001-16568. Due to the rapid mutation rate of HV1, this region is a suitable sequence for determining human mitochondrial haplotypes, which can further be used to implicate ancient human origins. A pilot study of three individuals was conducted to establish a streamlined protocol for human mitochondrial haplotyping. The development of this efficient protocol is important, as it will be used in a student laboratory setting at Fairfield University.

FUTURE PLANS:

Jennifer White works at Fairfield University as the Molecular Biology Laboratory Supervisor and is planning to attend Physician Assistant school. Currently, she is volunteering as an Emergency Medical Technician as she applies for schools.

Russell Meister works as a lab technician at Fairfield University. He has been accepted into a Ph.D. program at UCONN in the Ecology and Evolutionary Biology department under Dr. Chris Simon, Ph.D. His work will focus on the coevolution of cicadas and their gut symbionts.

2010/2011 STUDENT RESEARCH IN BIOLOGY

NAME: Michael Whitley, Sarah Lander

CLASS: 2012, 2011

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: A rapid and sensitive fluorometric method for the quantitative analysis of snake venom metalloproteases and their inhibitors

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: James Biardi, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 2

DATE OF PROGRAM: Spring 2010 – Fall 2010

SPONSOR: Fairfield University; NIH NIGMS

DESCRIPTION OF WORK (Short Abstract):

Metalloproteases are responsible for the hemorrhagic effects of many snake venoms and contribute to other pathways that lead to local tissue damage. Methods that quantify snake venom metalloproteases (SVMP) are therefore valuable tools in research on the clinical, physiological, and biochemical effects of envenomation. Comparative analysis of individual, population, and species differences requires screening of large numbers of samples and treatments, and therefore require a method of quantifying SVMP activity that is simple, rapid, and sensitive. This paper demonstrates the properties of a new fluorometric assay of SVMP activity that can provide a measure of metalloprotease activity in one hour. The assay is reliable, with variation among replicates sufficiently small to reliably detect differences in between species ($F_{19,60} = 2924$, $p < 0.001$), even for those venoms with low overall activity. It is also sensitive enough to detect differences among venoms using < 2 ng of whole venom protein. We provide an example use of this assay to detect the presence of natural SVMP inhibitors in minute samples of blood plasma from rock squirrels (*S. variegatus*), a natural prey species for North American rattlesnakes. We propose this assay is a useful addition to the set of tools used to characterize venoms, as well as high-throughput screening of natural or synthetic inhibitors, or other novel therapeutic agents against SVMP effects.

FUTURE PLANS:

Published as part of Biardi, J.E., Nguyen, K.T., Lander, S., Whitley, M., and K.P. Nambiar. (2011) Development and validation of a rapid and sensitive fluorescence-based assay of snake venom metalloprotease activity. *Toxicon* 57:342-347

Erica Bernardes**
Kaitlyn Buzard
Julie Colangelo*
Amanda DiMarzio
Anne Elise Drozdoski
Elmira Emini*
Mariam Iftikhar**
Matthew Fasullo*
Muller Gomes
Steven Hannigan
Lauren C. Keilich
Kathryn Mancuso
Kimberly Manoogian**
Brianne O'Loughlin
Steven Scappaticci
Taylor Szupiany*

*Biology Major

**Biochemistry Major

CHEMISTRY

2010/2011 STUDENT RESEARCH IN MEDICINAL CHEMISTRY

NAME: Julie Colangelo

CLASS: 2013

MAJOR: Biology

TOPIC OF RESEARCH PROJECT: Assay validation for sandwich-ELISA detection of TNF-R55 binding with TNF α

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Jessica M. Davis, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 4

DATE OF PROGRAM: 2007-present

SPONSOR: Fairfield University, CBIA-Pfizer, Research Corporation, NIH-AREA

DESCRIPTION OF WORK (Short Abstract):

The over-expression of tumor necrosis factor alpha (TNF α) has been associated with various diseases, particularly autoimmune diseases such as rheumatoid arthritis and Crohn's disease. Some biologic therapies for these diseases specifically target this cytokine, sequestering it, and preventing its interaction with its 55 kD receptor (TNFR₁). While these therapies have proven the validity of this approach, they are large proteins that require intravenous administration. Small molecule inhibitors of this interaction are highly desirable and some have been developed. However, such inhibitors have not been reported to have made it through clinical trials. One prohibition to this approach is the current state of *in vitro* testing of such molecules. Assays have been developed that use radio labeled or biotin labeled TNF α . *In vivo* methods exist, but are cost prohibitive to screening a large selection of molecules. Reported here-in is an inexpensive, highly robust, sensitive assay for inhibitors of the TNF α interaction with TNFR₁ that does not require modification of TNF α . The simplicity of this assay should allow for increased investigation into inhibiting this important interaction.

