SIGMA XI

THE SCIENTIFIC RESEARCH SOCIETY

FAIRFIELD UNIVERSITY CHAPTER

12TH ANNUAL POSTER SESSION

Thursday | April 26, 2012

Barone Campus Center

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

Fairfield UNIVERSITY

Sigma Xi acknowledges additional support by the Office of Academic Engagement

BIOLOGY

Faolain Barrett
Kimberly Beatty
Sadia Bhatti
Kathryn Bimson
Matthew Bisaccia
Carly Bock
Justina Caushi
Christopher Daniele
Emily Davis
Carlie Famiglietti
Kelsey George
Casey Gerety
Jessica Gilpin
Richard Gladding
Daniel Gonzalez
William Haffey
Gina Impronto
Piotr Kostyk
Allison Lai
Amanda LaMattina
Alanna Locast
Audrey Longfellow
Tess Mahoney
Samantha Matte
Caitlin McDonald
Umar Munshi
Leshawna Murrell
John Noto
Joey Owen
Katherine Ritchie
Braulio Rodriguez (3)
Clare Shanahan
Kevin Sherman (2)
Sullivan Smith
Kekoa Taparra (2)
Lauren Tehan (2)
Katherine Whitney
Julianne Wilmot
Colin Wirth

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Sadia Bhatti

CLASS YEAR: 2012

MAJOR: Biology

TITLE OF RESEARCH PROJECT:

The Effect of Zinc Supplementation on the Cytoxicity of Exogenous Oxidants to Articular Chondrocytes

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Glenn Sauer, Ph.D.

DATE OF PROGRAM: 2010-2012

SPONSOR: The Corrigan Scholarship Fund

DESCRIPTION OF WORK (Short Abstract):

Degenerative diseases of joint tissue such as osteoarthritis have been linked to the cytotoxic effects of a variety of endogenous and exogenous oxidizing agents. Studies with cultured articular chondrocytes have shown that supplementing the growth media with zinc enhances the production of metallothionein and other proteins that may have anti-oxidant properties. Thus, zinc supplements could have a protective effect on cartilage and joint health. In the present study, normal human articular chondrocytes (NHAC) were grown in DMEM culture media with or without added zinc (50 uM). After 5 weeks, the NHAC cultures were exposed to the oxidizing agents hydrogen peroxide, sodium nitropruside (SNP), or glucose oxidase over a range of concentrations for a 24 hr. period. Cytoxicity of the oxidants was tested by quantifying the release of lactate dehydrogenase (LDH) into the culture media. Zinc-supplemented NHAC were significantly more resistant than controls to cytotoxicty caused by hydrogen peroxide. The zinc-supplemented NHAC were also significantly more resistant to high concentration glucose oxidants than the control cells. In contrast, zinc did not provide protection to nitric oxide (SNP) cytotoxictiy. The results indicate that Zn-induced antioxidants may have a protective effect for some, but not all, oxidizing agents.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Matthew Bisaccia, Kelsey George, and Tess Mahoney

CLASS YEAR: 2013, 2012, 2012

MAJOR: Biology

TITLE OF RESEARCH PROJECT: Fast-start Escape Response in Bluegill

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Shannon Gerry, Ph.D.

DATE OF PROGRAM: April 26, 2012

SPONSOR:

DESCRIPTION OF WORK (Short Abstract):

Fast-starts are a response mechanism used by fish to avoid predation. Adult bluegill (Lepomis macrochirus) differ in their morphology and fast-start performance based on habitat. Pelagic bluegill have slender bodies and faster starts compared to the deeper bodied littoral ecomorph. All juvenile bluegill hatch and develop in the littoral zone. This study examined fast-start performance and morphology of juvenile bluegill to see if they differed in their escape response like the adults. Sixty juveniles were collected and their fast-start response recorded using high-speed video. Peak velocity and acceleration, and peak angular velocity and acceleration, were quantified from the tracking videos. We show that there is a significant negative correlation between body depth and angular velocity and between body depth and angular acceleration. There is a significant positive correlation between pectoral fin aspect ratio and angular acceleration. We conclude that juvenile bluegill show a divergence in their fast-start performance related to morphology, which may be driving the divergence shown by adults.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Carly Bock

CLASS YEAR: 2012

MAJOR: Biology

TITLE OF RESEARCH PROJECT:

Structure/Function Analysis of the MEL-28 Protein in the Nematode Worm *Caenorhabditis elegans*

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Anita Fernandez, Ph.D.

DATE OF PROGRAM: April 26th, 2012

SPONSOR:

DESCRIPTION OF WORK (Short Abstract):

MEL-28 is a protein essential for early embryogenesis in all metazoans, including humans. While it is known that the protein has essential roles in early cell division, it has very few domains that are well characterized, and it is not clear which domains are important for MEL-28 function. To determine which parts of the MEL-28 protein are required for its function, we generated mutated versions of the *mel-28* gene fused to the gene that encodes GFP. In one construct we deleted the N-terminal AT hooks (implicated in DNA binding) and in another we deleted the internal coiled coil domain (implicated in protein-protein interactions). Otherwise wild-type animals carrying these constructs were analyzed to determine whether the deleted region is required for proper GFP localization, and in both cases we found the mutated versions of GFP localized properly. To determine if the deleted region was also required for proper MEL-28 function, we crossed animals carrying the GFP transgene to *mel-28* mutants. We found that the version of MEL-28 lacking the AT hooks did not rescue the *mel-28* mutant phenotype, and the version lacking the coiled coil domain did rescue the mutant phenotype. Our results indicate 1) that proper localization of the MEL-28 protein is not sufficient for its function and 2) that the AT hooks are required for MEL-28 function, but the coiled coil domains are not.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Christopher Daniele '14, Casey Gerety '14, Amanda LaMattina '14, Braulio Rodriguez '12

CLASS: Noted Above

MAJOR: Biology

TITLE OF RESEARCH PROJECT:

Behavioral Response to Human Presence and Stimulation of Positive Memory in Psittaciformes

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Ashley Byun, Ph.D.

DATE OF PROGRAM: Spring 2012

DESCRIPTION OF WORK (Short Abstract):

This research conducted at the Beardsley Zoo in Bridgeport, Connecticut investigated the behaviors of individuals from the Order Psittaciformes. Lorita, the Yellow-Naped Amazon Parrot from the species *Amazona auropalliata* and Newton, the Blue and Gold Macaw from the species *Ara ararauna* were the two individuals evaluated. This study included the observations of the general behaviors of the two individuals and their response to human presence and the memory of their past experiences. Behaviors associated with relaxation and agitation were acknowledged. The study attempted to create a controlled environment in order to monitor the particular behavioral responses for both birds, with and without the company of humans. In the Yellow-Naped Amazon Parrot's study, the animal's stimulation to positive past experiences was observed. Lorita's previous owner played Spanish films for her, therefore Lorita's response to a Spanish film was tested. For the first study concerning the absence and presence of humans, behavioral changes were observed between the two parrots such as their responses to specific types of people. In response to human interaction, both Newton and Lorita displayed signs of agitation. In the absence of humans, both Newton and Lorita showed signs of behaviors associated with relaxation. Lorita's response to the Spanish film showed that she displayed diverted interest to the film over the people in the room, and she showed behaviors associated with being more relaxed when it was played.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Emily Davis

CLASS YEAR: 2012

MAJOR: Biology

TITLE OF RESEARCH PROJECT:
Neonatal Outcomes Following Delivery at <39 Weeks with an Immature Lamellar Body Count, But a Mature L/S Ration or P/G ratio

HOST UNIVERSITY OR INSTITUTION: Hartford Hospital

NAME OF FACULTY RESEARCH SUPERVISOR: Yu Ming Victor Fang, M.D.

DATE OF PROGRAM: June- August 2011

SPONSOR: James Biardi, Ph.D.

DESCRIPTION OF WORK (Short Abstract):

Currently at Hartford Hospital if a woman has to deliver her baby prior to 39 weeks of gestation, she must undergo a Lamellar Body Count. This test is used to determine if her baby's lungs are mature enough for delivery. If the LBC comes out immature, then two subsequent tests are completed (L/S and P/G ratios). If either of these two tests shows fetal lung maturity, the baby can be delivered. Dr. Fang wanted to look at the data at Hartford Hospital to determine if this policy is a good one, specifically to see if all three tests are equivalent indicators of fetal lung maturity.

