Biology & Environmental Programs

Author's Name: Sarah Wike
Research Advisor: Dr. Constance Rogers-Lowery
Title: Use of fluorescently labeled seawater to observe calcification in a hydroid.

ABSTRACT: The hydroid *Janaria mirabilis* builds a thick exoskeleton that serves as a home for hermit crabs. *Janaria* secretes calcium carbonate crystals underneath the tissue of the colony as well produce crystals in some of this cells. I used fluorescein isothiocyanate-dextran to dye seawater in order to see the movement and processing of the seawater through the organism. A Zeiss epifluorescence microscope was used to analyze the seawater movement and capture images. Immediately after exposing the specimens to the dyed seawater, the dye was brightest inside the cells and in the stolen tubes, and mainly resides on the outer edges of the colony. 24-48 hours after exposure, I observed that the dye was nearer to the crystals on the inside of the colony. From this, I can conclude that the organism brings seawater in towards its inner tissue in order to build its skeleton.

Author's Name: Kyra Thurow, Sarah Wike, Johnny Money, Lauren Bost, Ashley Brown
Research Advisor: Dr. Joseph Poston
Title: The effect of perch height on the coloration of *Anolis carolinensis*

ABSTRACT: Previous studies with *Anolis carolinensis* have shown that aggressive behavior is correlated with perch height. The lizards can change color and range between various hues of green and brown. Coloration is known to relate to aggressive behavior in *Anolis.* However, there has not been a study on whether coloration in *Anolis* is correlated to different perch heights. This study investigated whether the coloration of *A. carolinensis* correlated with differing perch heights. Our experiment involved using a spectrometer to measure the absorbed wavelengths of 21 *A. carolinensis* at three different perch heights. We used the Center for the Environment at Catawba College balconies as the different perch heights. We measured the color of the lizards before and after being placed on the perch. Pictures were taken of each lizard for a visual representation of data during each measurement. An infrared thermometer was used to measure the temperature of the lizards before and after placement on each perch. Using peak integration analysis, the coloration of the *A. carolinensis* was analyzed to determine color change at different perch heights. Preliminary results suggest that coloration is not correlated with perch height.

Author's Name: Mary Lagro and Jay F. Bolin
Research Advisor: Dr. Jay Bolin
Title: An evaluation of hybrid intermediacy in the germination ecology of Ashe's Sumac, *Rhus asheii* (*Rhus michauxii* X *Rhus glabra*)

ABSTRACT: The federally endangered shrub *Rhus michauxii* hybridizes with the common small tree *Rhus glabra* to produce the apparently fertile hybrid *Rhus asheii.* This hybrid, may outcompete the parent plants and therefore threaten the long term persistence of *R. michauxii* populations. There is very little information on the germination ecology of *R. michauxii* or the hybrid *R. asheii*. Thus, we evaluated the germination ecology of *R. asheii*, *R. glabra,* and *R. michauxii* collected from the sandhills of Ft. Bragg, North Carolina. We applied dry heat treatments, simulating modest heat from wildfire, to seeds of the three species at 60, 80, and 100 C for five minutes. In addition to control groups we also evaluated the effect of endozoochory by Northern Bobwhite Quail (*Colinus virginianus*) to test for their effect on the germination of *R. asheii, R. glabra,* and *R. michauxii* seeds. Germination data from this study on the hybrid plant *R. asheii* and its parents should provide important information for the effective management of *R. michauxii.*

Author's Name: Ryan Barber
Research Advisor: Dr. Constance Lowery
Title: Effects of Ocean Acidification on Growth of a Marine Hydroid
ABSTRACT: Levels of atmospheric CO_2 have been rising: this is a well known problem with far reaching consequences. The oceans of our planet absorb approximately 1/3 of the carbon dioxide, altering the chemistry of sea water and the affecting the biota inhabiting the delicate salt-water ecosystem. For example, coral exposed to acidified seawater exhibits reduced growth and skeleton formations. The current study examines how rising CO_2 levels affect *Hydractinia symbiolongicarpus*, a small Atlantic hydroid normally found on the shells of hermit crabs. Explanted colonies were exposed to increased levels of CO_2 and temperature. Each week for 7 weeks, growth and the number of polyps produced each week were measured. It is hypothesized that increased levels of CO_2 and temperature will result in lower surface area growth and lower number of polyps produced.

