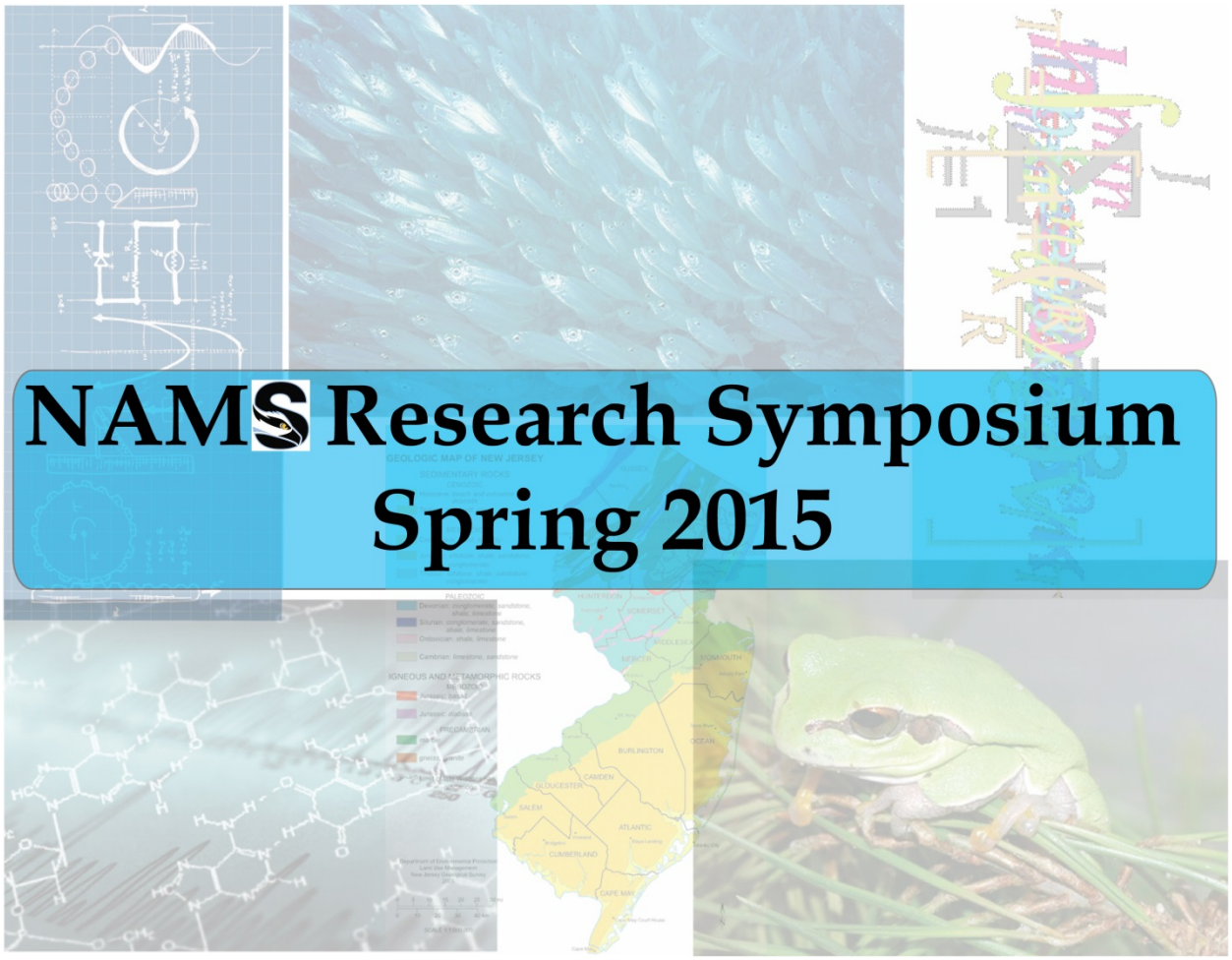

NAMS Research Symposium
Spring 2015

Friday, April 17, 2015

C/D Atrium Main Campus

Stockton University

Organizers: Dr. Matthew F. Bonnan and Dr. Tara Harmer Luke, Biology

NAMS Dean: Dr. Dennis Weiss

Posters by Number (#) – *the number corresponds to where the poster will be displayed in C/D Atrium*

Faculty sponsors are indicated in bold.

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2	Barnes, Corey, Caleb Bayewu, Alex Hilbman, Kayla Hope, Alex Lauffer, Shawn Oates, Sean Tonnesen, **Jason Shulman, Matthew F. Bonnan**	Biology, Physics	Forelimb kinematics in the Bearded Dragon, *Pogona vitticeps*
3	Bennett, David, **Elizabeth Pollock**	Chemistry	NMR Metabolic Profiling of Beer
4	Bland, Jared, **Brandy Rapatski**	Physics	Incorporating Exposure Periods, Hospitalization, and Mosquito Control into Dengue Fever Models
5	Bortnik, Volha, Kyle J. Knowles, **Melissa Zwick**	Biology	Impact of an inquiry-based approach in an undergraduate physiology lab on science process skills
6	Cabral, Troy, John O'Hara, **Brian Rogerson**	Biochemistry and Molecular Biology	Activation-Induced Cytidine Deaminase Gene Expression Levels in Aging Zebrafish
7	Calik, Nikola, Tiffany DellaValle, Kelsey Gamble, Cedric Howard, Bridget Kuhlman, Alyssa Rutherford, Kieran Tracey, **Jason Shulman, Matthew F. Bonnan**	Biology, Physics	Ferret Locomotion: An Unexpected Walk
8	Caruso, Jennifer, Matt Allen, Sean Deline, Tyler Mathis, Rae'Jean Boyd, **Ellis Benjamin**, and **Earl Benjamin III**	Chemistry	Investigation of Pig's Feet Decomposition in Salt Water Brine
9	Cilento, Maria, Jeffrey Mercurio, Thomas Powers, Andrew Lippman, Lisa Martinelli, **Manuela Tripepi**	Biology	Drug Resistance in Bacteria: Assessing a Local Enemy
10	Cohalan, Megan, Matthew Purcell, **Tara Harmer Luke**	Marine Science, Biology	Comparison of the DNA sequence of 18s ribosomal RNA of North Star Coral (*Astrangia poculata*) from the shipwreck Almirante to surrounding New Jersey artificial reefs
11	Coke, Lamarque, Hamad Hasan, Joulian Wilmer, Marina Barsoum, **Ellis Benjamin**, **Earl Benjamin III**	Chemistry	Computational Analysis of Antibiotic Mechanisms on *B. subtilis* and *E. coli*
12	Cornelius, Melissa, Tori Balnis, **Guy Barbato**	Biology	Embryonic growth of White Pekin ducks from lines selected for post-natal growth
13	Cubuk, Jasmine, Mihir Jani, Dhvani Shah, **Pamela Cohn, Shanthi Rajaraman**	Chemistry	Tough, Stimuli Responsive Hydrogels

