Academic Year Research Award (AYRA)

1. **Student: Lauren Cotter** **Major:** Psychology
Mentor: Cynthia May **Department:** Psychology
Title: *Prospective Memory, Emotion, and Aging*

Prospective memory (PM) involves remembering future goals, for example, remembering to take medication, to pay bills, or to send an email. Failures of PM can be embarrassing (e.g., forgetting to pick up a friend at the airport) or even life-threatening (e.g., forgetting to take medication). PM is known to decline in older adults (ages 60+), and the goal of this project is to enhance PM performance in older adults by prompting memory with emotional cues.

In this study, we will capitalize on the robust finding that memory is heightened for items with emotional content (e.g., words like "victory"; images of rotting food) relative to neutral items (e.g., images of office supplies). While this memory enhancement is robust for retrospective memory (e.g., remembering a list items), it has not been explored with PM. In this study, older adults will complete a primary task (e.g., make judgments about words that appear serially on a computer screen), and will also be given a concurrent PM task (e.g., press a key when a specific target word appears). This paradigm is meant to simulate PM performance in an otherwise busy day. PM targets will be neutral (e.g., corridor), negative (e.g., murderer), and positive (e.g., miracle). Words will be selected from a widely-used normative database to control valence and arousal across age groups. We have already tested 30 younger adults and need participant funds to compensate older adults. Our pool of older volunteers is established and we can begin testing immediately.

2. **Student: Caroline Duncan** **Major:** Biology
Mentor: Brooke Van Horn **Department:** Chemistry & Biochemistry
Title: *Synthesis of Iodine-Labeled Poly (E-Caprolactone) for X-ray Imaging*

With two of the most common processes for imaging in the human body being general X-ray radiography and computed tomography (CT) technologies, scientists today are exploring and developing exciting new choices for imaging agents and moving beyond the traditional small molecule contrast agents. A biocompatible, biodegradable polymeric macromolecule with engineered radio-opacity (X-ray and CT contrast) and reactive groups would have similar imaging utility as the traditional systems with additional means to covalently link directing groups for specific cellular targets and therapeutic agents for delivery. Using a 2011 SURF grant funds, Caroline demonstrated that synthetic linear (spaghetti-like) polyester polymer chains can be prepared with built-in ketone functional groups. During Spring 2012, we aim to synthesize and attach iodine-containing small molecules to these ketone groups by a specific chemistry (ketoxime ether linkages) to impart radio-opacity. The level of contrast will be tuned through the amount of ketone-containing monomer in the polymer during the polymer synthesis process and by varying the extent of coupling of the iodinated small molecule to the polymer chains. Additionally, the size of the polymers, and ultimately our final nanoparticle objects, can be adjusted by increasing or decreasing the length of the polymer chains/arms. It is with these types of goal applications and our specific small molecule and polymer products in mind that funding for this AYRA project is being requested.

3. **Student: Laura Jackson** **Major:** Biology
Mentors: Christine Byrum **Department:** Biology

Title: *Spatial Distribution of the Myoregulatory gene, SUM-1, in Late Development of the sea urchin Lytechinus variegatus.*

Importins and exportins are critical to many cellular processes, yet little is known about their expression during sea urchin development. These nuclear proteins, collectively known as karyopherins, regulate macromolecular entrance into and exit from the nucleus and are associated with biomedically relevant disorders such as cancer, AIDS, and schizophrenia. Dr. Byrum's laboratory is currently attempting to identify genes that code for importins and exportins in the genome of the sea urchin *Lytechinus variegatus* and is also developing qPCR primers to determine their temporal distributions during embryogenesis. The only documented presence of a karyopherin in echinoids was reported in a study by Song and Wessel (2007). These investigators demonstrated that low levels of Exportin-5 were expressed in ovaries, fertilized eggs, 4-cell embryos, and 32-cell embryos. By the midblastula stage, Exportin-5 expression was undetectable. To gain a better understanding of the roles of importins and exportins in sea urchin development and specification, we will first determine expression levels for several of the karyopherins. My role in this project is to specifically target two exportins: Exportin 1 (XPO1) and Chromosome segregation 1-like (CSE1L). I will evaluate expression levels in two-hour increments between 16-26 hours postfertilization (hpf) and will assist in optimization of the qPCR primers. Based on preliminary examination of microarray data from the sea urchin genome, we hypothesize that both genes will be expressed: XPO1 at 16 hpf and CSE1L at 16-26 hpf. We will confirm or refute this hypothesis.
*Song, JL, and Wessel, GM. 2007. Dev Dyn, 236(11): 3180-90.