Objective: To compare neonatal outcomes following delivery at <39 weeks with an immature Lamellar Body Count (LBC), but a mature Lecitin/Sphingomeylin (L/S) ratio or Phosphatidylglycerol (P/G) ratio. Differences between mothers with diabetes mellitus and those without were also studied.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Jessica Gilpin '12, Kathryn Bimson '12, Faolain Barrett '12, and Audrey Longfellow '13

CLASS YEAR: Noted Above

MAJOR: Biology

TITLE OF RESEARCH PROJECT:

Biology and Population Dynamics of the Green Crab (*Carcinus maenas*) in Milford Harbor (Connecticut USA): An Update

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Diane J. Brousseau, Ph.D.

DATE OF PROGRAM: 9/2011 through 5/2012

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 2011 a green crab population in Milford Harbor, CT was studied to determine abundance and population structure. Crabs ranged from 30-85 mm CW and male crabs were larger than female crabs. The sex ratio was 7:3. CPUE estimates show crab activity is highest from spring through fall and decreases during the winter months. A 50% reduction in the number of crabs trapped occurred in 2010. Unusually low winter water temperatures resulting in an increase in mortality or reduced crab activity may be the cause. Most berried females were caught during the winter (20%) and spring (75%). Field data generated by this work provides a foundation for the continued study of the population dynamics of *C. maenas* in Long Island Sound.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): William Haffey

CLASS YEAR: 2012

MAJOR: Biology

TITLE OF RESEARCH PROJECT:

The Relationship between Frugivorous Neotropical Birds and a Fruiting Plant, *Topobea multiflora*

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Brian Walker, Ph.D.

DATE OF PROGRAM: June 2011- present

SPONSOR: Fairfield University

DESCRIPTION OF WORK (Short Abstract):

Frugivorous bird species were observed feeding on a fruiting tree, *Topobea multiflora*, for a weeklong period in June-July 2011 in order to understand the importance of the tree to particular avian species. This experiment is of singular interest because *T. multiflora* grows in early successional habitats, which are becoming less common in an area that is undergoing reforestation. Avian species that depend heavily on *T. multiflora* would risk loosing an important food source.

Results show that the families *Thraupidae* (tanagers), *Emberizidae* (finches), and *Turdidae* (thrushes) comprise the majority of *T. multiflora*'s avian predators, and *Tangara* displayed the greatest diversity within a family. Additionally, an index of affinity was created, taking into consideration both a species' percent of total abundance and the frequency which it occurred. The aforementioned families, in addition to *Pipridae* (manakins), showed the highest index of affinity. The results of this experiment lead us to hypothesize that the reduction of *T. multiflora* that accompanies forest regeneration will have a significant effect on local frugivorous species.

2011/2012 STUDENT RESEARCH IN BIOLOGY AND PHYSICS

STUDENT RESEARCHER(S): Piotr Kostyk

CLASS YEAR: 2012

MAJOR: Biology

TITLE OF RESEARCH PROJECT:
Multimodal DIC Microscopy for MCF10A and MCF7 Cell Lines

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Shelley Phelan, Ph.D.
Min Xu, Ph.D.

DATE OF PROGRAM: Summer 2011

SPONSOR: Research Corporation

DESCRIPTION OF WORK (Short Abstract):

Normal breast epithelial cells from the MCF10A cell line, and cancerous breast epithelial cells from the MCF7 cell line are quite different from each other in many respects. In this study, we have developed a multimodal microscopy method for differentiating between the MCF10A and the MCF7 cell lines as they undergo various cellular processes. Specifically, we used DIC microscopy in conjunction with standard assays to observe morphological differences between the two cell lines during (1) induction of apoptosis after treatment with Staurosporine, (2) induction of necrosis after treatment with Triton-X 100, and (3) treatment with nutrient deficient growth media to determine differences in cell proliferation. For each treatment, we used fluorescently labeled antibodies to determine the proportions of both cell lines undergoing apoptosis over a four-hour length of time, the number of cells undergoing necrosis over a fifteen-minute period, and the proportion of cells proliferating. Overall, the numbers of cells from both cell lines undergoing apoptosis increased with longer periods of Staurosporine treatment. Furthermore, the MCF10A and the MCF7 cell lines both exhibited morphological features, which are common to cells undergoing apoptosis and to cells undergoing necrosis. Lastly, we determined that MCF10A cells decreased their rate of proliferation in a nutrient deprived environment, whereas MCF7 cells did not decrease their rate of proliferation. Instead, the MCF7 cells became more adherent in response to deprivation of nutrients. These results indicate that the differences observed between the MCF10A and the MCF7 cell lines using standard assays for measuring apoptosis, necrosis, and proliferation were also observed using our multimodal DIC microscopy method, verifying its value for future study of these cell lines.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Allison Lai

CLASS YEAR: 2013

MAJOR: Biology

TITLE OF RESEARCH PROJECT:

mel-28 npp-12 double mutant yields a novel phenotype in the nematode worm *Caenorhabditis elegans*

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Anita G. Fernandez, Ph.D.

DATE OF PROGRAM: January 2012 – April 2012

SPONSOR:

DESCRIPTION OF WORK (Short Abstract):

The nuclear envelope protects the genetic material located in the nucleus. In *C. elegans mel-28* encodes a protein that localizes to the nuclear envelope and is required for its function. *mel-28* is a maternal-effect lethal gene, as homozygous *mel-28* mutants look wild-type but yield only dead eggs. We were interested in identifying genes that might act in concert with *mel-28*. An RNA interference (RNAi) genetic interaction screen was performed, seeking genes that cause novel phenotypes when disrupted in *mel-28* mutants. Genes that encode proteins located in the nuclear pore complex such as *npp-12* and *npp-14* caused a novel sterility phenotype when disrupted in *mel-28* mutants but not wild-type animals. To better characterize these defects and to confirm them using genetics, we generated double mutant animals that were homozygous for null mutations in both *npp-12* and *mel-28*. We found that the double mutants exhibited severe defects, including shorter lifespan and reduced fertility (among the animals that survive to adulthood). Since neither *mel-28* nor *npp-12* single mutants individually show these phenotypes, our results indicate that *mel-28* and *npp-12* contribute to the same essential functions during development.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Samantha Matte, Kim Beatty, Dan Gonzalez, Rich Gladding

CLASS YEAR: 2014 (Sam, Dan, Rich) 2013 (Kim)

MAJOR: Biology

TITLE OF RESEARCH PROJECT:
Amur Tiger Courtship Behavior in Captivity

HOST UNIVERSITY OR INSTITUTION: Fairfield University with Connecticut's Beardsley Zoo

NAME OF FACULTY RESEARCH SUPERVISOR: Ashley Byun, Ph.D.

DATE OF PROGRAM:

SPONSOR:

DESCRIPTION OF WORK (Short Abstract):

Amur Tigers are among some of the most endangered cats in the world. There is estimated to be less than five hundred Amur tigers living in the wild. To support conservation, many zoo's across the United States have participated in a tiger Breeding program. The Beardsley Zoo in Connecticut has recently acquired a male tiger, Viktor, that they hope will reproduce with their female, Naka. The purpose of our research was to observe tigers at the Beardsley Zoo over three months to observe their behaviors and determine what the likelihood of reproduction would be, *and* what the zoo could do to increase the chances of reproduction. During this time, our group spent over twenty hours at the zoo observing Viktor and Naka looking for behaviors typical of mating and copulation. Our main finding was that Viktor seemed to be far less interest in Naka than we expected. Naka seemed to have far more interest in Viktor than he showed in her. Often times it is the female who is less interested, in this case the relationship was vice versa. Based on these observations we conclude that both Viktor and Naka's young age and inexperience contributed to the lack of copulation. With more maturity and experience there is a great possibility of reproduction. More time together will increase the chances of successful copulation.

2011/2012 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, Ph.D.