14	DeCicco, Nicholas, **Joseph Trout, J. Russell Manson**, Manny Rios (Federal Aviation Administration (FAA)), David King	Physics	Investigating Anomalies in the Output Generated by the Weather Research and Forecasting (WRF) Model
15	Farrell, Douglas, Timothy Licknack, **Guy Barbato**	Biology	Genetic analysis of prenatal skeletal development of Japanese quail divergently selected for stress responsiveness
16	Finger, Michael, Jeffrey Mercurio, Gianna Pezzano, **Nathaniel Hartman**	Biology, Biochemistry and Molecular Biology	The Akt-mTOR Pathway is a Key Regulator of Neurogenesis in the Subventricular Zone
17	Flipping-Burroughs, Robyn, Mathew Zivi, Joe Worthington, **Marc Richard**	Chemistry	Quantifying TNT and PETN recovery from liquid-liquid extractions using gas chromatography
18	Florre, Rebecca, Ryan Heckler, **Pamela Cohn, Shanthi Rajaraman**	Chemistry	An expeditious, radical pathway for sonication assisted Mitsunobu reaction of hindered secondary alcohols
19	Garofalo, Salvatore, **Emma Witt**	Environmental Sciences	Quantifying Sediment and Hydrologic Response of Cedick Run to Precipitation
20	Golato, Tyler, **Ron Hutchison, Daniel Hernandez**	Biology, Biochemistry and Molecular Biology	Bacterial community profiles of infected and uninfected eggs of Horseshoe crabs from the Delaware Bay
21	Grabias, Klaudia, Liane Lam, **Pamela Cohn**	Chemistry	Anion-Responsive Liquid Crystals
22	Greene, James T., Morgan Lee, Timothy McLure, **Matthew J. Severs**	Geology	The Geochemistry of Gadolinite-Bearing Pegmatites in the South Platte District
23	Gubista, Ashley, Andrea DeCarlo, Danielle Hellthaler, **Nathaniel Hartman**	Biology	mTOR Activation in the Subventricular Zone Drives Neurogenesis and Alters Neuronal Fate in the Olfactory Bulb
24	Haugh, John, **Emma Witt**	Environmental Sciences	Morphological Assessment of Ditch on Vera King Drive
25	Hodges, Sarah, **David W. Burleigh**	Biology	Survey of Growth Differentiation factor - 15 (GDF-15) Localization in Rat Tissues by Immunohistochemistry
26	Honick, Brian, **Marc Richard**	Chemistry	Synthesis and Analysis of Copper-Nickel Films Deposited on Indium Tin Oxide (ITO) Coated Substrates
27	Isak, Abraham, Keval Patel, Karan Arora, **Earl Benjamin III, Ellis Benjamin**	Chemistry	Engineering Improved GluR2 Antagonist to inhibit the effects of Traumatic Brain Injury
28	Jensen, John, **Boris Averkiev**	Chemistry	Structural Changes in the Series of Sulfur-Phosphorus Mixed Molecules
29	Johnson, Thomas, Alex Melchiore, **William J. Cromartie**	Environmental Sciences	Two-year Emergence Patterns and Distribution of Overwintering Wood Frogs (*Lithobates (Rana) sylvatica*)

30	Kheirkhah, Rahil, **Tara Harmer Luke**	Biochemistry and Molecular Biology	Metagenomic Analysis of Marine Sediment from a New Jersey Shipwreck
31	King Jr., David E., **J. Russell Manson, Joseph J Trout**, Nicholas DeCicco, Manny Rios (Federal Aviation Administration (FAA))	MSCP	A Study into the Impact of Physical Structures on the Runway Velocity Field at the Atlantic City International Airport
32	King Jr., David E., **J. Russell Manson**	MSCP	LES Simulation Around Aircraft
33	Landicini, Zachary, **Elizabeth Pollock**	Chemistry	Metabolis Response of *Chlamydomonas reinhardtii* to Temperature Shock
34	Le, Phuong, Karem Cristobal, Sehar Saleem, Favad Akhtar, Rahatul Ain, **Ellis Benjamin**, and **Earl Benjamin III**	Chemistry	In-vitro Examination of Bactericidal and Bacteriostatic Agents on *B. subtilis* and *E. coli*
35	Lippman, Andrew, Yesenia Feliciano, Marley Crowley, Xavier Graham, Jeanette Wittmer, **Ellis Benjamin**, **Earl Benjamin III**	Chemistry	Exploration of Pig's Feet Putrefaction Using Various Soil Conditions
36	Lyman, Audrey, **Ron Hutchison**	Biology	Studying biological diversity in composting systems using a metagenomic approach
37	Mahoney, Colleen, **Nathaniel Hartman**	Biology	TSC1 knockout drives NSCs activation
38	Malatino, Frank, **Jason Shulman**, Alexander Mo, Killian Ryan, Gemunu H. Gunaratne	Physics	Controlling Networks of Nonlinearly-Coupled Nodes using Response Surfaces
39	Mitchell, Sage, **Tara Harmer Luke**	Marine Science, Biology	Examining the Transcriptome of *Astrangia poculata* and the Effects of External Electrochemical Charge
40	Nardoza, Alex, **Emma Witt**	Environmental Sciences	Hydrology and Water Budget for a New Jersey Coastal Plain Lake
41	Palumbo, Emily, **Daniel Moscovici**	Environmental Sciences	Wildlife Habitat Management
42	Panyi, Apryle, **Elizabeth Lacey**	Marine Science	Population demographics and tube repair rates of the magnificent feather duster worm, *Sabellastarte magnifica*, on two coral reefs in Bocas del Toro, Panama
43	Panyi, Apryle, **Jacalyn Toth**	Marine Science	*Xenobalanus globicitpitis:* Occurrence patterns and use for stock identification in New Jersey bottlenose dolphins (*Tursiops truncatus*)
44	Popowitz, Adam, **Margaret Lewis**	Biology	Identification of Sex, Ancestry, and Age of Cranial Remains
45	Potts, Jessica, Katie Malikowski, **Earl Benjamin III, Ellis Benjamin**	Biology, Chemistry	Depth Studies of Emitted Gases of Decaying Pigs' Feet in Sand and Soil using Chemical Sensor Detection