Author's Name: Meredith Brown
Research Advisor: Dr. Connie Lowery
Title: The Effect of Sound on *Hydractinia symbiolongicarpus* Settlement
ABSTRACT: Cnidarians, as sessile organisms, rely upon their planula larvae to find new habitats for settlement, and research suggests that these larvae rely on environmental stimuli to find a suitable new habitat, the most important of which seems to be the identification of certain biological elements sensed by the larva's mechanoreceptors within the cnidocyte. A study performed by Vermeij, Marhaver, Huijbers, Nagelkerken, and Simpson (2010) suggests that sound may also play a crucial part in the settlement of coral larvae, as they have been found to settle near recordings of reef sounds. This leaves the question of whether or not sound could have an influence on other closely related members of this phylum, such as *Hydractinia*. Therefore, this experiment examines whether or not *Hydractinia* do in fact have the ability to sense sound, and if this plays a role in their settlement process as well. Significant results in this experiment could aid in determining whether or not noise pollution due to water traffic could be a disruption to natural settlement habits. This information could be used, in turn, to ensure the protection and continuation of cnidarian species. To test if *Hydractinia symbiolongicarpus* will respond to sound, approximately 20 *Hydractinia symbiolongicarpus* larvae are added to a 25-mL pipette, with an earbud placed at one end to deliver recorded reef sounds. The control group consists of pipettes with the same number of larvae, however with no sound provided. The experimental and control groups each consist of 12 pipettes with larvae. This experiment is undertaken in a dark room, surrounded by soundproofing material during the entirety of the experiment to eliminate light and sound contamination and to ensure consistency. Final results will be evaluated using statistical analyses to determine presence or absence of significant settling behavior in response to sound.

Author's Name: Jonathan Cooley and Jay F. Bolin
Research Advisor: Dr. Jay Bolin
Title: All Taxa Biological Inventory of Catawba College Preserve and adjacent lands
ABSTRACT: The Catawba College Ecological Preserve and the adjacent Horizons Unlimited Nature Study area is approximately 68 hectares and is located in the central piedmont of North Carolina (Rowan County). The study area is composed of a floodplain and bordering slopes. The floodplain drains towards Grants Creek, which is seasonally inundated and includes several manmade ponds and ditches. The southern half of the preserve was farmland as recently as 1995, and is proceeding through secondary succession. The mature forested slopes on the east and west sides of the property are classified as piedmont mixed mesic hardwood forest underlain by Pacolet and Poindexter soil types. The slopes have been designated by the North Carolina Natural Heritage Program as a significant Natural Heritage Area. Current and previous Catawba College students and faculty have conducted surveys and assembled lists of various taxa, but these lists have not been compiled and made accessible online, a goal of this study. An inventory of the mollusks, grasshoppers and crickets, dragonflies and damselflies, butterflies, moths, vascular plants, amphibians, birds, fishes, mammals, and reptiles of the Catawba College preserve and adjacent study area was conducted with the aim of updating existing databases and nomenclature.

Author's Name: Jonathan Cooley, Jillian V. Goodwin, and Dr. Joseph Poston
Research Advisor: Dr. Joseph Poston
Title: Interactions between red-eared sliders (*Trachemys scripta elegans*) and yellow-bellied sliders (*T. s. scripta*).
Abstract: The red-eared slider (*Trachemys scripta elegans*) is popular in the pet trade. Pet owners occasionally release unwanted turtles in the wild, with potential impacts on wild, native turtle populations. Many studies have examined the impacts of red-eared sliders on other species. Interactions between red-eared sliders and other subspecies of *T. scripta* have not been examined as carefully. We report the results of a study to compare the condition of turtles from these two subspecies in an area where they co-occur. The Catawba College campus hosts a population of yellow-bellied sliders (*T. s. scripta*). Sometime between 2000 and 2007, one or more red-eared sliders became established on the campus. To better understand the interactions between these two subspecies, in fall 2012 we trapped sliders and scored the color patterns on their plastron and on their head and neck to gauge their taxonomic identity (*T.s. scripta*, *T.s. elegans*, or intergrades between the two subspecies). We also measured the body size and weight of turtles to calculate an index of condition. We compare the condition of turtles based on their taxonomic identity. Also, we compare the frequencies of phenotypic traits for turtles from 2012 with those captured in a separate bout of trapping in 2007.