DATE OF PROGRAM:

SPONSOR: Fairfield University

DESCRIPTION OF WORK (Short Abstract):

Phragmites, or the common reed, is found in wetlands throughout the world. In America, there is a particular species called Phragmites australis, which is divided up into two major groups; introduced and native. The introduced haplotype M, of *P. australis*, is invasive. There are 11 native haplotypes, or non-invasive *P. australis*, and they are relatively easier to control. Haplotype M tends to overpower and permanently displace the native haplotypes of *P. australis*. The methods of controlling haplotype M are far too costly and destructive. Furthermore, after removal, the invasive species reappears after a given time. We speculate that one of the reasons as to why these invasive haplotypes are able to out-compete the native ones is because of their efficient ability to uptake nitrogen from the environment. Studies have shown that invasive *P. australis* uptake on average more nitrogen than native haplotypes. This study seeks to identify and compare the different types of bacteria that are responsible for nitrogen uptake in both native and invasive P. australis. The first step, in comparing the different endophytic bacteria associated in the roots of *P. australis*, is isolating and sequencing the bacteria.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Joey Owen, Caitlin McDonald, Gina Impronto, John Noto

CLASS YEAR: 2013, 2013, 2014, 2013 (respectively)

MAJOR: Biology

TITLE OF RESEARCH PROJECT:
Observations of Orinoco Geese at the Beardsley Zoo

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Ashley Byun, Ph.D.

DATE OF PROGRAM: Spring 2012

SPONSOR: Connecticut's Beardsley Zoo

DESCRIPTION OF WORK (Short Abstract):

Our group researched typical behaviors of the Orinoco Geese and constructed an ethogram of behaviors. The ethogram included typical actions, for example whistling, preening, cackling, walking, standing, courtship dances, fleeing and fighting, etc. The purpose of the observations of the Orinoco Geese was to establish a baseline behavioral profile, to document courtship and confirm breeding. Each of the members in our group stood in locations as far away as possible from the Geese to determine their actions. From our observations the pairs did not like to be separated by a human and preferred to stay within two feet of each other at all times. When a visitor came in between them, the male made a whistle-like call while the female shrilled. However, there was no clear leader; each followed one another around the boardwalk in turns. There were tentative signs of courtship such as puffing in the male, which is a display where he puffs out his chest to show the female his wings. However, the displays were not received well from the female and the male stopped. We also noticed that the Geese tended to become aggressive when other birds in the display bothered them. Our observations of the Orinoco Geese led us to a possible solution for the Beardsley Zoo in order for the Geese to mate. The group decided that the Geese need separation from the other species in order for them to mate. Our research about Orinoco geese showed that they are protective of their territory and will not show signs of courtship if they feel threatened. Thus, we concluded that the geese may benefit from separation from the other bird species in order to promote mating.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Katherine Ritchie '13, Carlie Famiglietti '13, Clare Shanahan '14, Alanna Locast '12

CLASS YEAR: Noted above

MAJOR: Biology

TITLE OF RESEARCH PROJECT:
Aggression and Social Dominance in *Camillimico goeldi*

HOST UNIVERSITY OR INSTITUTION: Connecticut's Beardsley Zoo

NAME OF FACULTY RESEARCH SUPERVISOR: Ashley Byun, Ph.D.

DATE OF PROGRAM: Spring 2012

SPONSOR: Connecticut's Beardsley Zoo

DESCRIPTION OF WORK (Short Abstract):

The main goal of this study was to aid the zoo staff in achieving their mission of providing all species at the Beardsley Zoo with optimal care. *Camillimico goeldi* was the focus species of this project. There were a total of three monkeys all from the same family group, a mother, her son and her daughter. After developing an ethogram that was centered on vocalizations and group interactions, the monkeys were observed weekly and detailed notes were recorded in order to determine the likelihood of inbreeding behavior. The duration of grooming and "close sitting" was timed; these observations served as key factors in tracking the relationship between the male monkey and his mother and sister. Each type of vocalization was noted and evaluated for its aggressive nature, especially between the two female monkeys. From overall observations, there was no indication of aggressive behavior or excess coupling that would suggest the future occurrence of inbreeding. Grooming responsibilities were shared equally among the three monkeys.

The only incidents of aggression were directed toward zoo visitors and the toucan species, which shares the same exhibit area.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Braulio Rodriguez

CLASS YEAR: 2012

MAJOR: Biology

TITLE OF RESEARCH PROJECT:

Design of Multimodal Microscopy System: Quantification of Nuclear Fragmentation in Cancerous Breast Epithelial Cells during Programed Cell Death

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Shelley Phelan, Ph.D.
Min Xu, Ph.D.

DATE OF PROGRAM: Summer 2011 - Spring 2012

SPONSOR: Research Corporation

DESCRIPTION OF WORK (Short Abstract):

The aim of this research project is to develop a multimodal microscopy system for the noninvasive and real-time imaging of live cells to obtain quantitative information about nuclear fragmentation during cell death. We hypothesize that the quantitative data that is collected will be comparable to the data collected by standard molecular cell biology techniques. The current phase in this study has involved using differential interference contrast (DIC) microscopy to image the process of apoptosis in normal and cancerous breast epithelial cells and to track nuclear fragmentation using DAPI fluorescent nuclear staining. So far, the nuclear fragmentation of the normal and cancerous breast epithelial cells has been tracked using DAPI. In addition, we have observed differences between the apoptotic and non-apoptotic cells, including the more diffuse staining within the cell of the former and the more distinct staining in the latter. The next step is to use the refractive index based quantification to track nuclear fragmentation during apoptosis and to validate the technique by comparing it to the DAPI staining method. The results of the study could provide a valuable tool for diagnosing cancer.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Kevin Sherman

CLASS YEAR: 2012

MAJOR: Biology

TITLE OF RESEARCH PROJECT:
Impacts of Human Activity on Wildlife Dispersal in the Tarangire-Manyara Ecosystem, Tanzania

HOST UNIVERSITY OR INSTITUTION: The School for Field Studies

NAME OF FACULTY RESEARCH SUPERVISOR: John M. Kioko, Ph.D.

DATE OF PROGRAM: Spring 2011

SPONSOR:

DESCRIPTION OF WORK (Short Abstract):

Wildlife movement between major habitat types occurs normally through wildlife movement corridors, or dispersal areas. This study illustrates the ecological importance of wildlife dispersion through these corridors by highlighting the extent of interactions between wildlife and humans in the dispersal area of the Tarangire-Manyara Ecosystem. GPS mapping was utilized to determine the area of land covered by human settlement, foot and road transects were used to determine wildlife and livestock numbers and distribution, including their dispersion in relation to the nearest human structure. Through the use of GIS, human settlement and activities were mapped alongside wildlife distribution. The total area of land mapped was 127.99 km^2; of this 20.5% (26.27 km^2) was agriculture while 23.1% (29.65 km^2) was settlement. A mean distance of 197m^2±37.71 SEM was determined between wildlife and all human structures. With the growth of agricultural practices and the continuation of drought conditions during the dry season, managerial and communal actions preserving the dispersal area are necessary to conserve both the wildlife diversity and the ecological stability.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Kevin Sherman, Colin Wirth, Leshawna Murrell*

CLASS YEAR: 2012, 2013, 2012

MAJOR: Biology/Biology Minor*

TITLE OF RESEARCH PROJECT: Observed Behavior of Juvenile Alligators in Captivity

HOST UNIVERSITY OR INSTITUTION: Connecticut's Beardsley Zoo

NAME OF FACULTY RESEARCH SUPERVISOR: Ashley Byun, Ph.D.

DATE OF PROGRAM: Spring 2012

SPONSOR:

DESCRIPTION OF WORK (Short Abstract):

The purpose of this study was to observe the general activity and any dominancy behaviors exhibited by two juvenile American alligators (*Alligator mississippiensis*) in captivity. Observations were conducted on a weekly basis for two-hour periods, totaling to 16 hours. Effectively all recorded activity exhibited by each alligator took place when both alligators were present in the tank together. Observations on the individual behavior of each alligator suggest that the corner underneath the platform farthest from the front of the tank is the ideal refuge. It is our belief that the corner is the safest spot from getting grabbed from above as the platform makes it difficult for the zookeepers. Dominancy is difficult to gauge at this age, as most dominancy behavior is expressed around maturity. However, the observations seem to suggest that the smaller individual (nicknamed Poseidon based on the ψ mark on the dorsal cephalic region) was more likely to initiate physical contact than the larger individual (Delta Δ). Further observations at times when the alligators are competing, such as at feeding-time, are necessary to further gain insight to the hierarchical positioning within the tank.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Sullivan Smith

CLASS YEAR: 2012

MAJOR: Biology

TITLE OF RESEARCH PROJECT:
Identifying Kinases Essential to pRB's Function as a Tumor Suppressor

HOST UNIVERSITY OR INSTITUTION: Massachusetts General Hospital, Cancer Center

NAME OF FACULTY RESEARCH SUPERVISOR: Katrin Tschop, Ph. D.