46	Revay, Rebecca, **Ron Hutchison**	Biology	Raccoon (*Procyon lotor*) Disease Control Through Vaccination Systems in Wildlife Rehabilitation Centers
47	Ruiz, Ryan, **Earl Benjamin III, Ellis Benjamin**	Chemistry	Determination of Zinc Chelation Bonding Energies of Hydroxamic Acid
48	Rundgren, Evan, **Joseph Trout, Jason Shulman**	Physics	Evaluating On-Line Books for Use in Undergraduate Physics Classes
49	Schkeeper, Caroline, **Mark Sullivan, Matthew Landau, Steve Evert**	Marine Science	Finfish community composition at Graveling Point (Mullica River-Great Bay Estuary, NJ) with progress towards synthesizing a long-term seining database
50	Shields, C.A., **Peter Straub, Steven Evert**	Marine Science	Oyster Reef Site Selection through Seabed Classification in the Mullica River
51	Starner, Victoria, **Kelly Keenan**	Biochemistry	Measurement of proteins and branched chain amino acids (BCAA) in milks and protein supplements
52	Torres, Alex, Rishi Patel, Melissa Cornelius, **Guy Barbato**	Biology	Analysis of prenatal development of quail's length, femur, humerus, and beak in respect to different corticosterone crosses
53	Zimmermann, Aaron, **Mark Sullivan, Steven Evert, Elizabeth Zimmermann**	Marine Science	Water quality monitoring on the Fitney Bit Oyster Reef, Great Bay, NJ

Abstracts

- Faculty sponsors of the research are indicated in **bold**.
- Authors from non-Stockton affiliations are indicated in parentheses.

1. Identification and Characterization of Aquifer Bactera

Anderson, Cooper, Mohammed Reza, Louay Zumot, Thai Tran, **Karen York**

Biology

In 1994, Richard Stockton College of New Jersey installed a large geothermal heat exchange system to heat and cool the main academic buildings. Thermal energy is exchanged underground in a four acre well field located under a parking lot. During the first ten years of operation, more thermal energy was deposited underground than was extracted, which resulted in an increased temperature from 14 ^{o}C to 24 ^{o}C in the Upper Cohansey aquifer that traverses the well field. Six bacterial isolates (CU 2, 7, 8, 10, 18, 24) were collected from the Upper Cohansey aquifer in 1997 when the temperature of the aquifer was 14°C. One isolate (73) was collected in 2005 when the Upper Cohansey aquifer temperature was 24°C. All seven isolates of aquifer bacteria were initially identified in previous work as being related to the genus "*Acidovorax*" by cloning and DNA sequencing of the 16S ribosomal RNA gene. The purpose of this project was to further characterize these seven bacteria isolates. The approach has been to amplify the *lepA* gene by polymerase chain reaction. *LepA* also known as translation elongation factor Tu (EF-Tu), is a highly conserved single copy protein encoding gene in bacteria. DNA sequences for *lepA* from the aquifer bacteria were compared to entries in the NCBI database and a phylogenetic analysis was performed. The bacteria were also characterized by their nutritional requirements on BiOLOG plates. Based on phylogenetic analysis of *lepA* DNA sequences and nutritional data each of the isolates are distinct from each other and not identical to any other known bacteria.

2. Forelimb kinematics in the Bearded Dragon, *Pogona vitticeps*

Barnes, Corey, Caleb Bayewu, Alex Hilbman, Kayla Hope, Alex Lauffer, Shawn Oates, Sean Tonnesen, **Jason Shulman, Matthew F. Bonnan**

Biology, Physics

Lizard locomotion is well-studied. However, although the kinematics of hindlimb movements in a variety of lizard species is well-documented, far fewer studies of forelimb kinematics have been conducted. Given that the sprawled forelimb posture of lizards is a both a model for tetrapods generally and for the early ancestors of mammals and dinosaurs in particular, studies quantifying the role the forelimb plays in locomotion should be fruitful. *Pogona vitticeps* , commonly referred to as the Bearded Dragon, is a desert dwelling member of the agamidae family of lizards. In this study, we examined the forelimb kinematics of *P. vitticeps* while running on a treadmill. Reflective beads attached to the skin allowed us to record three-dimensional data on four anatomical localities: left lateral wrist, left lateral elbow, mid-shoulder, and hips. Coordinates were captured using infrared cameras while the lizards moved on the treadmill. Our data shows that lateral movement varies upon body region, with the wrist undergoing the highest degree of movement upon the initiation of the swing phase than any other data point. Contrary

to what we expected, the elbow experienced significantly less lateral movement when compared to the wrist. Given the sprawling posture of *P. vitticeps* forelimbs, the horizontally-oriented humerus is acting like a spoke, which would limit the amount of ab/aduction the elbow could achieve. Given their sprawling forelimb posture, elbow and wrist abduction reached a maximum of over 100% of trunk length during some observed steps. Additionally, qualitative assessment of our motion capture movies suggest that when velocity increases, the forelimb *P. vitticeps* achieves a more erect posture, supporting previous work. Future research will be needed to determine if these trends also exist in other limbed squamates.