FUTURE PLANS:

Julie intends to apply to medical school after she graduates.

2010/2011 STUDENT RESEARCH IN CHEMISTRY

NAME: Amanda DiMarzio, Lauren Keilich, Brianne O'Loughlin

CLASS: 2011

MAJOR: Chemistry

TOPIC OF RESEARCH PROJECT: *Inorganic Chemistry* (Synthesis and Characterization)

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: John Miecznikowski, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 3

DATE OF PROGRAM: Spring 2009 to Present

SPONSOR: Fairfield University (Start-up Funds) and Kuck Fund

DESCRIPTION OF WORK (Short Abstract):

A series of tridentate SNS ligand precursors were metallated with ZnCl_2 to give new tridentate SNS pincer zinc complexes. The zinc complexes serve as models for the zinc active site in Liver Alcohol Dehydrogenase (LADH) and were characterized with single crystal X-ray diffraction, ^1H , ^{13}C , and HSQC NMR spectroscopies and electrospray mass spectrometry. The bond lengths and bond angles of the zinc complexes correlate well to those in horse LADH. The SNS ligand precursors were characterized with ^1H , ^{13}C , and HSQC NMR spectroscopies and cyclic voltammetry, and were found to be redox active. Gaussian calculations were performed and agree quite well with the experimentally observed oxidation potential for the pincer ligand. The zinc complexes were screened for the reduction of electron poor aldehydes in the presence of a hydrogen donor, 1-benzyl-1,4-dihydronicotinamide (BNAH). The zinc complexes enhance the reduction of electron poor aldehydes. Density functional theory calculations were performed to better understand why the geometry about the zinc center is pseudo-tetrahedral rather than pseudo-square planar, which is seen for most pincer complexes. For the SNS tridentate pincer complexes, the data indicate that the pseudo-tetrahedral geometry was 43.8 kcal/mol more stable than the pseudo-square planar geometry. Density functional theory calculations were also performed on zinc complexes with monodentate ligands and the data indicate that the pseudo-tetrahedral geometry was 30.6 kcal/mol more stable than pseudo-square planar geometry. Overall, the relative stabilities of the pseudo-tetrahedral and pseudo-square planar systems are the same for this coordination environment whether the ligand set is a single tridentate SNS system or is broken into three separate units. The preference of a d^{10} Zn center to attain a tetrahedral local environment trumps any stabilization gained by removal of constraints within the ligand set.

FUTURE PLANS:

Synthesize and characterize a novel SNS tridentate ligand precursor based on a novel bis-triazole ligand. Metallate the novel ligand precursor with ZnCl_2 . Metallate and characterize all ligand precursors with NiCl_2 , CuCl , and CuCl_2 .

2010/2011 STUDENT RESEARCH IN INSTRUMENTAL CHEMISTRY

NAME: Anne Elise Drozdoski and Kaitlyn Buzard

CLASS: 2012

MAJOR: Chemistry

TOPIC OF RESEARCH PROJECT: Caffeine and Antioxidant Content in Black, White, Red, Green, and Oolong Teas

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Amanda Harper-Leatherman, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 2

DATE OF PROGRAM: Spring 2011

DESCRIPTION OF WORK (Short Abstract):

Caffeine is a natural component of many common foods and beverages and stands today as America's most widely consumed drug. Medically, caffeine is known to be a cardiac stimulant that offers heightened alertness and a sudden "boost" of energy throughout the systems of the body. In the first half of this study, the caffeine content in five different types of teas including white, black, red, green, and oolong was analyzed. UV-Vis spectroscopy was used to create a calibration curve from caffeine standards and was then used to evaluate the caffeine content of each of the tea samples. It was determined that black tea had the most caffeine, containing 660 ± 40 mg/L and that red tea contained the least caffeine, containing only 40 ± 30 mg/L.