Author's Name: Susan Ethridge
Coauthors: Emily Schilling and Dr. Sue K. Calcagni
Research Advisor: Dr. Sue K. Calcagni
Title: The Aminoglycoside Antibiotic Kanamycin Does Not Alter Growth, Feeding, or Reproduction in *Daphnia pulex*.

ABSTRACT: Recent reports of pharmaceutical compounds in natural waters continue to demonstrate that these compounds, including antibiotics, pass through wastewater treatment facilities, ultimately reaching surface waters. Within this group of xenobiotics commonly designated the pharmaceuticals and personal care products or PPCP, the pharmaceuticals are particularly concerning because they are designed to be biologically active. Even though the mechanisms of action (MOA) for antibiotics are typically thought to be bacteria-specific (e.g., targeting the bacterial cell wall or bacterial ribosomes), time and again xenobiotics have been shown to interact with biological systems in unexpected ways. One only need consider the endocrine disruptors as an example. Moreover, the conservation of important physiological processes across taxonomic groups suggests that non-target effects are plausible. Thus, the presence of antibiotics in natural waters raises concerns for more than just native bacterial communities. Kanamycin is an aminoglycoside antibiotic in the same family as streptomycin, gentamicin, and neomycin. Kanamycin is used in many applications, from molecular biology to clinical treatment of infection in both human and veterinary contexts. In the study presented here, *Daphnia pulex* (a freshwater crustacean) were exposed to water-borne kanamycin at nominal concentrations of 0.1, 1.0, 10, and 100 ug/L for a duration of 22-24 days. Data on growth, feeding, and reproductive endpoints were collected every 48 hours. Kanamycin did not alter any of the endpoints evaluated at any concentration tested, suggesting that this antibiotic alone and perhaps others in its class may pose little to no risk to aquatic invertebrates at environmentally relevant concentrations. These findings, however, do not rule out risks associated with exposure to PPCP mixtures the exposure reality for most aquatic species.

Business

Author's Name: Christian Klimczyk
Research Advisor: Dr. Pamela Thompson
Title: Mining the College Persistence Questionnaire Data

ABSTRACT: A topic of concern for many colleges today is the retention of students. A major issue at colleges like Catawba College is identifying the factors unique to a particular school that play the greatest role in retention. First year students at Catawba complete a college persistence questionnaire (CPQ) that has many questions related to areas that may impact retention.
The CPQ has been administered at Catawba College since 2008. Data from the questionnaire will be combined with student records from the college database (courses, grades, etc.) in order to create the foundation for a data set that can be mined for student persistence at Catawba College. After data cleansing, techniques for association, decision trees, and clustering will be used to uncover hidden information in the data. This research hopes to produce new and statistically significant predictors for student retention at Catawba College.

Author's Name: Leah Constan-Tatos
Research Advisor: Chairperson: Professor Spencer, Committee Advisers: Dr. Hake and Dr. Vandergriff-Avery
Title: Taxation, Fiscal Policy and Social Welfare
Type: Thesis

ABSTRACT: This study examines the relationship between optimal taxation, fiscal policy and social welfare. After a review of the relevant literature, the following was concluded: because each country's objectives differ there is no single optimal system of taxation because each country has different needs and goals related to social welfare. Each topic will be reviewed based on the literature available. For the optimal taxation section of the essay, theories from the following authors will be discussed: Mankiw, Wienzierl and Yagan; Golosov, Troshkin and Tsyvinski; Slemrod; Dhami and Al-Nawaihi; Gentry; Wynne; Amadi; and Desai. These theories will be considered in light of the existing optimal taxation models and theories: Ramsey, Mirrlees, Chamley, Judd, Atkinson and Stiglitz, and McLure. Some suggestions made regarding tax reform were in favor of a zero marginal taxation rate in the top income tax bracket, commodity taxation, consumption taxation, and an elimination of capital taxation and capital gains taxation. The section that reviews the relationship between fiscal policy and social welfare will refer to the following theories from the following authors: Altar and Samuel, Korpi, Muffels and Heady, Wynne, Meldgaard, and Kvist. The social welfare component covers the theories as illustrated by: Korpi, Cashel and McGavin, and Scully. With reference to the literature, topics of concern include observing the relationship between economic growth and social welfare, and policy change. Suggestions made regarding the relationship between fiscal policy and social welfare was that countries that spend a significant portion of GDP on social welfare may experience slower economic growth, and as per capita government expenditures related to social welfare increases the PQL Index curve becomes flatter, which suggests that government expenditure per capita is optimal to a certain point (approximately $4130). The last section integrates the topics of optimal taxation, social welfare and fiscal policy, and includes a review of the work of Scully; Garfinkel, Rainwater and Smeeding; Farhi and Werning; Mirrlees; Garriga and Sanchez-Losada; Domenech and Garcia; and Krueger.