3. NMR Metabolic Profiling of Beer

Bennett, David, **Elizabeth Pollock**

Chemistry

Understanding the complex molecular make up of beer, both in terms of changes that are occurring during the brewing process and between different brands and types of beer, is helpful in achieving a better quality product and consumer experience. Profiling of beer samples using NMR spectroscopy has been shown to be an effective way to understand some of these differences. A variety of different types of beer were analyzed, from lagers to porters, home-brew, microbrewery and macrobrewery products. PCA analysis of the NMR spectra showed that lagers were clearly distinguishable based on type of grain used in the fermentation process due to differences in the aromatic region. Changes occurring during the fermentation process, using samples from a local microbrewery could be monitored using chemical shifts in the sugar, malt and ethanol regions. Succinic, acetic and lactic acid was formed after the fermentation process. These results suggest that a fast, simple characterization of beer using NMR spectroscopy could be used to help people try new exotic beers and potentially help smaller craft brewers increase sales.

4. Incorporating Exposure Periods, Hospitalization, and Mosquito Control into Dengue Fever Models

Bland, Jared, **Brandy Rapatski**

Physics

Dengue Fever is an epidemic in many third world nations and warrants the attention of mathematical modeling to understand its dynamics and propose solutions to combat the deadly disease. Our model incorporates hospitalization effects, which greatly reduce the deadliness of the disease, exposure periods, which more realistically model the phenomenon, and active participation by the community to reduce the ability for mosquitoes to breed. Here, I present the results of a system incorporating these effects. The exposure period and hospitalization result in a longer lasting epidemic, but with a less pronounced peak. Our model also aimed to confirm a study from Sri Lanka, which used community involvement to reduce the mosquito breeding grounds, thereby reducing the number of Dengue cases. Our model compared different results corresponding to the timing of community involvement, and, as expected, the sooner the community is involved, the less Dengue cases; this confirms the intuition that year-round maintenance is required to help prevent epidemics.

5. **Impact of an inquiry-based approach in an undergraduate physiology lab on science process skills**

Bortnik, Volha, Kyle J. Knowles, **Melissa Zwick**

Biology

Recent research has demonstrated that inquiry-based labs are more effective in developing scientific competencies in students and increase their interest in scientific research. This study examined the effectiveness of an inquiry-based undergraduate physiology lab course to increase core STEM competencies and self-efficacy towards science process skills. BIOPAC hardware and software allow students to record real-time physiological data from themselves and their peers. These labs often follow a simple set of instructions with little to no inquiry. We hypothesized that an inquiry-based, student-directed lab utilizing BIOPAC would be more efficient in increasing students' scientific knowledge and confidence. Students enrolled in a physiology lab course during the fall 2014 semester used the ECG component of BIOPAC to design and carry out an experiment over five weeks. Students ($n = 31$) were administered pre and post surveys measuring core STEM competencies and self-efficacy toward scientific process skills. As a result of the inquiry-based BIOPAC experiment, students answered more questions correctly on the science process skills posttest than the pretest ($p = 0.001$, Wilcoxon signed rank test). Students also demonstrated increased confidence toward conducting experiments, reading and interpreting graphs and working with statistics (all $p < 0.05$, Wilcoxon signed rank test). However there was no change in confidence in scientific writing and designing graphs (both $p > 0.05$, Wilcoxon signed rank test). Inquiry-based, student-directed BIOPAC labs provide an opportunity for students to develop core competencies as well as their confidence in aspects of conducting scientific research.

6. **Activation-Induced Cytidine Deaminase Gene Expression Levels in Aging Zebrafish**

Cabral, Troy, John O'Hara, **Brian Rogerson**

Biochemistry and Molecular Biology

B-cells are able to sustain long-term adaptive immunity due to their ability to improve antibody effectiveness by redesigning antigen binding sites during immune responses. The underlying mechanism involves activation-induced cytidine deaminase (AID), an enzyme that deaminates cytosine in regions within target immunoglobulin DNA, which thereby causes mutations that result in antibody diversification. By studying the levels of AID mRNA within zebrafish (*Danio rerio),* a model organism for studying the immune system, it is possible to determine whether the observed decline in the quality of the antibody response associated with aging, is the result of a decline in the amount of AID mRNA produced. Previous work was conducted with five- and thirteen-month old zebrafish supplied by the Zebrafish International Resource Center (ZIRC). Since extended housing was not available at ZIRC, it became necessary to age zebrafish on site. The main goal of this project was to assess any impact on gene expression due to differences in housing conditions at Stockton. We evaluated the AID gene expression levels of 11-month old zebrafish housed at Stockton for two months, and compared them to the levels observed in the five- and thirteen-month old zebrafish obtained from ZIRC. To isolate the AID mRNA from the zebrafish, gut tissue, which expresses the highest level of AID, was micro-homogenized in Trizol reagent, and the extracted RNA was treated with DNase I to remove traces of genomic DNA.

RNA samples were quantified through real-time qPCR. Preliminary results suggest that a change in housing conditions did not alter the AID gene expression profile. Future work will include the analysis of AID and E47 transcription factor, involved in AID gene expression, in 20 month-old zebrafish.

7. Ferret Locomotion: An Unexpected Walk

Calik, Nikola, Tiffany DellaValle, Kelsey Gamble, Cedric Howard, Bridget Kuhlman, Alyssa Rutherford, Kieran Tracey, **Jason Shulman, Matthew F. Bonnan**

Biology, Physics

Previous studies have defined mammalian forelimb kinematics as being "upright," with the majority of the movement occurring in the dorsoventral plane like an inverted pendulum. But does this simple model apply to small mammals? The ferret (*Mustela putorius furo*), is a burrowing predator found in North America and throughout Europe, often noted for its cylindrical body type. Our study was an exploration to see how the forelimb of this burrowing predator moves relative to the body during a complete step cycle. To study the step cycle of *M. p. furo*, two ferrets, a young female and older male of approximately similar size and mass, were trained to run on a treadmill. Optical markers on the wrist, elbow, and back were tracked in three-dimensional space using an OptiTrack V120 Trio motion capture camera. During a typical step cycle, it was found that the elbow and wrist generally traveled in the same vertical and dorsoventral patterns, with the wrist attaining larger maximum and minimum values during both stance and swing phase. Beginning with manus (hand) down in the stance phase, the wrist and elbow are in an adducted position. As the forelimb is retracted, continued adduction occurs. This is coincident with lateral movement of the anterior back to bring the center of mass over the wrist. The elbow and wrist are then maximally abducted as they begin the swing phase, which is when the elbow and wrist also reach their maximum heights. The results of this study support the classic findings of the "pendulum-like" movement of the mammalian step cycle. Whereas abduction occurs at the wrist and elbow, these movements account for approximately 50-150 mm of total movement. This translates to a maximum relative movement of 15-20% of trunk length during the swing phase. These results, while confirming the classic pendulum mechanics reported for therian mammals, were surprising given the burrowing habits of *M. p. furo*. Our data suggest that whereas ferrets have a derived morphology ideal for burrowing, their forelimb movements remain constrained by the evolutionary contingencies of therian forelimb functional morphology.