In the second half of our study the antioxidant content of each tea sample was calculated. Antioxidants are substances that protect the cells of the body from the harmful effects of free radicals—atoms or groups of atoms with an odd number of electrons that can do significant damage to cellular components such as DNA or the cell membrane. Antioxidants are proven to be helpful in the prevention of cancer and other diseases. In this experiment, standards containing gallic acid and Foulin-Ciocalteu reagent were created and tested in the UV-Vis Spectrophotometer to calibrate the instrument. It was determined that oolong and white tea had the most gallic acid equivalents, containing 33 mg/L. At 18 mg/L, red tea had the lowest amount of gallic acid equivalents.

FUTURE PLANS: Tea samples will be reanalyzed by the method of High Performance Liquid Chromatography (HPLC) to compare results.

2010/2011 STUDENT RESEARCH IN MEDICINAL CHEMISTRY

NAME: Elmira Emini and Taylor Szupiany

CLASS: 2013

MAJOR: Biology

TOPIC OF RESEARCH PROJECT:

Progress towards targeting the interaction between TNFR and TNF α

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Jessica M. Davis, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 9

DATE OF PROGRAM: 2006-present

SPONSOR: Fairfield University, CBIA-Pfizer, Research Corporation, NIH-AREA

DESCRIPTION OF WORK (Short Abstract):

Abnormal production of tumor necrosis factor-alpha (TNF- α) has been implicated in autoimmune disorders, including Crohn's disease which causes inflammation of the gastrointestinal tract. Current therapies of Crohn's disease have limited efficacy and more efficient, drug-like therapeutics are needed. The binding event of TNF- α with its 55 kd receptor (TNF-R55) is a part of a signal cascade that leads to inflammation. A guanine scaffold has been identified as containing the correct structural and spatial elements to mimic a critical binding region of TNF-R55. The design and synthesis of tri-functionalized guanines, serving as small molecule mimetics of TNF-R55 and potential inhibitors of the TNF- α interaction, will be presented.

FUTURE PLANS:

Taylor and Elmira intend to apply for medical school after they graduate.

2009/2010 STUDENT RESEARCH IN MEDICINAL CHEMISTRY

NAME: Matthew Fasullo

CLASS: 2011

MAJOR: Biochemistry

TOPIC OF RESEARCH PROJECT: Alanine scan of constrained peptide mimetic of TNFR55

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Jessica M. Davis, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 4

DATE OF PROGRAM: 2007-present

SPONSOR: Fairfield University, CBIA-Pfizer, Research Corporation, NIH-AREA

DESCRIPTION OF WORK (Short Abstract):

Abnormal production of tumor necrosis factor-alpha (TNF-alpha) has been implicated in autoimmune disorders, including Crohn's disease which causes inflammation of the gastrointestinal tract. Current therapies of Crohn's disease have limited efficacy and more efficient, drug-like therapeutics are needed. The binding event of TNF-alpha with its 55 kd receptor (TNF-R55) is a part of a signal cascade that leads to inflammation. We have conducted an alanine scan of a constrained peptide that directly mimics a previously reported critical binding region of TNF-R55 (Greene, 2001). It is hoped that the results of this scan have elucidated the amino acids essential for the interaction between TNF-alpha and TNF-R55 and can be used in the design of small molecule mimetics of TNF-R55. These results, as well as a new will be presented.

FUTURE PLANS:

Matt will be applying for medical school next year.

2010/2011 STUDENT RESEARCH IN CHEMISTRY

NAME: Steven Hannigan

CLASS: 2011

MAJOR: Chemistry

TOPIC OF RESEARCH PROJECT:

Isotope Edited FT-IR Spectra of Hexamers of α -Aminoisobutyric Acid

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Matthew Kubasik, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM: Fall 2010 – Spring 2011

SPONSOR: Department of Chemistry

DESCRIPTION OF WORK (Short Abstract):

Isotope-edited FT-infrared spectra of the Amide I region of hexamers of α -aminoisobutyric acid (Z-Aib₆-OtBu) have been collected in order to explore the effects of ¹³C=O enrichment on the FT-IR spectra in the conformational context of 3_{10} helices. Oligomers of Aib are known to adopt predominantly 3_{10} helical structures, even at short peptide lengths. The Amide I band is sensitive to the details of peptide secondary structure, but the competency of this band to distinguish between α - and 3_{10} helical secondary structure remains an open question. We have collected infrared spectra of isotopomers of hexamers of Aib (e.g., Z-Aib-Aib-Aib-Aib-Aib-Aib-OtBu, Z-Aib*-Aib-Aib*-Aib-Aib-Aib-OtBu, and Z-Aib*-Aib*-Aib-Aib-Aib-Aib-OtBu Aib* = ¹³C enrichment at *C=O) in dichloromethane (a nonpolar aprotic solvent) and methanol (a polar, protic solvent) to examine the effects of carbon-13 enrichment on the spectra. Differences between the spectral lineshapes and isotopically-induced shifts ($\sim 40\text{ cm}^{-1}$) of the Amide I bands of these peptide isotopomers in these two solvents will be discussed.