Major Academic Year Support (MAYS)

1. **Student: Caitlin Black** **Major:** Biology
Mentors: Paul Nolan **Department:** Biology - The Citadel
Melissa Hughes Biology

Title: *Development of Bird Song Along an Urban to Rural Gradient*

Urban environments pose a variety of challenges to wildlife, containing more stressors than are found in rural areas. These challenges include pollution, lack of food sources, and lack of nesting sites [7]. Organisms also face the challenge of developing successfully from an embryo to a reproductive adult [9]. Along the way, they must learn and practice the traits, such as songs, used later when attracting mates.

A key developmental period for bird song is in the fall when males narrow their song repertoire from the broad set of song notes learned as nestlings, to the subset they will use as adults [9]. The adult repertoire reflects their own capabilities as influenced by their internal, physiological development, and their response to acoustic characteristics of their environment [9]. Birds respond to noisy environments, such as those in urban areas, and may need to shift the fundamental frequency, length, and complexity of their songs if they are to adapt [1,4,13].

Our objective is to study the hypothesis that house finch song development is influenced by environmental factors that vary along an urban to rural gradient. We have available to us a collection of six sites within the Phoenix, AZ metropolitan area, ranging from downtown Phoenix to an undeveloped desert park. In each area, the resident house finches are already well- studied. We will test for effects of urban noise on song development by recording and comparing finch's song characteristics between the sites. We will also test the impact of specific urban noise by studying song characteristics within sites.

2. **Student: Philip Boehner** **Major:** Physics
Mentor: Michael Larsen **Department:** Physics & Astronomy

Title: *Development of a GPU-based Radiative Transfer Algorithm*

We seek to simulate how light is transmitted through clouds using a simulation technique more sophisticated than any that currently exists in the scientific literature. This is necessary because the scientific community's understanding of cloud microstructure (the distribution of cloud droplets within a cloud) has radically altered within the last 15 years and the old computational models made assumptions about the 3-dimensional structure that w now know are not valid. An accurate simulation of the transmission of light through clouds requires –we now realize–actual simulation of the particles within the cloud on a particle-by-particle basis, instead of the "volume-averaged parameterization" used for the last 20+ years.

We have previously written a simulation that successfully models a simplified light transmission process while explicitly resolving particle positions. Although this simulation is a substantial accomplishment in its own right, it still does not include all of the physics we want to investigate and uses a "naïve" parallel structure that we are confident we could improve upon. We now seek to reconstruct the computational algorithm to better leverage our hardware. By doing this, we hope to be able to increase the size of our simulations and incorporate some more complex (but relevant) physics (e.g. scattering, polarization, etc.)

3. **Student: Lauren Fuess** **Major:** Marine Biology
Mentors: Phil Dunstan **Department:** Biology
Andrew Shedlock

Title: *A Molecular Assay for the Cause of Bleaching in the Coral Species Occulina arbuscula*

We propose to study the cause of bleaching in the temperate scleractinain coral, *Oculina arbuscula* over the course of seasonal warming off Charleston South Carolina (June to October). Reports of coral bleaching on the wreck of the Freddy Day were confirmed during the summer of 2009. Previous data suggests that the seasonal bleaching has decreased the total coral coverage of the reef, however the cause of bleaching is still unknown. We will collect samples to study mitotic index and pigment density at a site located 10 miles offshore in approximately 13 meters depth. In addition, we will use PCR amplification and DNA sequencing to search for the potential pathogen *Vibrio shiloi*. This study aims to distinguish between thermal stress and bacterial infection and determine the actual cause of bleaching on the reef. This study represents beginning investigations into the reach of global climate change on temperate zone zooxanthellate stony corals.