8. Investigation of Pig's Feet Decomposition in Salt Water Brine

Caruso, Jennifer, Matt Allen, Sean Deline, Tyler Mathis, Rae'Jean Boyd, **Ellis Benjamin**, and **Earl Benjamin III**

Chemistry

Previous studies in our laboratory have established that water plays an essential role in the decay of pig's feet in various environmental conditions. These studies show that under arid conditions the decomposition process is either significantly delayed or halted. The goal of this study was to identify the effect of brine on the decomposition of pig's feet as a model for cadaver decomposition in marine

environments. Our research used a series of samples to determine pig's feet breakdown. The samples were [1: control] pig's feet in air, [2: water control] pig's feet in distilled/deionized water, [3: low salt water] pig's feet in 0.5 ppm salt water, [4: high salt water] pig's feet in 37 ppm water. Our results show that the [2: water control] sample had the greatest decomposition of all samples.

9. Drug Resistance in Bacteria: Assessing a Local Enemy

Cilento, Maria, Jeffrey Mercurio, Thomas Powers, Andrew Lippman, Lisa Martinelli, **Manuela Tripepi**

Biology

The ability of bacteria to become antibiotic-resistant is a concern, not only to the Center for Disease Control (CDC), but also to those who simply consume prescribed antibiotic medication. Infections that are resistant to treatment with standard antibiotics are responsible for at least 23,000 U.S. deaths per year. Antibiotics are used in humans and animals in order to rid the body of harmful bacteria. Antibiotics that are ingested by patients destroy a targeted bacterium, and then proceed to be flushed out of the digestive system in the form of waste, being released into the environment. These antibiotic pollutants can then select for growth of resistant microbes in the affected area. Individuals generally do not become infected through handling of soil, but the prevalence of resistant microbes in soil can be an indicator of environmental "hot spots" where increased levels of antibiotic-resistant microbes have spawned due to the presence of commercial antibiotics in the soils and waterways. This poster shows the implementation of the PARE (Prevalence of Antibiotic-Resistance in the Environment) program. This program, developed at Yale University, aims to assess the prevalence of antibiotic resistance in the environment. To develop a comprehensive understanding of the prevalence of antibiotic-resistant microbes across a large geographic range requires reporting at many different sites where all values are determined using uniform methodology. Our group was selected to be one of the 10 institutions part of the 2015 pilot PARE (Prevalence of Antibiotic Resistance in the Environment) program. We worked together with students at the Cedar Creek High school and also analyzed soil samples from the Stockton campus. PARE provides an opportunity for undergraduate laboratory instructors to engage their students in an authentic research experience with the aim of assessing the prevalence of antibiotic resistance in the environment while also allowing students in high school to take part in genuine data collection.

10. Comparison of the DNA sequence of 18s ribosomal RNA of North Star Coral (*Astrangia poculata*) from the shipwreck Almirante to surrounding New Jersey artificial reefs

Cohalan, Megan, Matthew Purcell, **Tara Harmer Luke**

Marine Science, Biology

The goal of this experiment was to analyze genetic variation of different populations of North Star corals (*Astrangia poculata*) in artificial reefs off the coast of Southern New Jersey. North Star coral is an important species to study, as it is one of the only corals to live in the temperate zone. However, due to New Jersey's sandy continental plains, its growth is limited to the hard surfaces of artificial reefs. In this experiment, North Star coral colonies were collected of the coast of Atlantic City, New Jersey, from the shipwreck Almirante in September of 2014. Genomic DNA was extracted from coral polyps, amplified

using PCR, cloned, and sequenced using the Applied Biosystems Genetic Analyzer (Applied Biosystems). These sequences were then analyzed and compared to a reference sequence of *A. poculata* from GenBank as well as sequences of *A. poculata* found from the artificial reefs Glory, John Marvin, Sea Girt, Lemuel Burrows, Jet Trader, and Car Float.

11. Computational Analysis of Antibiotic Mechanisms on *B. subtilis* and *E. coli*

Coke, Lamarque, Hamad Hasan, Joulian Wilmer, Marina Barsoum, **Ellis Benjamin**, **Earl Benjamin III**

Chemistry

Antibiotic resistance is starting to become a pressing issue in the medical world, one that seems like it will be around for a long time. Bacteria will continue to develop resistances to the drugs that are used to treat them. But is it possible to bypass the ability of bacteria to develop these resistances? This experiment set out to answer that question by creating several combinations of antibiotics and testing them on gram negative and gram positive bacteria. Through several programs, it was possible to see in theory how effective these drugs would be together. By using IGEMDOCK, the binding activity for these drugs were tested and analyzed in order to simulate which would seemingly be the best combinations against bacteria.

12. Embryonic growth of White Pekin ducks from lines selected for post-natal growth

Cornelius, Melissa, Tori Balnis, **Guy Barbato**

Biology

We obtained eggs from the 13th generation of selection of two unique lines of White Pekin ducks from the Joe Jurgielewicz & Son, Ltd. duck company (Shartlesville, PA). These lines, J and S were developed from the same founder stock to exhibit different post-natal growth curves. The S-line was selected to have maximum body weight at the standard processing time for ducks (35 days of age). The J-line was selected for maximum growth rate to 14 days of age. The differences in age of selection correspond to the inflection point of the growth curve (S-line) and the early instantaneous growth acceleration (J-line). Eggs were incubated at 95F at 54% relative humidity and removed and dissected during the incubation period. The embryos were weighed and photographed using a dissection microscope. Representative photos of the different embryonic stages are presented. Statistical analysis of the resulting embryonic growth curves indicates large differences between the lines. The quadratic equation had the best fit of all growth models (R^2>0.93). The growth rate and acceleration of the J-line was significantly greater than that of the S-line. These data are consistent with previous research suggesting that selection for growth to the inflection point of the growth curve was associated with slow embryonic development.