FUTURE PLANS:

Collected FT-IR spectra will be compared against quantum chemical calculations that predict vibrational frequencies. In addition, singly ¹³C-labeled hexamers will be synthesized for comparison of FT-IR spectra.

2010/2011 STUDENT RESEARCH IN CHEMISTRY

NAME: Kimberly Manoogian and Katie Mancuso

CLASS: 2012

MAJOR: Biochemistry/Chemistry

TOPIC OF RESEARCH PROJECT: Organic vs. Traditionally-grown produce

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Amanda Harper-Leatherman, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 2

DATE OF PROGRAM: Spring 2011

DESCRIPTION OF WORK (Short Abstract):

The goal of this research was to determine if the produce farming method affects the nutritional value of vegetables. Organic foods have gained popularity among consumers over the past few years and in this study we compared our results with previous results that show nutritional benefits of organic foods. The iron and calcium content of both traditionally grown and organically grown spinach, celery, and potatoes were analyzed using atomic absorption spectroscopy or UV-Vis spectroscopy. We found the weight percent of calcium in organic spinach to be 0.06 ± 0.02 and in traditionally grown spinach to be 0.03 ± 0.02 . The weight percent of iron in traditionally grown spinach was calculated to be 0.019 ± 0.001 while the weight percent of iron in organically grown spinach was 0.023 ± 0.007 . The weight percent of calcium in traditionally grown celery was found to be 0.026 ± 0.007 and 0.01 ± 0.01 in organically grown celery. Traditionally grown potatoes had 0.004 ± 0.001 by weight iron, and organically grown potatoes had 0.0006 ± 0.0005 by weight iron. Finally, the weight percent of iron in traditionally grown potatoes was 0.010 ± 0.005 and 0.006 ± 0.005 in organically grown potatoes.

FUTURE PLANS: If we were to continue with this research, we would test more fruits and vegetables for calcium and iron in addition to other nutrients. We could also develop a method to test for pesticides that may be present in the food samples.

2010/2011 STUDENT RESEARCH IN CHEMISTRY

NAME: Steven Scappaticci

CLASS: 2011

MAJOR: Chemistry

TOPIC OF RESEARCH PROJECT: Electrochemical Oxidation of 1-Phenylethanol and Benzyl Alcohol: A mechanistic investigation

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: L. Kraig Steffen, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM: Fall 2010

SPONSOR: Fairfield University

DESCRIPTION OF WORK (Short Abstract):

Electrochemical oxidation is performed by applying a potential across a mixture that ultimately results in the oxidation of an alcohol to a ketone or aldehyde. By first determining how efficiently, how quickly and the mechanism by which alcohols can be electrochemically oxidized, it becomes possible to develop catalysts that can perform these oxidations at lower potentials and faster rates. In the present report, acetophenone and benzaldehyde were successfully synthesized from 1-phenylethanol and benzyl alcohol by electrochemical oxidation at -1.800 V. The reaction mixtures were successfully characterized with $^1\text{H-NMR}$, and chemical ionization and electron ionization were employed in an effort to determine if intermediates formed. Due to the poor sensitivity of chemical ionization, and the noise associated with electron ionization, no intermediates were definitively found.

FUTURE PLANS:

Further tests with GC-MS are planned to be employed after investigation of the sensitivity issue

2010/2011 STUDENT RESEARCH IN CHEMISTRY

NAME: Steven Scappaticci and Mariam Iftikhar

CLASS: 2011

MAJOR: Chemistry (Scappaticci) and Biochemistry (Iftikhar)

TOPIC OF RESEARCH PROJECT: The UV-visible response of aerogel-encapsulated cytochrome *c* and alcohol dehydrogenase to gases

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Harper-Leatherman, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 2

DATE OF PROGRAM: Spring 2011

SPONSOR: Fairfield University

DESCRIPTION OF WORK (Short Abstract):