4. **Student: Marcus Henderson** **Major:** Biology
Mentor: Brooke Van Horn **Department:** Chemistry & Biochemistry

Title: *Alkene-containing Polyesters for Water Solubility & Cellular Targeting*

With the growing need for improved means to deliver drugs and chemotherapy to specific tissues and cellular targets, scientists today are exploring and developing exciting nanoscale vessels and moving beyond the traditional unspecific small molecule, high dosage therapies. A biocompatible, biodegradable polymeric macromolecule with engineered immunological "stealth" character and surface-available reactive groups would potentially provide a means to covalently link directing groups for specific cellular targets and therapeutic agents to the vessel for timely and precise delivery. Our research lab at CofC is interested in the fundamental design, synthesis, and characterization of such nanoscale vessels for a variety of biomedical applications. Using 2011 HHMI Summer Research grant funds, we have demonstrated that linear (spaghetti-like) polyester

polymer chains can be prepared with built-in alkene (carbon-carbon double bond) functional groups and can be easily reacted with thiol-containing molecules to attach model compounds to the polymer chains. During the 2011-2012 academic year, we aim to synthesize more alkene-lactone monomer, perform additional linear polymerizations, and attach hydrophilic polymer chains to these alkene groups in the polyester polymers by a specific chemistry (thiol-ene reactions) to impart water solubility to the inherently hydrophobic polyester material. The amount of reactive alkene group will be tuned through the molar quantity of synthetic monomer incorporated during the polymerization process, allowing for adjustment of the hydrophilicity/targeting agent incorporation during subsequent reactions. Additionally, the size of the polymers, and ultimately our final nanoparticle objects, can be adjusted by increasing or decreasing the length of the polymer chains/arms.

5. **Student: William Hendricks** **Major:** Biology
Mentor: Elizabeth Meyer-Bernstein **Department:** Biology
Title: *Molecular Mechanisms Underlying Biological Rhythms in the Sea Anemone*

The overall objective of this project is to investigate the mechanisms underlying biological rhythms in the starlet sea anemone, *Nematostella vectensis*. Specifically, we plan to investigate circadian and circatidal behaviors and gene expression related to these behaviors in *N. vectensis*. Outcomes of the proposed experiments will allow us to better understand the gene regulatory pathways that regulate rhythmic behavior in this evolutionarily informative species. By collecting extensive data describing the behavioral oscillations of locomotor activity in *N. vectensis*, we have already clearly established that diurnal rhythmicity persists under constant photoperiodic conditions (constant light or constant dark) indicating the presence of a circadian rhythm which is endogenously generated. In addition, a subset of the test subjects also displayed circatidal rhythms both under constant and photoperiodic lighting conditions. We have additional evidence that suggests this tidal component can be synchronized to a simulated tidal cycle in the laboratory. Furthermore, recent studies have clearly demonstrated that circadian genes similar to those found in mammals and insects are also present in *N. vectensis*. While circadian and circatidal oscillations are not unique among intertidal marine organisms, co-existence of the circadian and tidal behavioral oscillations in an animal for which we have genomic information makes *N. vectensis* a unique and exciting model system for further development. The proposed experiments will provide a greater understanding of the molecular mechanisms underlying circadian and circatidal behavior and provide important insights into evolution of the circadian clock.

6. **Student: Jessica Hoffmann** **Major:** Anthropology
Mentor: Maureen Hays **Department:** Anthropology
Title: *Strontium Tells All at Tell Dothan: Exploring Migration with Strontium Isotope Analysis*

Strontium isotope analysis has been used to explore migration patterns. Because of the unique isotopic signature of bedrock at different localities, when organisms eat and drink, strontium becomes incorporated into the mineral part of their bones and teeth. In this study strontium (87Sr/86Sr) signatures from human samples will be compared to those of archaeological fauna from the site of Tell Dothan (Southern Levant) to track patterns of migration from the Late Bronze Age (1550-1200 BCE) to Early Iron Age (1200-900 BCE). A high incidence of migration during this period due to the city's geographic location and historical context is predicted. The transition period between the Bronze Age and Iron Age is often believed to be one of constant migration across the Southern Levant.