13. Tough, Stimuli Responsive Hydrogels

Cubuk, Jasmine, Mihir Jani, Dhvani Shah, **Pamela Cohn, Shanthi Rajaraman**

Chemistry

Hydrogels are a promising technology in a variety of fields. In particular, their use in biomedical applications (e.g. tissue engineering) is an active area of research. A hydrogel is a polymer network that swells in water. A polymer is a substance that has a molecular structure consisting mainly or entirely of large numbers of similar units bonded together. Currently, the majority of hydrogels are not mechanically tough enough to be useful in a tissue engineering application, such as prosthetic or implant technologies. One consequence of toughness is that the material can withstand a high degree of wear and tear. While there are reports of tough hydrogels in the recent literature, there are extremely limited reports of tough hydrogels that respond to external stimuli for example, the ability of the prosthetic material to self-heal after a fracture. Our present research aims to use a combination of thiol-ene coupling chemistry to synthesize a copolymer of poly(N-isopropylacrylamide) (poly(NIPAM)) and a tetrathiol cross-linker. The cross-linker would allow for the generation of free thiol groups within the main chain of the copolymer, and allow for the formation of disulfide bonds, which have been used to allow a material to recover its mechanical properties upon a fracture (or to heal) in response to heat or light. In order to demonstrate feasibility of this chemistry, a model thiol-ene reaction of a copolymer N,N-methylenebis(acrylamide) and the tetrathiol crosslinker (Pentaerythritol tetrakis(3-mercaptopropionate)) was achieved. Inter-chain crosslinking of the copolymers was achieved through oxidation of the free thiols to disulfide bonds. Future work aims to apply this synthetic strategy to poly(NIPAM) copolymers to establish structure-mechanical property relationships with the type of cross-linker used and the cross-link density.

14. Investigating Anomalies in the Output Generated by the Weather Research and Forecasting (WRF) Model

DeCicco, Nicholas, **Joseph Trout, J. Russell Manson**, Manny Rios (Federal Aviation Administration (FAA)), David King

Physics

The Weather Research and Forecasting (WRF) model is an advanced mesoscale numerical weather prediction (NWP) model comprised of two numerical cores, the Numerical Mesoscale Modeling (NMM) core, and the Advanced Research WRF (ARW) core. An investigation was done to determine the source of erroneous output generated by the NMM core. In particular were the appearance of zero values at regularly spaced grid cells in output fields and the NMM core's evident (mis)use of static geographic information at a resolution lower than the nesting level for which the core is performing computation. A brief discussion of the high-level modular architecture of the model is presented as well as methods utilized to identify the cause of these problems. Presented here are the initial results from a research grant, ``A Pilot Project to Investigate Wake Vortex Patterns and Weather Patterns at the Atlantic City Airport by the Richard Stockton College of NJ and the FAA''

15. Genetic analysis of prenatal skeletal development of Japanese quail divergently selected for stress responsiveness

Farrell, Douglas, Timothy Licknack, **Guy Barbato**

Biology

Embryonic development is a complex process of events controlled by many maternal and paternal factors. We sought to investigate the role of maternal corticosterone in embryonic development. We used the *Coturnix Japonica*, Japanese Quail, as it has long been used as a model organism in developmental biology, given the availability of genetically defined populations and short incubation period (18d). In this study, we utilized eggs from two lines of quail divergently selected for stress responsiveness, resulting in hens that had high or low levels of corticosterone in their blood and therefore in the eggs they laid. Prior work by us, suggested that higher levels of corticosterone in the egg yolk resulted in slower growth rates. However, we were unable to separate true maternal effects (i.e., corticosterone from the hen) from direct genetic effects (incurred during the creation of the original lines). This year, we obtained reciprocal crosses from the HH and LL purelines resulting in HL and LH hybrids. Eggs were incubated at 95F and 45% relative humidity and were periodically dissected and photographed. We plotted embryo mass/ egg mass as a product of time and fit a quadratic curve. Comparison of the quadratic parameters allowed us to quantify several important developmental factors. Most importantly, we found a significant maternal effect, as evident by a maternal ratio (HL-LH) of 277mg and genetic ratio (HH-LL) -82mg. This maternal ratio has a significantly larger acceleration than that of the genetic ratio. In addition, we found that there is dominance in the direction of the maternal parent. Together, these data suggest that high maternal corticosterone levels attenuate embryonic developmental.

16. **The Akt-mTOR Pathway is a Key Regulator of Neurogenesis in the Subventricular Zone**

Finger, Michael, Jeffrey Mercurio, Gianna Pezzano, **Nathaniel Hartman**

Biology, Biochemistry and Molecular Biology

The Akt-mTOR pathway is important for cellular growth, proliferation and differentiation. Dysregulation of this pathway in neural stem cells (NSCs) can lead to neurodevelopmental pathologies, such as Tuberous Sclerosis. It is unclear whether Akt and mTOR play roles independent of each other in NSC development. NSCs in the subventricular zone (SVZ) continually generate new daughter cells that migrate to the olfactory bulb (OB), differentiating into neurons. Here, we show that a constitutively active form of Akt resulted in a threefold increase in the number of newly born neurons in the OB. In contrast to driving mTOR alone, Akt activation did not result in any apparent aberrant migration in the SVZ or OB. Both Akt and mTOR activation resulted in increased dendrite length and complexity. We also observed that Akt induces proliferation of cells in the SVZ. These data suggest that Akt controls NSC differentiation via mTOR but may exert proliferative effects independently.