DATE OF PROGRAM: Jun-Aug, 2011

SPONSOR: Shelley Phelan, Ph.D. and James Biardi, Ph.D.

DESCRIPTION OF WORK (Short Abstract):

The project that I was involved in this past summer was focused on a well-characterized tumor suppressor called retinoblastoma protein (pRB). pRB's tumor suppressive functions include inhibition of cell proliferation and promotion of cell differentiation and senescence, which are permanent states of cell cycle exit. In other words, pRB helps to prevent cells from dividing uncontrollably as they would in a cancerous state. In many types of cancer cells, pRB is inactivated, thus making it easier for them to continue growing and dividing. The gene for pRB is often mutated or deleted in tumor cells. Additionally, tumor cells can inactivate pRB through changes in the p16-pRB pathway. Mutation or deletion of $p16^{INK4A}$ as well as amplification of Cdk4/6-Cyclin D result in hyper-phosphorylated, inactive pRB protein. pRB has over 200 known interacting proteins that help mediate its effects. The project we were working on aimed to determine which of these proteins are most important for pRB to be able to achieve its function as a tumor suppressor. We set up a high-throughput RNAi screen that allowed us to systematically knock down individual pRB interactors to identify those that were necessary for certain pRB-induced phenotypes, such as inhibition of cell proliferation and induction of differentiation or senescence. From these results, we were able to get an idea of their relative importance to pRB's ability to prevent cells from entering a cancerous state. Proteins whose knockdown allowed cells to overcome the pRB-induced phenotypes mentioned above were considered important to pRB's tumor suppressive function. By gaining a better understanding of how this important tumor suppressor's action is mediated by its surrounding network of interacting proteins, we hoped to facilitate the development of new treatments in the future.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER: Kekoa Taparra

CLASS YEAR: 2012

MAJOR: Biology (Molecular Biology) & Psychology

TITLE OF RESEARCH PROJECT:

The Potential Effects of Peroxiredoxin Knockdown via siRNA Transfection on MCF7 Breast Epithelial Cancer Treated with Doxorubicin Chemotherapy

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Shelley Phelan, Ph.D.

DATE OF PROGRAM: Summer 2011 – Spring 2012

DESCRIPTION OF WORK (Short Abstract):

Breast cancer is the most diagnosed cancer in women and the second leading cause of cancer related deaths. Chemotherapy is often used to relieve symptoms and reduce the recurrence of localized tumors. Doxorubicin is a chemotherapy used in the treatment of a variety of cancers. Doxorubicin intercalates into DNA, resulting in arrest of cell growth and nonapoptotic cell death. The limitation of the drug is its cytotoxic effects. Previous studies have shown that drug-iron complex formation leads to increased Reactive Oxygen Species (ROS).

Peroxiredoxins (Prdx) are antioxidant proteins that protect cells from oxidative stress. In addition to regulating cell signaling, proliferation and apoptosis, many recent studies have found elevated peroxiredoxin levels in cancer, suggesting that cancer cells may utilize peroxiredoxin overexpression as an adaptation to the cancerous state. Despite the apparent link between doxorubicin, oxidative stress, and the peroxiredoxins, the interaction between these three elements has not yet been analyzed.

This current study addresses the effects of doxorubicin on the MCF7 breast epithelial adenocarcinoma cancer cell line. Reduction of protein expression is a classic experimental procedure to assess normal gene function in cell culture. Small interfering RNA (siRNA) technology is a useful tool to reduce gene expression. Through the use of siRNAs specific to Prdx1 and Prdx6, protein expression of these genes were significantly knocked down. Cell viability was assessed under varying dosages of the doxorubicin chemotherapy. Preliminary results suggest that the knockdown of Prdxs1 and Prdx6 may enhance effects of cell growth arrest in breast cancer cells. This suggests a potential role of Prdx in doxorubicin chemotherapy. In addition to cell viability, future studies underway include assessments of cytotoxicity and apoptosis.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Kekoa Taparra, Lauren Tehan, & Braulio Rodriguez

CLASS YEAR: 2012

MAJOR: Biology

TITLE OF RESEARCH PROJECT:

(Poster Presented at the American Association for Cancer Research conference, Chicago IL, March 2012)

Overexpression and Regulation of the Peroxiredoxin Family of Antioxidant Proteins in MCF7 Breast Cancer Cells

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Shelley A. Phelan, Ph.D.

DATE OF PROGRAM: Summer 2011-Spring 2012

SPONSOR: NIH- 1R15CA13374D-01A1; National Cancer Institute

DESCRIPTION OF WORK (Short Abstract):

Peroxiredoxins are thiol-specific antioxidant proteins that protect cells from oxidative stress, and are implicated in the regulation of cell signaling, proliferation and apoptosis. Many recent studies have found elevated peroxiredoxin levels in cancer, suggesting that cancer cells may upregulate peroxiredoxin expression as an adaptation to the cancerous state. We compared the expression of all six peroxiredoxins between the MCF7 breast cancer cell line and the non-cancerous MCF-10A cell line. We found significant overexpression of five of the six peroxiredoxins (PrdxI-V) at both the mRNA and protein level. We also found that MCF-7 cells express markedly higher levels of reactive oxygen species (ROS) and Map Kinase activity, as compared to MCF-10A cells. We hypothesized that elevated ROS and/or enhanced MAP kinase activity may mediate peroxiredoxin induction in these cells. MCF-7 cells were cultured under conditions of serum deprivation, ROS reduction, or Map Kinase inhibition, and peroxiredoxin expression was analyzed by western blotting. After 48 hours of serum deprivation, the expression of Prdx3 and Prdx6 was reduced. In contrast, inhibition of ROS resulted in no significant change. Treatment of MCF-7 cells with an ERK 1/2 inhibitor had no effect on peroxiredoxin levels, but inhibition of JNK 1/2 led to an increase in Prdx2, 3 and Prdx6. Finally, treatment of MCF-7 cells with hydrogen peroxide (which elevates ROS) caused a robust and transient increase in Prdx2, Prdx3 and Prdx6. Together, these data reveal overexpression of the peroxiredoxin family in MCF-7 cancer cells, and suggest that these genes are differentially regulated by oxidative stress and Map kinase pathways.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Lauren Tehan

CLASS YEAR: 2012

MAJOR: Biology

TITLE OF RESEARCH PROJECT:
Regulation of Peroxiredoxin Expression in Breast Cancer Cells in Response to MAP Kinase Inhibition and TNF-a Stimulation

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Shelley Phelan, Ph.D.

DATE OF PROGRAM: Summer 2011- Spring 2012

SPONSOR: NIH- 1R15CA13374D-01A1; National Cancer Institute

DESCRIPTION OF WORK (Short Abstract):

Peroxiredoxins are a class of evolutionarily conserved antioxidant proteins that function to reduce cellular oxidative stress and subsequently prevent apoptosis. Recent work from our lab has shown that five of the six peroxiredoxins are upregulated in mammary adenocarcinoma cancer cells, which implies a dualistic tumor suppressive and tumor supportive role. While the functions of peroxiredoxins have been widely studied, the mechanism by which peroxiredoxins are regulated has not been fully elucidated. To determine possible regulatory pathways, the MAP kinases and the role of TNF-α were studied. The MAP kinases normally function in response to cellular stress, and induce cell survival genes, or apoptosis if the stress is too extreme. TNF-α is a cytokine involved in the inflammatory response pathway, and is a known inducer of apoptosis. It was discovered that the activity of two of the MAP kinases, ERK and JNK, were upregulated in the MCF7 cells compared to the non-cancerous MCF10A cells. It was additionally determined that inhibition of the JNK pathway yields modifications in the expression of several peroxiredoxins in the MCF7 cells. Lastly, it was determined that exposure to TNF-α induces peroxiredoxin expression in the MCF7 cells. The observed changes in peroxiredoxin expression in response to MAP kinase inhibition and TNF-α stimulation may represent mechanisms that promote tumor cell survival in the oxidative stress response pathway.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Katherine Whitney

CLASS YEAR: 2012

MAJOR: Biology

TITLE OF RESEARCH PROJECT:
Lake Lillinonah: A Study in Water Quality through the Years

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Jennifer Klug, Ph.D.