Chemistry

Author's Name: Blake Rushing
Coauthors: Jamie DeWitt
Research Advisor: Dr. Mark Sabo
Title: Immunotoxic Effects of Undecafluoro-2-methyl-3-oxahexanoic Acid in Mouse Models

ABSTRACT: Perfluorinated compounds (PFC) are organic compounds where the C-H bonds have been replaced with C-F bonds. The chemical characteristics of these compounds make them useful for many industrial and consumer products. Among these PFCs is a compound named perfluorooctanoic acid (PFOA), which is known to induce multisystem toxicity in experimental animals, notably immunotoxicity. A new compound named undecafluoro-2-methyl-3-oxahexanoic acid (U2M3-OHxA) is a potential replacement for PFOA. It was hypothesized that U2M3-OHxA also would cause immunotoxicity. This experiment used C57BL/6 mice that were exposed to 0, 1, 10, and 100 mg/kg of U2M3-OHxA by gavage. Body and organ weights were recorded and spleens were used for immunophenotyping. Serum was collected to measure U2M3-OHxA concentrations at 24, 48, 72 hours, 5 days, and 14 days after the initial dose. Mice were immunized with sheep red blood cells (SRBCs) on day 24 and ELISAs were used to measure the IgM an tibody responses. Results showed a loss in body weight for females in the 100 mg/kg group, increased liver weight for 10 and 100 mg/kg doses, increased thymus weight for the 100 mg/kg males, decreased splenic weight for 100 mg/kg females, a decrease in the CD45 (B cell) splenic lymphocytes for males in the 1 and 100 mg/kg dose groups, and no changes in IgM responses.

Author's Name: Elizabeth White
Coauthors: Casie Hilliard
Research Advisor: Dr. Janet Bluemel
Title: Syntheses of Diphosphine and Diphosphine Dioxide Cages

ABSTRACT:
The adsorption of phosphines and phosphine oxides (*Dalton Trans.* **2012**, *41*, 1742) on oxide supports is important for many fields, e.g. chromatography, or for probing surface acidities. Upon adsorption of polycrystalline phosphines and phosphine oxides their ^{31}P solid-state NMR signals shift to lower field and show smaller chemical shift anisotropies (CSA). This phenomenon can be due to translational mobility of the adsorbed species, partial quaternization (phosphines), or hydrogen bridges reducing the P=O bond order (phosphine oxides). To disentangle these factors, probe molecules, such as "empty" gyroscopes (*J. Am. Chem. Soc.* **2006**, *128*, 4962) with two phosphine groups, where only one can interact with the surface, while the other experiences the same translational mobility, are desired. In this contribution, we show how diphosphine cages and their dioxides, containing alkyl chains with 10 to 12 methylene groups, can be synthesized from their corresponding Fe gyroscopes.

Author's Name: Justin M. Smith
Research Advisor: Dr. Aaron Straight
Title: Investigating the Role of Non-coding RNAs in Pericentric Heterochromatin Formation

ABSTRACT: Proper chromosome segregation is necessary during mitosis and meiosis in order to accurately segregate a cell's genome. One domain involved in this process is the pericentric heterochromatin which surrounds the centromere on chromosomes. Pericentric heterochromatin is responsible for maintaining cohesion between sister chromatids, ensuring equal segregation of the genome. Previous research has shown that centromeric RNA plays a role in the formation of the pericentric heterochromatin in *Schizosaccharomyces pombe*. However, it is not clear if pericentric proteins are recruited by centromeric RNA in human cells. To test the effect of disrupting centromeric RNA *in vivo*, we generated fusion protein constructs consisting of a pericentric localizing protein, green fluorescence protein (GFP) and RNase. After transfecting these DNA constructs into HeLa cells, we analyzed the expression of fusion proteins by Western blot, and confirmed their RNase activity by using immunoprecipitated protein in *in vitro* RNase activity assays. Finally, we tested the effect of expressing these fusion proteins in cells on the localization of heterochromatin protein and centromeric RNA by analyzing fixed cells via immunofluorescence microscopy. Our model predicts that centromeric RNA plays a role in the initial recruitment of proteins to pericentric heterochromatin.