17. Quantifying TNT and PETN recovery from liquid-liquid extractions using gas chromatography

Flipping-Burroughs, Robyn, Mathew Zivi, Joe Worthington, **Marc Richard**

Chemistry

Due to the terrorist threats that plague many countries, the need for reliable identification and detection methods for trace amounts of explosives continues to grow. An area of major concern in the transportation sector involving the shipment of packages primarily consisting of cardboard products. Quantitative techniques are required to determine the collection of efficiency of trace explosive detection methods. The quantitative determination of the amount of trace explosives on cardboard surfaces is difficult due to the presence of adhesives and other substances that interfere with analysis. In order to develop a method for the extraction of trace explosives from cardboard surfaces, an optimal non-polar solvent must be chosen that minimizes the loss of analyte. The best solvent will remove the unwanted material while leaving the highest percentage of trace explosive in the polar solvent. A liquid-liquid extraction (LLE) technique was coupled with gas chromatography (GC) in order to quantify the amount of trinitrotoluene (TNT) and pentaerythritol tetranitrate (PETN) recovered from extractions using various non-polar solvents. The percent recovery of TNT from the non-polar solvents studies studied was inconsistent with cyclohexane exhibiting the best recovery. PETN recovery was greatest when hexane was used as the Hexane was non-polar solvent in the liquid-liquid extraction.

18. An expeditious, radical pathway for sonication assisted Mitsunobu reaction of hindered secondary alcohols

Florre, Rebecca, Ryan Heckler, **Pamela Cohn, Shanthi Rajaraman**

Chemistry

The Mitsunobu reaction is versatile and widely-used in organic synthesis for the protection of and inversion of enantiomerically-pure alcohol substrates. However, the reaction rate dramatically decreases with secondary alcohols. It has been previously reported that the use of sonication dramatically accelerates the rate of the Mitsunobu reaction of hindered substrates. Our current work explores the reaction pathway to investigate if the rate enhancement is due to an alternate radical mechanism as opposed to the classically accepted ionic mechanism. Mitsunobu reactions of enantiomerically-pure secondary alcohols of (+) and (-) menthol were carried out under sonication conditions in tetrahydrofuran (THF). The product distribution from each reaction was studied with ^{1}H NMR spectroscopic techniques. In a classical Mitsunobu reaction, the enantiomerically-pure alcohol would cleanly invert its stereochemical configuration at the alpha -carbon and lead to one product. However, the NMR analysis showed an unequal mixture of diastereomers, which suggests tandem operation of an alternate or free-radical pathway along with an ionic pathway under sonication conditions. Efforts are underway to compare the product ratio with change in solvent, namely, inhibitor-free THF vs. THF with BHT inhibitor as solvents.

19. Quantifying Sediment and Hydrologic Response of Cedick Run to Precipitation

Garofalo, Salvatore, **Emma Witt**

Environmental Sciences

An important factor that can modify stream morphology and water quality is the supply of fine sediment to the watershed system. The quantity of sediment transported in a stream increases with the intensity of a storm due to the amount of runoff and the high energy associated with high flow events. The objective of this research was to determine the total suspended sediment transported into Lake Fred on a given storm. Additionally, the storm hydrologic response of Cedick Run and Morse's Mill streams were compared. For this research, we used an ISCO automated water sampler to samples for sediment analysis on a 30 minute interval following precipitation events. Samples were analyzed for total suspended solids concentration and compared to stream discharge to begin developing a regression relationships. Results indicate that sediment that is being transported through the stream of Cedick Run into Lake Fred during storm events. Further research will work to develop a sediment rating curve, which relates amount of precipitation with the amount of sediment.

20. Bacterial community profiles of infected and uninfected eggs of Horseshoe crabs from the Delaware Bay

Golato, Tyler, **Ron Hutchison, Daniel Hernandez**

Biology, Biochemistry and Molecular Biology

Limulus polyphemus, the Atlantic horseshoe crab, is a marine chelicerate arthropod that spawns in the Delaware Bay each Spring. Members of the genus Limulus appear in the fossil record during the late Ordovician period, approximately 450 mya. The blood of horseshoe crabs is a vital and commonplace tool for medical research. Limulus Amebocyte Lysate (LAL) is an extract from horseshoe crab blood that reacts with bacterial endotoxins and is used for the quantification and detection of endotoxins, serving as an important assay in pharmaceutical quality control. Additionally, horseshoe crab eggs serve as a key dietary resource for shorebirds during the final leg of their North-bound migration. The threatened red knot, *Calidriscanutus*, is particularly dependent on horseshoe crab eggs to reach critical departure weight. In the span of a few weeks, knots must consume enough eggs to nearly double their mass before departing. Recently, a phenomenon has been observed in which horseshoe crab eggs turn red, coinciding with arrested development of embryos. In order to identify the pathogen responsible for this phenomenon, conventional DNA sequencing and Next-Generation Sequencing (NextGen) technology was utilized to analyze microbial diversity in both healthy and afflicted horseshoe crab eggs. Ribosomal RNA sequences were used to identify organisms. Both 16S/18S universal primers that amplify ribosomal RNA allowed for the identification of prokaryotic and eukaryotic microbial communities within the egg. The sequences obtained from healthy and afflicted eggs were compared using QIIME (Quantitative Insights Into Microbial Ecology) and Galaxy. The microbial community within afflicted eggs was found to consist primarily of a betaproteobacteria. Healthy eggs did not contain these bacteria in significant numbers. A novel betaproteobacteria was isolated from afflicted eggs and a complete genome sequence of this organism is being determined and will be discussed further.

21. Anion-Responsive Liquid Crystals

Grabias, Klaudia, Liane Lam, **Pamela Cohn**

Chemistry

Previous efforts in the field of sensing have focused on developing materials that can respond to a stimulus (e.g. light or chemical) with a measurable output signal in the solid phase. The limited solubility of these materials in water is one of their biggest disadvantages, since water is the medium for most environmental-sensing applications. One approach to address this issue is to incorporate the small molecules into a larger assembly, which can respond to stimuli at the interface between water and a solid film. In order to employ this strategy, the present research focuses on studying the assembly of anion-responsive azo-benzenes in liquid crystalline (LC) phases. As a proof of the concept, a family of azo-benzenes with flanking ureas exhibiting a range of electronic properties was synthesized and characterized with thermal and spectroscopic analyses. Some of these compounds showed evidence of LC transitions in thermal analysis, as well as color changes upon exposure to aqueous halide salt solutions when the compounds were incorporated into thin films. Future efforts will focus on characterizing all of the compounds with polarized optical microscopy as part of a larger structure-property study of their assembly.