This study examines first molar tooth enamel from multiple individuals, and third molar enamel from a smaller sample of those individuals, to track individual migration over time. The 87Sr/86Sr ratio of human teeth and bones reflect the strontium signature of the area where an individual lived. A local range for Tell Dothan is established using the mean strontium value of archaeological fauna. By comparing the human data to the local range determined by faunal samples, we can look for outliers who may be migrants. Data collected thus far have fallen within the local range indicating low frequency of migration into Tell Dothan. By expanding the sample size, a more definitive conclusion about migration at Tell Dothan may be reached at this very important cultural transition.

7. **Student: Jennifer Hunnicutt** **Major:** Athletic Training
Mentor: Anh-Dung Nguyen **Department:** Health & Human Performance
Title: *Assessment of Risk Factors for ACL Injuries in Adolescent Athletes*

The anterior cruciate ligament (ACL) is the most frequently injured ligament in the knee.1 Injuries to the ACL result in significant health costs2-4 and can greatly increase the potential for re-injury.5 In the female knee alone, the associated medical cost is estimated at $1861 per injury2, and over $850 million is spent annually on reconstructive surgery.3 Beyond these initial costs, there are long term complications associated with ACL injury (e.g. early onset osteoarthritis6,7-9 which can further impact health care costs, and lead to a premature decrease in physical activity across the lifespan). This is of particular concern when the initial injury occurs at a young age, setting the stage for a lifetime of reduced physical activity. But while the initial injury is consistently reported as a leading risk factor for subsequent injury5, 10, the association of ACL injury with maturation and gender are poorly understood. Given evidence that injury risk increases with age11-14 and physical maturation15, and that *young maturing females have a greater risk than young males of presenting with an ACL injury* 16, there is a need to focus on the maturing youth population to determine the most relevant risk factors for ACL injury.

To that end, the primary focus of this work is to determine the combination of risk factors that put physically active youth at risk for ACL injury. Understanding the risk factors that mediate the relationship between gender, maturation stage and ACL injury is essential toward developing the most timely and effective injury prevention strategies.

8. **Student: Jessica Latham** **Major:** Spanish
Mentor: William Veal **Department:** Teacher Education
Title: *The Development of the Self in a Cultural and Linguistic Immersion*

The purpose of this project is to explore the concept of self and self-identity in indigenous students who have been sent to an American academy in Quito, Ecuador from their tribal village in the Amazon. Thus, the two indigenous, Cofan, students are separated from their families and native culture for the majority of the year. By understanding the tribal and educational cultures in which they are periodically immersed, the researchers seek to understand the drive for acculturation and assimilation which has been demonstrated in one student's self-election of a new name. The concept of self will be explored using the three constructs of accomplishment, belonging, and engagement in the diverse cultural settings. Once this is understood, it is possible to formulate and understand a learning environment in which both cultures have equal prestige and provide the students with equal access to learning through differentiated instruction allowing the students to develop their identity without compromising academic standards or cultural traditions and practices. The project will provide insight into differentiated teaching methods designed for teachers who instruct students in multicultural classrooms. The tools and recommendations from this study will allow teachers with multicultural classrooms to become successful without

compromising the positive aspects of students' native cultures, allowing the students to develop self-identities that match their cultural backgrounds. The tools and recommendations will be disseminated to international school teachers, local area teachers, and in publications on culture (e.g., National Geographic).