Silica aerogels are ultra-porous materials that have enormous surface areas in small volumes, owing to their porous structure. Aerogels are formed by supercritically drying sol-gels to retain their porous structure outside of solution. Aerogels have found uses as capacitors, fuel cell catalysts, battery electrodes and sensors. Doping in proteins adds a bio-functionality to aerogels that has, to date, not been extensively studied. In the present report cytochrome *c* and alcohol dehydrogenase (with cofactors NAD⁺ and NADH) were doped into sol-gels and supercritically dried. Protein functionality inside the aerogels was tested through exposing the proteins to different gases. Cytochrome *c*, when exposed to nitric oxide, was shown using UV-visible spectroscopy to reversibly bind to the molecule with improved accessibility when compared to cytochrome *c* associated with gold nanoparticles. When alcohol dehydrogenase and its NAD⁺ cofactor encapsulated in an aerogel was exposed to gaseous 1-propanol, a moderate UV-vis response outside of the expected 330-350 nm spectral range was observed. These results imply that both proteins retain their functionality through the supercritical drying process. Cytochrome *c*'s improved response to nitric oxide was attributed to the increased exposure of cytochrome *c* compared to the amount of cytochrome *c* exposed when confined to gold nanoparticle~cytochrome *c* superstructures.

FUTURE PLANS:

Our future plans involve performing studies of aerogel-encapsulated ADH and cofactors with and without gold nanoparticles using fluorescence. Furthermore, we plan to perform further nitric oxide binding studies of cytochrome *c* but with functionalized multi-walled nanotubes associating with cytochrome *c*.

Christine Caples
Maryam Sumra*

*Biology Major

MATHEMATICS & COMPUTER SCIENCE

2010/2011 STUDENT RESEARCH IN MATHEMATICS

NAME: Christine Caples

CLASS: 2011

MAJOR: Math

TOPIC OF RESEARCH PROJECT: 2-Dimensional Shape Modeling

HOST UNIVERSITY OR INSTITUTION: California State University, Channel Islands

NAME OF SUPERVISOR/SEMINAR LEADER: Kathryn Leonard, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 2

DATE OF PROGRAM: June 13 – August 6, 2010

SPONSOR: National Science Foundation

DESCRIPTION OF WORK (Short Abstract):

Modeling shapes in the plane, such as those bounded by simple, closed curves like ellipses and circles, is integral in the area of computer image analysis. The so-called medial axis of such a bounding curve, which can best be thought of as the “skeleton” of the curve, offers one way to simplify how the curve is represented and can be used to make image analysis more efficient. We will define what it means for a representation to be optimal for a class of shapes in the plane, and explore different versions of the medial axis in an attempt to optimize how well our shapes can be represented.

FUTURE PLANS:

Next Fall I will begin the Math PhD program at the University of Iowa. My ultimate career goal is to become a professor of Math at a liberal arts college.

2010/2011 STUDENT RESEARCH IN MATHEMATICS & BIOLOGY

NAME: Maryam Sumra

CLASS: 2011

MAJOR: Biology Major/Mathematics Minor

TOPIC OF RESEARCH PROJECT: Analysis of Factors associated with Lake Lillinonah Annual Algal Blooms

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Laura McSweeney, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM: Spring 2011

SPONSOR: N/A

DESCRIPTION OF WORK (Short Abstract):

Connecticut's Lake Lillinonah experiences massive algal blooms every summer. These algal blooms block light from passing through the surface and reduce nutrient levels for other species in the lake. Eventually the algae, which are composed of photosynthetic cyanobacteria, sink to the bottom of the lake allowing bacteria to consume the algae. This depletes the oxygen at the bottom of the lake, a condition known as hypoxia. This problem is the cause of the "Dead Zone" in the Gulf of Mexico and if unresolved, Lake Lillinonah might suffer the same fate. In an effort to avoid this and to determine which factors may predict the timing and intensity of the algal blooms, Friends of the Lake (FOTL) installed an automated buoy system that measured 13 variables for weather conditions and water quality every 2 minutes of every hour and data was investigated from June 7, 2010 to September 27, 2010. It was hypothesized that chlorophyll levels would be correlated with conductivity and photosynthetic active radiation. It was also hypothesized that chlorophyll levels would be highest during the day and lowest at night. The data was organized and time series plots of the variables were generated in MATLAB. Correlations between the different variables were obtained and patterns among some of the variables were modeled. Results showed that there was a strong positive correlations between dissolved oxygen concentration and dissolved oxygen saturation and between specific conductivity and conductivity and strong negative correlations between pH and dissolved oxygen concentration, pH and dissolved oxygen saturation, and pH and water temperature. Results also show that chlorophyll levels are highest in the mornings and low at night. Analysis of periodic behavior among variables is currently under investigation.