SPONSOR: Fairfield University Department of Biology and Friends of the Lake

DESCRIPTION OF WORK (Short Abstract):

The goal of this project was to reconstruct the water quality history of Lake Lillionah. This lake is an impoundment on the Housatonic River that was created in 1955 for the purpose of electric power generation. Since very early in its existence as a lake, Lillinonah has had frequent algal blooms during the summer months. Algal blooms are the result of excess nutrients present, particularly phosphorus. They have a negative impact on lake ecosystems because as they start to die, bacteria associated with decaying organic matter that once was the unsightly algae consumes dissolved oxygen in the water and can result in hypoxic conditions. Thus, this is not just an aesthetic problem, but one affecting the general health of the lake. Although water quality data has been collected since the early 1970's, there has been no comprehensive analysis of the entire time-series. We compiled data from a variety of sources to assess if any patterns in water quality could be explained by hydrologic events, changes in watershed land use, or nutrient management programs throughout Lillinonah's history. The water quality variables we used were total nitrogen and total phosphorus concentration (mg/L), secchi disk depth (m) – a measure of water clarity, and water temperature (C). We learned there were improvements made in waste water treatment plants (WWTP) directly affecting Lillinonah in the 1970's and 80's, and expected that these would have lead to improvements in water clarity. Results are presented which describe the relationships between nutrient concentrations and water clarity over time.

2011/2012 STUDENT RESEARCH IN BIOLOGY

STUDENT RESEARCHER(S): Julianne Wilmot

CLASS YEAR: 2012

MAJOR: Biology

TITLE OF RESEARCH PROJECT:

The Effect of Zinc Supplementation on Growth and Differentiation of Articular Chondrocytes

HOST UNIVERSITY OR INSTITUTION:

NAME OF FACULTY RESEARCH SUPERVISOR: Glenn Sauer, Ph.D.

DATE OF PROGRAM:

SPONSOR: Sadia Bhatti – scholarship program & Fairfield University Biology Department

DESCRIPTION OF WORK (Short Abstract):

Articular cartilage of joints is produced and maintained by chondrocytes which undergo a series of phenotypic changes over the course if normal development. Under culture conditions, the proliferative phenotype can be maintained by the inclusion of Fibroblast Growth Factor (FGF) in the culture media. The normal differentiated phenotype is favored by transforming growth factor β (TGF-β). The present study was conducted to determine whether Zinc supplementation could enhance the differentiated phenotype, by measuring alkaline phosphatase, an enzyme characteristic if the differentiated phenotype. Primary cultures if human articular chondrocytes in the presence of FGF or TGFβ with or without the addition of Zinc (50 μm) to the growth media over a 7 week period. Zinc increased the rate of cell growth and protein production in both growth (FGF) and differentiation (TGF-β) media. Zinc supplementation increased alkaline phosphatase in differentiation media but not in growth media. The results suggest that Zinc may enhance joint health by promoting growth and differentiation of chondrocytes.

CHEMISTRY

Kerry A. Archer (2)
Elizabeth E. Butrick**
Kaitlyn Buzard
Julie Colangelo*
Anne Elise Drozdoski
Elmira Emini*
Elizabeth Garvey
Muller Gomes
Molly Graffam**
Matthew Guberman-Pfeffer
Alexandria McGovern*
Jacob Perriello
William Roberts
Daniel Santaniello
Taylor Szupiany*
Timothy Zeko

*Biology Major
**Biochemistry Major

2011/2012 STUDENT RESEARCH IN CHEMISTRY

STUDENT RESEARCHERS: Kerry Archer, Jacob Perriello, Matthew Guberman-Pfeffer

CLASS YEAR: 2013

MAJOR: Chemistry

TITLE OF RESEARCH PROJECT:

Determination of the effects of beverage brand and pH on the presence of diethyl phthalate in flavored beverages by SPME-GCMS

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Amanda S. Harper-Leatherman, Ph.D.

DATE OF PROGRAM: Spring 2012

SPONSOR: CH 326 Instrumental Chemistry Lab supported by Fairfield University Chemistry & Biochemistry Department

DESCRIPTION OF WORK (Short Abstract):

Diethyl phthalate is a common plasticizer, thought to be potentially toxic to humans, which may be present in commercial beverages stored in polyethylene terephthalate plastic. Analyses of beverages purchased in the United States for phthalate contamination are scarce, and consequently, the safety of the containers of popular sports drinks, such as Vitamin Water and Powerade, is unknown. With the use of solid-phase microextraction, coupled with gas chromatography-mass spectrometry, the concentration of diethyl phthalate in Vitamin Water Fruit Punch, Vitamin Water Kiwi Strawberry, and Powerade Fruit Punch will be determined and compared. A statistical analysis of the dependence of diethyl phthalate concentration on brand and beverage pH will be presented. Knowledge of these effects on the presence of diethyl phthalate may assist consumers in minimizing their exposure to this potential toxin.

2011/2012 STUDENT RESEARCH IN CHEMISTRY

STUDENT RESEARCHER(S): Kaitlyn Buzard '12, Elizabeth Garvey '13, Molly Graffam '13

MAJOR: Chemistry, Biochemistry

TITLE OF RESEARCH PROJECT:

Protein monolayer electrochemistry of cytochrome *c* and gold~cytochrome *c* superstructures

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Amanda Harper-Leatherman, Ph.D.

DATE OF PROGRAM: May 2011 – April 2012

SPONSOR: Research Corporation for Science Advancement

DESCRIPTION OF WORK (Short Abstract):

Thousands of cytochrome *c* (cyt. *c*) molecules self-assemble around gold (Au) nanoparticles in buffered solution through electrostatic and other weak interactions creating loosely multilayered superstructures of protein, abbreviated as Au~cyt. *c* superstructures. Fluorescence unfolding studies indicate that each Au~cyt. *c* superstructure stabilizes thousands of protein molecules to unfolding relative to cyt. *c* alone in solution. To expand on this work, we have conducted protein monolayer electrochemistry (PME) to determine if the electron-transfer characteristics of cyt. *c* organized within Au~cyt. *c* superstructures are significantly different than those of cyt. *c* alone. Two different monolayers were used to adsorb cyt. *c* or Au~cyt. *c* superstructures to electrode surfaces for PME studies. Using mercaptoundecanoic acid monolayers, the cyclic voltammetrically measured thermodynamic and adsorption parameters were not significantly different when comparing cyt. *c* to Au~cyt. *c* superstructures of varying ratios of Au to cyt. *c*. Although, Au~cyt. *c* superstructures did show greater stability to denaturation over time We obtained very different results using 11-mercapto 1-undecanol monolayers supporting our hypothesis that cyt. *c* is less attracted to the 11-mercapto 1-undecanol monolayer than it is to itself within the Au~cyt. c superstructure, preventing the superstructure from losing its organization and allowing for its properties to be electrochemically probed. The 11-mercapto 1-undecanol results support our hypotheses about Au~cyt. c superstructure electrochemical characteristics. We observed through the thermodynamic and adsorption parameters that more cyt. *c* molecules were electrochemically active when organized within Au~cyt. c superstructures, and that the electron transfer was more reversible. However, on 11-mercapto 1-undecanol, Au~cyt. *c* superstructures were less stable to denaturation than cyt. *c.*

2011/2012 STUDENT RESEARCH IN CHEMISTRY & BIOCHEMISTRY

STUDENT RESEARCHERS: Anne Elise R. Drozdoski, Elizabeth E. Butrick, Kerry A. Archer

CLASS YEAR: 2012 (ARD); 2013 (EEB and KAA)

MAJOR: Chemistry (ARD and KAA); Biochemistry (EEB)

TITLE OF RESEARCH PROJECT:
Syntheses, Characterization, DFT Calculations and Activity of Tridentate SNS or NNN Zinc Pincer Complexes Based on Bis-Imidazole or Bis-Triazole Precursors

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: John R. Miecznikowski, Ph.D.