9. **Student: Jefferson Rabe** **Major:** Athletic Training
Mentor: Anh-Dung Nguyen **Department:** Health & Human Performance
Title: *Assessment of Risk Factors for ACL Injuries in Adolescent Athletes*

The anterior cruciate ligament (ACL) is the most frequently injured ligament in the knee.1 Injuries to the ACL result in significant health costs2-4 and can greatly increase the potential for re-injury.5 In the female knee alone, the associated medical cost is estimated at $1861 per injury2, and over $850 million is spent annually on reconstructive surgery.3 Beyond these initial costs, there are long term complications associated with ACL injury (e.g. early onset osteoarthritis6,7-9 which can further impact health care costs, and lead to a premature decrease in physical activity across the lifespan). This is of particular concern when the initial injury occurs at a young age, setting the stage for a lifetime of reduced physical activity. But while the initial injury is consistently reported as a leading risk factor for subsequent injury5, 10, the association of ACL injury with maturation and gender are poorly understood. Given evidence that injury risk increases with age11-14 and physical maturation15, and that *young maturing females have a greater risk than young males of presenting with an ACL injury* 16, there is a need to focus on the maturing youth population to determine the most relevant risk factors for ACL injury.

To that end, the primary focus of this work is to determine the combination of risk factors that put physically active youth at risk for ACL injury. Understanding the risk factors that mediate the relationship between gender, maturation stage and ACL injury is essential toward developing the most timely and effective injury prevention strategies.

Research Presentation Grants (RPG)

1. **Student: Zachary Adkins** **Major:** Biology
Mentor: Eric McElroy **Department:** Biology
Title: *The Effect of a Myxosporean Parasite, Kudoa inornata, on the Flesh Quality of Spotted Seatrout, Cynoscion nebulosus*
Conference: Southeastern Society of Parasitologist Annual Meeting

Spotted seatrout, *Cynoscion nebulosus*, is an important game fish in SC estuarine waters. Unofficial reports from fishermen say that the flesh of spotted seatrout is often 'mushy' during warm months and thus unappealing. Concurrently, the presence of a myxosporean parasite, *Kudoa inornata*, has been observed in SC populations of the fish. One closely related *Kudoa* species is known to induce post-mortem myoliquefaction ('mushiness') in other species of fish by secreting enzymes. We investigated the effects of this parasitic infection on the flesh quality ('mushiness') of spotted seatrout. We expected that greater parasite intensity and greater time post-mortem would reduce the maximum strain that a muscle sample could withstand. Results suggest that higher parasite loads, but not time post-mortem, result in a fillet that has a more 'mushy' quality. Thus, infection by this myxosporean parasite may explain reports from fishermen.

2. **Student: Caitlin Black** **Major:** Biology
Mentors: Paul Nolan **Department:** Biology - The Citadel
Melissa Hughes Biology

Title: *Impacts of Anthropogenic Noise on Bird Song along an Urban to Rural Gradient*

Conference: Society of Integrative and Comparative Biology 2012 Annual Meeting

Urban environments pose a variety of challenges to wildlife, containing more stressors than are found in rural areas. One of these challenges is the interference of urban noise to bird song. Our study analyzes house finch song characteristics along an urban to rural gradient. 20 songs from 10 males at each of the 6 field sites in the Phoenix, AZ area were recorded in May 2011. Songs were analyzed to determine frequency range, upper and lower frequencies, song length, and complexity (% of unique notes per song). Our results showed significant differences in song characteristics between the extreme ends of the urban to rural gradient with mixed results in between. In particular, the birds responded differently to continuous and periodic noise. We conclude that urban noise does impact the birds' singing behavior but that the birds have sufficient behavioral flexibility to adapt to this interference.

3. **Student: Diego Castro Oliva** **Major:** Biology
Mentors: Robert Podolsky **Department:** Biology

Title: *Effects of Elevated Oceanic CO_2 on Sperm Motility and Swimming Speed in Sea Urchins: Implications of Ocean Acidification for Fertilization Success*

Conference: Society for Integrative and Comparative Biology

Increases in atmospheric CO_2 are raising CO_2 levels in the ocean, driving a decrease in oceanic pH through a process known as ocean acidification. Because several key biological processes are sensitive to small changes in pH, there is increasing concern about continued production of CO_2 through the burning of fossil fuels. We focused on consequences of acidification for one of those processes, external fertilization, by analyzing the effect of CO_2-induced acidification on sperm activity in the sea urchin *Arbacia punctulata*. Increases of CO_2 to 2.5 times current levels, corresponding to 100 years in the future based on climate models, led to significant declines in both sperm motility and swimming speed. Changes in these parameters are predicted by mathematical models to lead to decreases in fertilization success. Such effects highlight the potential costs of climate change for free spawning, which is the most widespread form of reproduction among marine organisms.