FUTURE PLANS:

I plan to further analyze the relationships between variables and provide a mechanism to predict the occurrence and concentration of algal blooms. In future experiments, it would be critical to set up a system that would eliminate (or at least minimize) the number of missing data. I plan to further analyze by evaluating the autocorrelation data and I plan on using the periodogram function to look at cyclic behavior within each variable.

**Grant Arzumanov
Jared Buckley
Bianca DeAngelo
Patrick Shanley**

PHYSICS

2010/2011 STUDENT RESEARCH IN PHYSICS

NAME: Bianca DeAngelo, Patrick Shanley, Grant Arzumanov, Jared Buckley

CLASS: 2012

MAJOR: Physics

TOPIC OF RESEARCH PROJECT: Characterization of Pathological Slides and the Prediction of the Grade of Cancer Using DIC Microscope

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Min Xu, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 4

DATE OF PROGRAM: Summer 2009- present

SPONSOR: NIH (1R15EB009224) Research Corporation

DESCRIPTION OF WORK (Short Abstract):

We developed a quantitative phase image with the use of a DIC microscope. We characterized different samples (polystyrene sphere thin film and prostate cancer slides) with this approach. We are developing a method to compute an optical index for the grade of cancer from the phase maps measured by the DIC microscope.

FUTURE PLANS:

In the near future we will need to investigate fresh tissue slides for the above approach.

Joseph Calvaruso
Lisa Capobianco
Tanja Davidovic
Andrea DelGaudio
Ashley Fresenius
Catherine Hassett*
Vianette Hernandez
Christina Maffei
Izarelli Mendieta
Niles Muzyk
Lucas Nixon
Alexa Pazniokas
Lawrence Rispoli
Derek White
Stephen Weinstein
Renise Williams

*Biology Major

PSYCHOLOGY

2010/2011 STUDENT RESEARCH IN PSYCHOLOGY

NAME: Joseph Calvaruso '11, Vianette Hernandez '12, Niles Muzyk '12, Andrea DelGaudio '12 & Christina Maffei '12

CLASS:

MAJOR: Psychology

TOPIC OF RESEARCH PROJECT:

A Developmental Study of Racial Preferences of Black Children

HOST UNIVERSITY OR INSTITUTION:

Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER:

Judy Primavera, Ph.D.
Dorothea Braginsky, Ph.D.
Michael Andreychik, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM:

5

DATE OF PROGRAM:

SPONSOR: Dorothea Braginsky, Ph.D.

DESCRIPTION OF WORK (Short Abstract):

The purpose of this study was to explore the developmental trends in racial preferences between black preschool and elementary school inner-city children. Previous work by this research team conducted in 2008 and 2009 found that black children preferred the white doll and ascribed negative traits to the black doll. Using the Clarke & Clarke 1940 protocol, 121 black boys and girls were interviewed regarding their perceptions of the dolls. The results of the current study reiterate the findings of the previous studies and also revealed gender and age differences. Black children's negative views of their own race were more pronounced for girls and older children. Implications for future research will be discussed.

FUTURE PLANS:

To further explore the influence of the race of the experimenter on black children racial preferences.

2010/2011 STUDENT RESEARCH IN PSYCHOLOGY

NAME: Lisa Capobianco '12, Lucas Nixon '13, & Stephen Weinstein '13

CLASS: see above

MAJOR: Psychology

TOPIC OF RESEARCH PROJECT: Intergroup attitudes

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Michael Andreychik, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 3

DATE OF PROGRAM: 4/28/11

SPONSOR: Dr. Andreychik/Fairfield University

DESCRIPTION OF WORK (Short Abstract):

Although implicit negative associations with outgroups have generally been taken as indicating unconscious prejudice toward the outgroup, previous correlational research has shown that *social explanations*—the explanatory frameworks that people use to understand the status and action of others—shape the specific nature of implicit negativity (Andreychik & Lombardi, 2010). The present study presents an experimental test of the idea that whereas among individuals who explain the low status and/or negative action of an outgroup in terms of internal deficiencies of the group, implicit negativity is prejudicial in nature, among individuals who explain outgroup status and action in terms of external forces that have negatively affected the group, such implicit negativity is empathic in nature. Participants were presented with the negative actions of a fictitious social group. Half of the participants received no explanation for these behaviors whereas the other half received causal information highlighting the role of external forces in shaping the behaviors. Although all participants formed equivalently negative implicit associations with the group, among participants who received no additional explanatory information, that implicit negativity was prejudice-based and was significantly related to endorsement of punitive strategies for dealing with the group's negative behavior. In contrast, among participants who received external explanations, implicit negativity was empathy-based and was related to endorsement of compassionate strategies for dealing with the group.