DATE OF PROGRAM: Summer 2011 to present

SPONSOR: Kuck Fund; Fairfield University Research Expense Grant

DESCRIPTION OF WORK (Short Abstract):

A series of tridentate pincer ligands, each possessing two sulfur- and one nitrogen-donor functionalities (SNS), based on bis-imidazole or bis-triazole salts were prepared. These ligand precursors were metallated with $ZnCl_2$ to give either SNS or NNN zinc(II) pincer 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, ^{1}H, ^{13}C, and HSQC NMR spectroscopies, electrospray mass spectrometry, and elemental analyses. Some of the zinc complexes feature SNS donor atoms and pseudo-tetrahedral geometry about the zinc center, as is seen for liver alcohol dehydrogenase. The NNN zinc(II) pincer complex has pseudo-trigonal bipyramidal geometry about the zinc(II) center and exhibits metal-ligand binding that contrasts with our previous SNS-bound systems despite the availability of these same donor atoms in the current ligand set. The bond lengths and bond angles of the SNS zinc complexes correlate well to those in horse LADH. Density functional theory calculations were performed to investigate the nature of the NNN binding of the ligand to the zinc(II) center. 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), and it was determined that they enhance the reduction of electron-poor aldehydes. The SNS zinc pincer complexes with bis-triazole ligand precursors exhibit higher activity for the reduction of 4-nitrobenzaldehyde than do SNS zinc pincer complexes with bis-imidazole ligand precursors. Quantitative stoichiometric conversion was seen for the reduction of pyridine-2-carboxaldehyde via SNS zinc pincer complexes with either bis-imidazole or bis-triazole ligand precursors.

2011/2012 STUDENT RESEARCH IN CHEMISTRY

STUDENT RESEARCHER(S): Elmira Emini, Taylor Szupiany, Alexandria McGovern, Julie Colangelo

CLASS YEAR: 2013

MAJOR: Biology

TITLE OF RESEARCH PROJECT:

Targeting TNFα with small molecule inhibitors of the TNFα–TNFR interaction

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Jessica M. Davis, Ph.D.

DATE OF PROGRAM: 2010 - present

SPONSOR: NIH, Research Corporation and Fairfield University

DESCRIPTION OF WORK (Short Abstract):

Abnormal production of tumor necrosis factor-alpha (TNFα) 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 TNFα with its 55 kd receptor (TNF-R55) is a part of a signal cascade that leads to inflammation. The crystal structure of a closely related cytokine, TNFβ, bound to the extracellular, soluble domain of TNF-R55 (sTNF-R55) has been used to create a homology model of the TNFα/sTNF-R55 interaction. The design and synthesis of small molecule mimetics of TNF-R55 as potential TNFα/TNF-R55 interaction inhibitors utilizing a guanine scaffold will be presented.

2011/2012 STUDENT RESEARCH IN CHEMISTRY

STUDENT RESEARCHER(S): Muller Gomes

CLASS YEAR: 2012

MAJOR: Chemistry

TITLE OF RESEARCH PROJECT:

NMR Characterization of Helical Peptide Conformational Dynamics Via $T_1/T_{1\rho}$ Measurements

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Matt Kubasik, Ph.D.

DATE OF PROGRAM: 2010-2012

SPONSOR: Department of Chemistry and Biochemistry

DESCRIPTION OF WORK (Short Abstract):

NMR experiments have been performed to characterize the rates of conformational exchange of the peptide Z-B_6-OMe in methanol. (B = amino acid residue of α-aminoisobutryic acid). Proton $T_{1\rho}/T_1$ relaxation experiments were employed rather than previously explored complete Carbon 13 lineshape analysis, because $T_{1\rho}$ measurements have the capacity to measure faster conformational exchange rates with less spectral congestion and higher signal to noise. The Z-B_6-OMe peptide adopts a 3_{10} helix and will exchange between left and right handed helices. When this exchange occurs, the two methyl groups on each residue will exchange positions. These two methyl groups exchanged positions when the helix changed handedness at a rate of 5650 exchanges per second at room temperature. In addition the methyl group relaxation study, the relaxation time of the O-Me group bonded to the peptide's C terminus was measured to discover if any other relaxations were contributing to the methyl groups' relaxation time. The O-Me group was found to undergo some kind of exchange at a rate of 852 exchanges per second at room temperature

2011/2012 STUDENT RESEARCH IN CHEMISTRY

STUDENT RESEARCHER(S): Daniel Santaniello, Timothy Zeko, William Roberts

CLASS YEAR: 2013

MAJOR: Chemistry

TITLE OF RESEARCH PROJECT:
HPLC Analysis of Capsaicin and Dihydrocapsaicin in Cayenne Hot Sauces and in Fresh and Dry Habanero Peppers

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Amanda S. Harper-Leatherman, Ph.D.

DATE OF PROGRAM: Spring 2012

SPONSOR: CH 326 Instrumental Chemistry Lab supported by Fairfield University Chemistry & Biochemistry Department

DESCRIPTION OF WORK (Short Abstract):

The first purpose of this study is to test whether extra hot versions of cayenne pepper-based hot sauces contain Scoville heat values (SHV) that are higher than regular cayenne pepper-based hot sauces by testing the relative levels of capsaicin and dihydrocapsaicin in the sauces. The second purpose of this study is to test dried and fresh Habanero peppers to determine whether dried samples have higher amounts of capsaicin and lower amounts of dihydrocapsaicin than the fresh samples due to the changes of capsaicinoids levels during pepper development and maturation. Samples of these products were run through a high performance liquid chromatography instrument with UV detector to separate out the capsaicinoids within the samples. In order to compare the capsaicin and dihydrocapsaicin concentrations, the SHVs were calculated by means of developing standard curves of known capsaicinoids concentrations. We will present data that supports whether extra hot versions of cayenne hot sauces contain SHVs that are higher than their standard hot sauce counterparts as well as whether dried peppers have higher concentrations of capsaicin but lower concentrations of dihydrocapsaicin than that of fresh habanero peppers.

PHYSICS

Bianca DeAngelo
Patrick Shanley

2011/2012 STUDENT RESEARCH IN PHYSICS

STUDENT RESEARCHER(S): Bianca De Angelo and Patrick Shanley

CLASS YEAR: 2012

MAJOR: Physics

TITLE OF RESEARCH PROJECT:
Investigation on the correlation between the spatial and spectral optical properties and the malignancy of prostate cancer slides using DIC microscopy

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Min Xu, Ph.D.

DATE OF PROGRAM: May 2009 - present

SPONSOR: NIH (1R15EB009224) Research Corporation

DESCRIPTION OF WORK (Short Abstract):

We developed a quantitative phase imaging approach with the use of a DIC microscope. The spatial and spectral optical properties of prostate cancer slides of different level of malignancy were investigated with this approach. The correlation between the optical properties of samples and their different Gleason Scores, a measure of malignancy, will be reported.

PSYCHOLOGY

Kaila Anderson
Annie Buckley
Jennifer Callaghan
Frederick Garland
Emily Goodman
Vianette Hernandez
Joshina James
Anne-Sophie Janvier
Jessica Karanian
Emily Kupper
Mairead McConnell
Shannon McGuirk
Taylor McGuinness
Nicole Mollé (2)
Niles Muzyk
Lisbeth Reyes-Fondeur (2)
Ryan Rutigliano

2011/2012 STUDENT RESEARCH IN PSYCHOLOGY

STUDENT RESEARCHER(S): Jessica Karanian, Nicole Molle, Anne-Sophie Janvier, Lisbeth Reyes-Fondeur, Ryan Rutigliano

CLASS YEAR: 2012

MAJOR: Psychology

TITLE OF RESEARCH PROJECT:

The Effects of Ethanol Consumption (Binge Drinking) During Adolescence on Reproductive Behavior in Male Rats

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Shannon Harding, Ph.D.