Modern Foreign Languages

Author's Name: Donald McIntyre III
Research Advisor: Dr. Mike Wilson
Title: The Impact of New World Crops on World Culture, Economy, and the Environment

ABSTRACT: Why is Italian food most recognized by the tomatoes? Or why was Ireland so dependent on potatoes? And why is Indian food so spicy? In my research on the discovery and impact of American crops on the rest of the world, I learned the answers to these questions and more. Medieval European cuisine was rather bland and lacking in nutrition, so the spice trade with the Middle East and Asia was important to Europeans in order to add more flavor and nutrition to their diet, however the way to Asia was long and arduous. The need for a faster route to Asia, and the desire for spices, led to a search for a shorter route to Asia in which Columbus suggested a route across the Atlantic, unaware of the landmass lying in the middle of the ocean which would later come to be known as the Americas. Upon the discovery of the different types of food and cultivation in this new continent, colonization ensued shortly followed by a period of intense trade known as the Colombian Exchange in which slaves, diseases, and more importantly, food, was exchanged in between the two continents. Some of the major types of food that were discovered in the Americas included the potato, tomatoes, peppers, turkeys, and chocolate. Although none of these foods were native to Europe, they flourished and became extremely important aspects of the diet, culture, and economy of Europe, even impacting the global environment in ways the still affect us today. All of these points will be further explained in my presentation.

Psychology

Author's Name: Maura L. Pantone and Dr. Sheila Brownlow
Research Advisor: Dr. Sheila Brownlow
Title: Does saying mean (not) doing? Articulation of alcohol policies and underage drinking.

ABSTRACT: We examined whether expressing positive reasons for abstaining from alcohol use decreased likelihood of subsequent self-reported alcohol use among first-year college students. Participants who articulated the benefits of prohibiting underage drinking showed a slight trend toward steady/less alcohol use one month later, a trend not accounted for by baseline levels of drinking or general rule following, but mitigated somewhat by personal reasons for drinking. Marginal effects of gender (with men drinking more) were also seen.

Author's Name: Ashley E. Acken, Maura L. Pantone, and Dr. Sheila Brownlow
Research Advisor: Dr. Sheila Brownlow
Title: Does ego depletion increase implicit egotism?

ABSTRACT: We examined how ego depletion via cognitive load led to indirect indices of self-enhancing behavior reflecting implicit egotism. Participants were either ego-depleted or not through a cognitive task, and then provided information about their names, and their favorite items. They also wrote about their lives in the future. Depleted persons showed some evidence of implicit egotism by liking their first names more, but they did not name-letter match more. They also employed more evidence of achievement focus in their writing. The results were not a function of self-reported baseline depletion levels.

Theater Arts

Author's Name: Brooke Beall
Research Advisor: David Pulliam
Title: References to Salvador Dali Make Me Hot
ABSTRACT: This presentation will be able the set design of References, a Blue Masque production. I will have a poster with my process of design and the elements I used in my design. I will have images from my portfolio with process pictures included.

Author's Name: Jodye Carroll
Research Advisor: Dr. Kurt Corriher/Missy Barnes
Title: The Relationship Between Dance and Spirituality
ABSTRACT: My thesis for Theatre Arts Capstone was as follows:
By centering dance on a higher being, dancers can lose themselves in the movement, leading to a purer, more captivating form. The relationship between dance and worship is a symbiotic one--it is mutually beneficial to both parties. Since writing my thesis, I have applied that thinking and research to the production I just directed and choreographed, *Once on this Island*. Set in Haiti, I was able to explore the religiously-centered dances and movements of the peasant class while also applying the tribal nature of their movements. In addition to the folktale being told, a story came to life about the dance itself and its meaning in the eyes of the gods, who were characters directly influencing the outcome of the play. I would like to include my research from my thesis, from my show, and some production photos that exemplify how we put this research into action for others to see.