FUTURE PLANS:

Lisa plans to go on to receive her M.Ed. in Special Education M.A. in Art Therapy. Steven plans to pursue future research in social psychology and attend Law school.

2010/2011 STUDENT RESEARCH IN PSYCHOLOGY

NAME: Tanja Davidovic '11, Izarelli Mendieta '12, Alexa Pazniokas '12, Lawrence Rispoli '11, and Renise Williams '12

CLASS:

MAJOR: Psychology

TOPIC OF RESEARCH PROJECT:

The Effect of Interviewers Race on Black Children Racial Preferences

HOST UNIVERSITY OR INSTITUTION:

Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER:

Dorothea Braginsky, Ph.D.
Judy Primavera, Ph.D.
Michael Andreychik, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM:

5

DATE OF PROGRAM: April 13, 2011

SPONSOR: Dorothea Braginsky, Ph.D.

DESCRIPTION OF WORK (Short Abstract):

Previous work by this research team on 4 year-old black children found a marked preference for white dolls and negative stereotypes for black dolls. This trend was stronger among girls than boys. Since these results were attained with white interviewers, for this study the protocol was repeated on 50 black preschool girls with a black interviewer. The results of this study replicate those found by white experimenters: the girls preferred the white doll and attributed negative traits toward the black doll. At first glance, it appears these trends are more pronounced with the black experimenter. Implications for future research will be discussed.

FUTURE PLANS:

Focus groups will be conducted with teachers of black preschool children in the hopes to find insight into these results.

2010/2011 STUDENT RESEARCH IN PSYCHOLOGY

NAME: Ashley Fresenius

CLASS: 2011

MAJOR: Psychology

TOPIC OF RESEARCH PROJECT:

Culture, Cognition, and Language: An Investigation of Measures of Tolerance for Ambiguity

HOST UNIVERSITY OR INSTITUTION:

Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER:

John F. McCarthy, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM:

4

DATE OF PROGRAM: Ongoing

SPONSOR:

DESCRIPTION OF WORK (Short Abstract):

The present study is part of an ongoing effort to investigate the impact of culture on cognition. Marked syntactical differences between the languages of German and English have led McCarthy et al (2007,2008) to believe that different language processing strategies exist between these native speakers and may account for the cultural differences that seem to exist in thinking and behavior. Based upon our previous research we are interested in how these differences impact tolerance for ambiguity. Through our investigation we have found many measures of tolerance for ambiguity, but now face the question of whether they all measure the same facet of information. We have since developed our own measure of tolerance for ambiguity through reactions to artwork. Our study compares subjects responses to three different measures of tolerance for ambiguity. Results reveal that some of the measures correlate highly with other measures but this is not true for all of the inter-correlations.

FUTURE PLANS:

Our research team plans to take this investigation further by looking at individual responses to each measure of tolerance for ambiguity through electroencephalography data. With this we hope to confirm our previous findings of differences in reaction time and brain waves between language groups based on this most recent task.

2010/2011 STUDENT RESEARCH IN PSYCHOLOGY

NAME: Catherine Hassett and Derek White

CLASS: 2011

MAJOR: Biology, Psychology

TOPIC OF RESEARCH PROJECT: The Effects of Chronic Alcohol Administration During Puberty on Reproductive Behaviors in Female Rats

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Shannon Harding, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 4

DATE OF PROGRAM: Summer 2010 - Fall 2010

SPONSOR:

DESCRIPTION OF WORK (Short Abstract):

Previous research suggests that ethanol administration can delay the onset of puberty in female rats. The present study examined whether early ethanol exposure during puberty affects sexual performance, motivation and arousal in female rats. On postnatal day 30, 24 Long Evans female rats were divided into 4 groups: no ethanol, low ethanol (3%), high ethanol (6%), and an isocaloric control (4.5% sucrose). After 6 weeks of forced ethanol consumption, the study tested each group for sexual arousal (50 HZ-vocalizations), motivation (partner preference), and performance (copulation). Preliminary data analysis suggests that while arousal and performance were not affected by ethanol, sexual motivation was reduced in the low ethanol condition. Currently, the lab is repeating the assays after a period of abstinence to assess long-term effects. These findings may provide insight into long-term effects of underage drinking in humans.