4. **Student: Katelynn Corder** **Major:** Biology
Mentor: Agnes Ayme-Southgate **Department:** Biology

Title: *Presentation at the SICB National Meeting*

Conference: Society for Integrative and Comparative Biology

The contractile units of muscles known as sarcomeres contain short, inextensible filaments anchoring at a dense structure, the Z-band and linking to the myosin. In insects these filaments are known as C-filaments and contain two large proteins, projectin and kettin/Sls that are proposed as responsible for the stiffness of flight muscles. Different forms of the same protein or isoforms can be generated by alternative splicing of the messenger RNA. Instances of alternative splicing are documented for the projectin gene and particular projectin isoforms could confer differences in muscle properties. We focused our analysis onto a special projectin region, known as the PEVK domain that is proposed as one of the protein's elastic elements and undergoes extensive alternative splicing. We will present our data from the molecular analysis in *Drosophila melanogaster* to

determine the presence and ratio of projectin PEVK isoforms under different conditions such as age, sex, and flight ability.

5. **Student: Meghin Gilstrap** **Major:** Psychology
Mentor: Garrett Milliken **Department:** Psychology
Title: *Modafinil reverses methamphetamine-induced memory Deficits on an Object-in-place Task in Rats: Role of Glutamate Receptor Expression*
Conference: Faculty for Undergraduate Neuroscience Poster Presentation within the Society for Neuroscience Conference

Chronic self-administered methamphetamine (meth) results in object-in-place memory impairments, which measures the ability to identify objects relative to their location and surrounding objects. Rats were tested for memory one week after withdrawal from chronic self-administered meth or saline. Half the rats were tested for recognition memory with vehicle and the other half with modafinil. Saline-treated rats given vehicle or modafinil spent more time interacting with the objects in changed locations, while meth-treated rats distributed their time equally among all objects, regardless of location. Meth-treated rats given modafinil showed a reversal in the deficit. Corresponding comparisons of glutamate NMDA receptor levels in cortical areas will be presented. Characterization of meth-induced changes of glutamate receptors and their alteration by modafinil may identify neurobiological substrates that are the basis for the behavioral effectiveness and potential usefulness as a treatment in meth addiction.

6. **Student: Katherine Gumps** **Major:** Biology
Mentor: Chris Korey **Department:** Biology
Title: *Mutations in Palmitoyl Protein-thioesterase 1 Alter Exocytosis and Endocytosis at Synapses in Drosophila Larvae*
Conference: Society for Neuroscience Conference

Batten's disease is an inherited lysosomal storage disorder resulting in the degeneration of the central nervous system. Infant onset Batten's disease is caused by mutations in palmitoyl-protein thioesterase 1 (Ppt1), a soluble lysosomal enzyme involved in palmitoylation. We are interested in why loss of Ppt1 causes the significant loss of neuronal cells observed in patients. Previously, our lab has shown that Drosophila Ppt1 plays a role in endocytosis in non-neuronal cells. Using a fluorescent dye, we have shown that rate of endocytosis in neurons that project to larval muscles is significantly reduced. We have collaborated with an undergraduate electrophysiology lab at Pomona College to show that these same neurons have defects in their ability to communicate across their synapses. Our work with the fruit fly indicates that Ppt1 plays an important role in neuronal communication that is crucial for neuronal health.