DATE OF PROGRAM: Spring 2012

SPONSOR: Fairfield University

DESCRIPTION OF WORK (Short Abstract):

Alcohol consumption is a significant public health concern in the United States, with 90% of youth under the age of 21 adopting a binge pattern of drinking (www.cdc.gov). Previous studies have shown that ethanol consumption during adolescence can impair fertility in adulthood (Oliva et. al, 2006). This present study investigated the effects of binge drinking during adolescence on emerging reproductive behaviors. Twenty-six male Long-Evans rats were assigned to Ethanol (EtOH, n = 12) or Control (Water, n = 14) groups at postnatal day 32, receiving solution via gavage twice per week for 7 weeks. Reproductive behavior was assessed with tests for copulation, partner preference, and 50kHz vocalizations during EtOH consumption and after a 4-week period of abstinence. We found that the EtOH group had significant impairments in copulation and partner preference, with some effects persisting into adulthood. These findings suggest that binge drinking in adolescence may have long-term effects on reproductive success.

2011/2012 STUDENT RESEARCH IN PSYCHOLOGY

STUDENT RESEARCHER(S): Emily Kupper, Emily Goodman, Josina James, Vianette Hernandez

CLASS YEAR: 2012

MAJOR: Psychology

TITLE OF RESEARCH PROJECT:
Anger-management, Aggression, and Attribution in children

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Dorothea Braginsky, Ph.D.
Judith Primavera, Ph.D.

DATE OF PROGRAM: Spring 2012

SPONSOR:

DESCRIPTION OF WORK (Short Abstract):

Previous research relevant to attribution and aggression in children such as the Clarke and Clarke doll study, has found that children associate negative characteristics more quickly with black dolls than white dolls. However, by fifth grade, the subjects become aware of the purpose of the test. The purpose of this current study is to move to a more implicit measure of children's attitudes and attributions towards race using Rosenzweig's Picture-Frustration Test in both the adolescent and child versions. The pictures will be manipulated by alternating the race of who is doing the frustrating in each situation depicted in the test. After the adolescent version was presented to college age students, results indicate no significant difference between the stimuli. It is predicted that children will respond more negatively towards pictures where the person doing the frustrated is black.

2011/2012 STUDENT RESEARCH IN PSYCHOLOGY

STUDENT RESEARCHER(S): Taylor McGuinness '13, Mairead McConnell '13, Annie Buckley '12, Frederick Garland '13

CLASS YEAR: See Above

MAJOR: Psychology

TITLE OF RESEARCH PROJECT:
The Cultural Impact on Cognition as Measured by a Choice Decision and EEG

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: John McCarthy, Ph.D.

DATE OF PROGRAM: Ongoing

SPONSOR: Fairfield University

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 choice situations. In the present ongoing study, we have found significant differences between English and German speaking people in a choice situation involving their responses to visual stimuli of an artistic dimension. By using an electroencephalogram, we were also able to identify the electromagnetic evidence for these significant differences. Although this research project is not complete, these preliminary findings further strengthen the idea that culture plays a large role in the way people think.

2011/2012 STUDENT RESEARCH IN PSYCHOLOGY

STUDENT RESEARCHER(S): Shannon McGuirk, Kaila Anderson, Jennifer Callaghan

CLASS YEAR: 2013

MAJOR: Psychology

TITLE OF RESEARCH PROJECT:

Associating outgroups with "negative" is not the same as associating outgroups with prejudice: External explanations shape whether implicit negativity is animus-based or empathy-based

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Michael Andreychik, Ph.D.

DATE OF PROGRAM:

SPONSOR:

DESCRIPTION OF WORK (Short Abstract):

Although widely accepted as an indicator of implicit (i.e., unconsciously-held) prejudice, debate exists regarding the meaning of implicit associations between outgroups and generalized "negativity." In particular, the present work argues that measures of implicit associations are unable to distinguish between animus-based negative associations (e.g., "The group *is* bad") and empathy-based negative associations (e.g., The group *has been treated* badly"). We offer the hypothesis, rooted in attribution theory (e.g., Heider, 1958) that among individuals who explain the negative status and action of outgroups with reference to external forces that have negatively impacted the group (e.g., prejudice, discrimination), implicit measures of generalized negativity are actually capturing empathy-based negativity, negativity rooted in a recognition of the suffering and historical mistreatment of the outgroup. In contrast, among individuals who explain negative outgroup status and action with reference to internal qualities of the group, implicit measures of generalized negativity are capturing animus-based negativity, negativity rooted in a recognition of the deficiency or inferiority of the outgroup. To test this idea, participants completed a widely-used measure of general implicit associations with African Americans, a measure assessing the extent to which they implicitly associated African Americans specifically with animus (e.g., hatred, dislike) and/or empathy (e.g., concern, empathy), and a questionnaire assessing the extent to which they endorsed external explanations for African American status and action. Consistent with predictions, results showed that for those who strongly endorsed external explanations, general implicit "negativity" was related to stronger implicit associations between African Americans and empathy and weaker implicit associations between African Americans and animus. Conversely, among those who rejected external explanations, general implicit "negativity" was related to stronger implicit associations between African Americans and animus and weaker implicit associations between African Americans and empathy.

2011/2012 STUDENT RESEARCH IN BEHAVIORAL NEUROSCIENCE

STUDENT RESEARCHER(S): Nicole Mollé, Lisbeth Reyes-Fondeur

CLASS YEAR: 2012

MAJOR: Psychology

TITLE OF RESEARCH PROJECT:

The Effects of Binge Drinking in Male Adolescent Rats on Measures of Anxiety and Brain Anatomy

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Shannon Harding, Ph.D.

DATE OF PROGRAM: Spring 2012

SPONSOR:

DESCRIPTION OF WORK (Short Abstract):

Binge drinking during adolescence is a public health concern, with 72 percent of students reporting binge-drinking experience by high school graduation (Johnston et al., 2007). The maturing adolescent brain may be more vulnerable to ethanol-induced changes, and research has found an association between increased ethanol consumption and anxiety (Spear, 2000; Izidio & Ramos, 2007). The current study was conducted to determine whether adolescent binge drinking alters anxiety and brain anatomy. 14 male Long-Evans rats were assigned to (EtOH n=8) or (Water n=6) conditions at postnatal day 41, receiving solution via gavage twice weekly on consecutive days for 7 weeks. Anxiety was assessed using the open field test and the elevated plus maze on non-treatment days. Preliminary data analysis suggests EtOH consumption heightened anxiety during the binge-drinking phase; however, the effect was not long lasting. Additional studies are currently being conducted to examine corresponding changes in brain anatomy.

2011/2012 STUDENT RESEARCH IN PSYCHOLOGY

STUDENT RESEARCHER(S): Niles Muzyk

CLASS YEAR: 2012

MAJOR: Psychology

TITLE OF RESEARCH PROJECT:
The Effect of Age on Perceptions of Responsibility of the Mentally Ill

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Michael Andreychik, Ph.D. and Judy Primavera, Ph.D.

DATE OF PROGRAM:

SPONSOR:

DESCRIPTION OF WORK (Short Abstract):

Understanding stigma against the mentally ill is a necessary endeavor in the attempt to expand the reach of mental health care. Corrigan et al. (2003) propose numerous components of this prejudice (e.g., apparent dangerousness, responsibility for one's behaviors), but the interplay between these factors and personal variables needs further exploration. One such absence in the literature is how age influences our perceptions of responsibility of the mentally ill. For instance, an adult is expected to have more responsibility for his behavior than an adolescent, but it is unknown how much responsibility is expected of either age range if the target person suffers from a mental illness. Further research by Webb et al. (2009) suggests that the age of the observer making these responsibility attributions may also influence these perceptions. The present work explores these two ideas through testing Fairfield University students and their parents. Both groups were asked to read a vignette depicting the behaviors of "John", a person with Major Depressive Disorder. This vignette varied across three age ranges and whether or not John was diagnosed as mentally ill. Participants were then asked questions that measured their perception of John's responsibility for his depressive behaviors. By obtaining these responses, the present study aims to explore the effect of the age of a target and the age of an observer on attitudes toward the mentally ill. Preliminary analyses of this data are presented and explained.