FUTURE PLANS:

In the fall, Catherine plans on attending Tufts University School of Medicine's Master's in Biomedical Sciences program. She hopes to attend medical school in the future to further explore her interest in medicine and biomedical research. Upon graduation, Derek plans to enter and thrive in the neuroscience research field in either a clinical or preclinical context. In the future, he hopes to achieve a PhD in Neuroscience or Neuropsychology.

Spoorthy Gowda
Abha Shukla

SOFTWARE ENGINEERING

2010/2011 STUDENT RESEARCH IN SOFTWARE ENGINEERING

NAME: Spoorthy Gowda

CLASS: Graduate (2011)

MAJOR: Software Engineering

TOPIC OF RESEARCH PROJECT: Academic Partnerships in Engineering Education

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Amalia Rusu, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM:

DATE OF PROGRAM: 2010/2011

SPONSOR: School of Engineering, Fairfield University

DESCRIPTION OF WORK (Short Abstract):

Research shows that students who are engaged in their academic work are motivated by the need to succeed, need for self-expression, personal curiosity, and desire to fostering positive peer relationships. Engaging assignments help shape their understanding, allow them to explore their creative side, while interacting and teaming up with their peers. We present a comparative study of various approaches and partnerships for teaching hands-on engineering classes, including the pros and cons of technology students partnering with industry, non-profit organizations, or interdisciplinary school collaborations vs. traditional in-class course assignments. The findings are based on a survey conducted among undergraduate and graduate students in School at Engineering at Fairfield University. The focus group consisted of a mix of students who have worked with either one or more organizations as part of their academic work. The study also focuses on the issues and challenges while working with various organizations, and the results are presented from the students' perspective.

FUTURE PLANS:

We are planning on conducting additional surveys on similar collaborations to better understand the factors that affect students' academic learning, their creativity and interests, and follow up on their performance after graduation, in order to incorporate the lessons learned into our engineering curriculum.

2010/2011 STUDENT RESEARCH IN SOFTWARE ENGINEERING

NAME: Abha Shukla

CLASS: Graduate (2011)

MAJOR: Software Engineering

TOPIC OF RESEARCH PROJECT: Multilingual Synthetic Generator for Web Applications

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF SUPERVISOR/SEMINAR LEADER: Amalia Rusu, Ph.D.

NUMBER OF STUDENT PARTICIPANTS IN PROGRAM: 1

DATE OF PROGRAM: 2010

SPONSOR: School of Engineering, Fairfield University

DESCRIPTION OF WORK (Short Abstract):

Handwriting recognition systems require large training sets that contain a variety of handwriting styles. However, it is expensive (and often impractical) to collect these samples from humans. We have previously developed a method of artificially generating synthetic English handwriting samples based on real character templates. However, there are many applications that will make use of a synthetic handwriting generator when extended to other scripts, such as Devanagari, Chinese, Arabic, etc., including training handwriting recognizers in pattern recognition application or generating CAPTCHAs for Web security applications. Therefore in this project we furthered our research in this domain and started developing a unified theory for a multilingual synthetic handwriting generator. We enhanced our previous work done on synthetic English handwriting generation and focused on Devanagari script and Chinese symbols generation. After successfully generated Devanagari and Chinese words, we generated CAPTCHA challenges and built a user testing site, to conduct usability studies.

FUTURE PLANS:

The target application of our multilingual synthetic handwriting generator is the automatic generation of infinitely many random and distinct handwritten (image) challenges/CAPTCHAs (Completely Automated Public Turing Test to Tell Computers and Humans Apart) for securing not only websites presenting information in English but also Chinese, Indian, Arabic, etc. sites that would better benefit from using CAPTCHAs in their particular scripts rather than English. As a validation of our approach, we will perform tests on both humans and machines for both Devanagari and Chinese scripts. Moreover, we expect that our approach will work universally for other languages and same concepts and theories with some changes can be applied to synthetic handwriting generation of other scripts, thus we will investigate further Arabic and Russian script generation.