7. **Student: William Hendricks** **Major:** Biology
Mentor: Elizabeth Meyer-Bernstein **Department:** Biology
Title: *Anatomical Localization of Circadian Clock Genes in the Sea Anemone*
Conference: Society for Neuroscience/Faculty for Undergraduate Neuroscience

An organism's daily physiological and behavioral patterns are controlled by an internal daily or circadian clock, which synchronizes to environmental stimuli. Animals with centralized nervous systems have dedicated brain structures for these rhythms. Thus, how organisms with simple nervous systems that don't include a brain synchronize their behavior to rhythmic stimuli is an intriguing question. We have recently shown the marine invertebrate, *Nematostella vectensis*, has robust daily rhythms in locomotor behavior. Circadian clocks are regulated by a transcription-

translation negative feedback loop involving conserved circadian genes such as *cryptochrome* (*cry*) and *clock*. We have localized *cry* and *clock* gene expression using *in-situ* hybridization to the tentacle and mouth regions. Interestingly, this pattern overlaps with the localization of a protein that identifies sensory neurons in this same organism. This supports the idea of a centralized circadian clock in *Nematostella* suggesting greater organization within the nervous system of this invertebrate than previously thought.

8. **Student: Sarah-Kate Magee** **Major:** Arts Management
Mentor: Chris Burgess **Department:** Arts Management
Title: *Arts-Based Economic Development: Strategies, Knowledge Areas and Actors*
Conference: Social Theory, Politics and the Arts

This research explores how the arts can be utilized to create economic development. Four arts-pertinent development strategies were identified from business sources as well as already implemented arts-based development initiatives. The research and case studies show that the implementation of economic development strategies through the arts originates from partnerships; however, who specifically is involved is not important. What is of critical importance is what they know and how they are able to implement or apply their knowledge? Individuals with knowledge of the artistic/creative, community, and economy need to be represented for the initiative to be sustainable and effective. A deficit in the knowledge base threatens the sustainability and success of the economic development. Also, the actors must be effective and engaged in the project in order to create sustainable community-based economic development through the arts.

9. **Student: Jacob Oster** **Major:** Marine Biology
Mentor: Allison Welch **Department:** Biology
Title: *Combined Effects of Social Stress and an Agricultural Pesticide on Tadpole Growth and Development*
Conference: Society for Integrative and Comparative Biology Annual Meeting

Chemical pollutants, such as pesticides, pose a threat to natural populations. Stress from contaminants may produce even more severe outcomes when coupled with normal biotic stressors, such as competition and predation. We predicted that the stress of being an inferior competitor would increase an individual's vulnerability to environmental toxins. We tested this idea by exposing size-structured groups of tadpoles to a common pesticide. We found that size-advantaged tadpoles reached metamorphosis sooner, and that food limitation intensified competition, leading to an even greater delay in metamorphosis for small individuals. The pesticide inhibited growth for all size classes of tadpoles. Pesticide exposure also affected the outcome of competition, leading to less pronounced competitive suppression of smaller individuals. This result suggests that the larger individuals were less effective competitors when exposed to the pesticide. Understanding how stressors interact allows us to better assess the risks faced by amphibian populations in human-impacted environments.

10. **Student: Beverley E. Wood** **Major:** Political Science
Mentor: Allison M. Welch **Department:** Biology
Title: *Tadpole Responses to Environmental Stressors - Pesticides and Salinity*
Conference: Society for Integrative and Comparative Biology Annual Meeting

As the environment is becoming increasingly threatened, it is important to understand the role that humans play in that degradation. Wetlands, in particular, are threatened by rising salinity levels caused by climate change and harmful levels of pesticides caused by agricultural runoff. This

research focuses on tadpoles' responses to these stressors in order to analyze how multiple stressors impact the environment. I tested the responses of southern toad tadpoles to combinations of salinity and three pesticides – carbaryl, glyphosate, and atrazine. These pesticides are widely used in agriculture and have been shown to inhibit tadpole growth and activity. Throughout the research I conducted a series of observations and measurements, including activity, tadpole mass, burst speed, mass at metamorphosis and days to metamorphosis. My results show that both pesticides and salinity increase tadpole vulnerability individually, and that together, brackish water and carbaryl had an even greater combined effect, slowing tadpole growth.