ENGINEERING

Craig Alonzo
Adrian Ambrose
Matthew Brunelle
John Burke
Christian Ford
Benjamin Gerace (2)
Daswell Jones
Todd Lake
Clare McManus
Kevin Richard
Neil Rodrigues
George Romania
Musruk Siddique
Ebenezer Rodriguez Vidal
John Weichenrieder

2011/2012 STUDENT RESEARCH IN ELECTRICAL ENGINEERING

STUDENT RESEARCHER(S): Craig Alonzo and Daswell Jones

CLASS YEAR: 2012/2013

MAJOR: Electrical Engineering

TITLE OF RESEARCH PROJECT: Microplate Automation

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Paul Botosani, Ph.D. and Shahrokh Etemad, Ph.D.

DATE OF PROGRAM: Sept 2011 to May 2012

SPONSOR: Fairfield University, Hudson Robotics and Boehringer Ingelheim

DESCRIPTION OF WORK (Short Abstract):

The Microplate Automation Project consists of the design, fabrication and programming of an automated workcell which will utilize several specialized robotic equipment to perform a research experiment currently performed manually by the Chemistry Department at Fairfield University. The automated workcell will induce and transport 96-well microplates within the workcell; dispense and agitate the chemicals being tested and store completed microplates for incubation. By removing the human element, automation provides the consistency and increased throughput by implementing parallel processing that is not achievable by a single laboratory technician and not practical with multiple technicians is the same physical space. We will conclude by determining the automation time savings when compared to the manual process.

2011/2012 STUDENT RESEARCH IN ENGINEERING

STUDENT RESEARCHER(S): John Burke, Clare McManus, Kevin Richard, Neil Rodrigues

CLASS YEAR: 2012

MAJOR: Mechanical Engineering (McManus, Richard, and Rodrigues)
Electrical Engineering (J. Burke)

TITLE OF RESEARCH PROJECT: Light-Sports Aircraft Development Using 4 Stroke Engine

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Ryan Munden, Ph.D.
Shahrokh Etemad, Ph.D.

DATE OF PROGRAM: September 2011 - May 2012

SPONSOR: Fairfield University and NASA Connecticut Space Grant Consortium

DESCRIPTION OF WORK (Short Abstract):

The purpose of this project is to design and build a tandem seat, weight-shift control light-sports aircraft (WSC-LSA) powered by a four-stroke motorcycle engine. The craft is being built to FAA accepted ASTM Consensus Standards. The primary focus of the project is the design of the aircraft fuselage for ideal weight distribution, center of mass, and power transfer from the engine to a propeller. The main structural component of the frame is carbon fiber: a lightweight, yet incredibly strong material that is increasingly entering the aerospace market. This portion of the project covers the first year of an expected two year undertaking. The end goal is to have designed and built a unique WSC light-sport aircraft registered for airworthiness by the FAA. Flight safety analysis will be performed on the finished craft.

The aircraft is designed to be cheaper and more feasible to build than others of its type. The finished product will meet the growing demand of aeronautics for common people, through the utilization of a motorcycle engine that is compact and relatively inexpensive – yet extremely powerful and reliable.

2011/2012 STUDENT RESEARCH IN ENGINEERING

STUDENT RESEARCHER(S): Christian Ford, Adrian Ambrose, Benjamin Gerace

CLASS YEAR: 2012

MAJOR: Mechanical Engineering, Computer Engineering

TITLE OF RESEARCH PROJECT:
Improvement of an On-Site Power and Heat Generator

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Shahrokh Etemad, Ph.D.
Anekwe, Ph.D.
Mr. Daniel Shichman

DATE OF PROGRAM: Sept 2011-May 2012

SPONSOR: Fairfield University-School of Engineering

DESCRIPTION OF WORK (Short Abstract):

On-site power and heat generation systems can save thousands of dollars yearly and are already used by many large facilities such as Fairfield University. For our project, we took on a much smaller version of these systems meant to support only one house, and we looked to increase its efficiency. Through many changes of the mechanical system and installing efficient insulation, we increased the efficiency; thus, making the product more appealing to the market of on-site co-generation systems.

2011/2012 STUDENT RESEARCH IN ENGINEERING DESIGN

STUDENT RESEARCHER(S): Todd Lake and Matthew Brunelle

CLASS YEAR: 2012

MAJOR: Mechanical Engineering

TITLE OF RESEARCH PROJECT:
A Rotating Tank for Visualizing Ocean Dynamics

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Shanon Reckinger, Ph.D.
Shahrokh Etemad, Ph.D.

DATE OF PROGRAM: Fall 2011 - Spring 2012

SPONSOR: Fairfield University

DESCRIPTION OF WORK (Short Abstract):

The motivation for this project is to provide visualization of ocean phenomena for educators, students, and researchers. The use of the rotating tank will aid in the understanding of ocean dynamics theory, enable the collection of data, and provide a tool for looking at simplified, idealized test cases. In constructing an improved rotating tank, it will be possible to provide a more user friendly setup that will enhance the ability of students and researchers to gain a better understanding of ocean dynamics. The predecessor of this proposed rotating tank is the first of its kind; therefore there are various ways to improve its design.

2011/2012 STUDENT RESEARCH IN ENGINEERING

STUDENT RESEARCHER(S): Ebenezer Rodriguez Vidal and Benjamin Gerace

CLASS YEAR: 2013 and 2012, respectively

MAJOR: Software Engineering & Computer Engineering

TITLE OF RESEARCH PROJECT:
Rapid Prototyping for Rotorcrafts using X-Plane Software

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Amalia Rusu, Ph.D.

DATE OF PROGRAM: 2011-2012

SPONSOR: CT Space Consortium/NASA Grant in collaboration with Sikorsky Innovations

DESCRIPTION OF WORK (Short Abstract):

Within the aircraft industry, NASA, and military community, there is a need for further research into the area of systems design and rapid simulation of aircraft technology. Current process for design of complex systems (rotorcrafts) is cumbersome in nature and takes a significant amount of time and energy, and consequently increasing the overall costs. On the other hand, design is iterative and the quicker iterations occur, the more money is saved and the more creative aircraft companies can be. The need to find better design technologies that involve little complexity, low cost, and move faster from the concept to visualization is at a forefront of our research. One aspect of this need is the ability to rapidly create a parameter-based model, test and visualize it, utilizing minimum resources, time, energy, and cost.

In order to drastically reduce the effort and independent steps, we proposed building a Rapid Simulation Environment (RSE) for rotorcrafts as a test-bed for conceptual ideas on future aircraft technology. This project focuses on the rapid creation, testing, and deployment in a virtual environment of rotorcrafts and the algorithms that support tuning rotorcrafts performance, executing functionality, and visualizing the concept. The RSE will display a conceptual model in virtual reality so that the relevance and viability of the rotorcraft can be easily evaluated in a simulated environment.

2011/2012 STUDENT RESEARCH IN ENGINEERING

STUDENT RESEARCHER(S): Musruk Siddique, George Romania, John Weichenrieder

CLASS YEAR: 2012

MAJOR: Mechanical Engineering

TITLE OF RESEARCH PROJECT:

Human Powered Vehicle
(American Society of Mechanical Engineering National Competition)

HOST UNIVERSITY OR INSTITUTION: Fairfield University

NAME OF FACULTY RESEARCH SUPERVISOR: Shahrokh Etemad, Ph.D.

DATE OF PROGRAM:

SPONSOR: Fairfield University

DESCRIPTION OF WORK (Short Abstract):

The Fairfield University Rising Stag (HPV) is a tadpole design. A tadpole design is where a large rear wheel powers the vehicle while two smaller front wheels provide the steering. This vehicle is approximately 6 feet long. The braking system will consist of disk brakes that will apply to all wheels as it will provide a more security when it comes to hard braking. The center of mass is to be distributed equally between the front and rear wheels. The gear system will be towards the front of the vehicle. The rider is to be sitting in the vehicle in a reclined, low seated position. A rollover bar is incorporated to ensure rider safety in the event of a rollover. Our frame design and materials chosen were determined by a design matrix based on weight, strength, and cost requirements. The frame was determined to be composed of high strength aluminum. The objective for our team was to thoroughly research and to ultimately develop and fabricate a human powered vehicle that meets all the requirements to compete in the ASME unrestricted HPVC as well as to outperform the previous designs of Fairfield's alumni. The secondary objectives of the project were to create a vehicle that is economical and ergonomic, to reduce human effort, and to increase practicality.