22. The Geochemistry of Gadolinite-Bearing Pegmatites in the South Platte District

Greene, James T., Morgan Lee, Timothy McLure, **Matthew J. Severs**

Geology

Pegmatites are intrusive igneous rocks that contain interlocking crystals that are two centimeters or larger that form in the final stages of solidification of a magma chamber. Pegmatites are important for their economic value as industrial and gem resources as well as for their rare earth elements. Therefore, the geochemistry of the minerals and fluid inclusions trapped in those minerals offer valuable data for understanding the formational conditions in which the pegmatite crystallized. There are two primary types of pegmatites that are categorized by their trace element composition. The first type of pegmatites is the Lithium-Cesium-Tantalum (LCT) type and the second type of pegmatites are niobium-yttrium-fluorine (NYF) type. This project aimed at investigating the geochemical nature of NYF-type pegmatites that are less commonly utilized for gem-minerals, but are potentially more economic for their Y-, Nb-, and heavy rare earth element (HREE)-minerals. The focus of this study is to investigate the petrogenesis and geochemistry of the White Cloud pegmatites located in Jefferson, C.O. During exploration, the major minerals found included quartz, perthitic microcline, plagioclase, and fluorite. In the Lesser White Cloud pegmatite the Y-Ce silicate mineral gadolinite was found in small amounts. The White Cloud pegmatite and Lesser White Cloud Pegmatite are both located in the South Platte Pegmatite District approximately 500 meters from one another. Fluid inclusions (FI) were examined to determine the history of crystallizing fluids as well as the mechanisms of formation. The focus of our research is to examine primary fluid inclusions in growth zone assemblages as they represent the fluid from which the minerals crystallized. Petrographic and microthermometric analyses were conducted to determine the geochemical signatures of these fluid inclusions.

23. mTOR Activation in the Subventricular Zone Drives Neurogenesis and Alters Neuronal Fate in the Olfactory Bulb

Gubista, Ashley, Andrea DeCarlo, Danielle Hellthaler, **Nathaniel Hartman**

Biology

Neural stem cells (NSCs) of the subventricular zone (SVZ) give rise to inhibitory interneurons in the olfactory bulb based on their location in the SVZ. Recent studies have shown that activation of the mammalian target of rapamycin (mTOR) pathway can drive NSCs to differentiate and alter dendritic morphology. Here, we transfected NSCs either in the dorsal or ventral SVZ. Stem cells in the dorsal SVZ were more likely to produce periglomerular neurons, whereas ventral SVZ cells primarily gave rise to granule cells. In addition, activation of mTOR resulted in increased dendritic complexity in both periglomerular cells. Interestingly, driving mTOR increased overall neurogenesis only in the dorsal SVZ. In contrast, increased mTOR activity bolstered the production of periglomerular cells from the ventral SVZ, but did not the dorsal SVZ. NSCs isolated in culture show increased mTOR pathway activity to their ventral counterparts. These results suggest that mTOR can affect regional identity of NSCs, either driving neurogenesis or altering the cell fate of progenitors. Currently, we are investigating transcriptome-wide differences between these two NSC populations to identify potential candidate genes affected by mTOR activity.

24. Morphological Assessment of Ditch on Vera King Drive

Haugh, John, **Emma Witt**

Environmental Sciences

Human constructed waterways (ditches) differ in many ways from natural streams, including in their morphology. The objective of this research is to assess the morphology of the drainage ditch and contributing tributaries located on East Vera King Drive which runs through the campus of Stockton University. The morphology of the ditch will be compared to Cedick Run, a less impacted stream located on campus. Common morphological components of the ditch and its tributaries were measured, including bankfull depth, bankfull width, width of the floodprone area, sinuosity, and slope, and were used to classify the type of ditch, using the Rosgen classification system. Additionally, the location of each culvert and where the resulting stream ended relative to the ditch were mapped using GPS. It appears these drainages areas have been moving deeper into the woods towards the location of our ditch, with the potential for greater hydrologic connectivity in the future. Through these observations we have come to understand that the drainage ditch is a small, low velocity, straight water body, influenced by rainwater run off of the surrounding parking lots and campus center. These areas result in ephemeral streams that may lead into the ditch, perhaps causing a change in ditch morphology in the future. Future analysis we can determine if the tributaries are finally meeting the stream and whether that has increased depth or morphology of the stream. We may also be able to identify water quality parameters where the ditch meets Moss Mill stream, another important stream running through Stockton University. As time progresses with additional testing, our study will become more conclusive.

25. Survey of Growth Differentiation factor -15 (GDF-15) Localization in Rat Tissues by Immunohistochemistry

Hodges, Sarah, **David W. Burleigh**

Biology

Growth differentiation factor-15 (GDF-15) and its human ortholog, macrophage inhibitory cytokine (MIC-1), are reported to have a variety of physiological functions depending on the tissue or cell. Discovery of the mRNA encoding for GDF-15 protein by multiple researchers during a relatively short span of time led to the protein being assigned a host of different names; including, placental bone morphogenetic protein, nonsteroidal anti-inflammatory drug (NSAID) activated gene-1 (NAG-1), prostate-derived factor (PDF), and placental transformation growth factor β (PTGF-β). GDF-15 is a member of the transforming growth factor family and shares homology with bone morphogenetic proteins. Elevated concentrations of GDF-15 in human blood is associated with chronic heart failure. GDF-15 has been proposed to have both tumor-promoting and anti-tumor activity, is being considered as a biomarker for type 2 diabetes, and may trigger an imbalance between bone-forming osteoblasts and bone-resorbing osteoclasts, thus affecting bone repair and osteoporosis. With such a myriad of possible physiological functions, a two-pronged approach that identifies tissues expressing GDF-15 protein and its receptor (presently unknown) will prove beneficial in elucidating receptor-mediated functions. This study partially completes the first part by localizing GDF-15 protein in rat tissues using the technique of immunohistochemistry. The collected tissue samples were exposed to GDF-15 primary antibody overnight; followed by exposure to the secondary biotinlated antibody, reaction with vector avidin/biotinylated enzyme complex (ABC) reagent, and they were developed with chromogen 3, 3' Diaminobenzidine (DAB) and nickel sulfate. Through microscopy, the tissues of the thyroid, skeletal muscle, cardiac muscle, submaxillary gland, segments of the kidney, and the islet of Langerhans in the pancreas were observed as negative for GDF-15; while the thymus, spleen, sublingual gland, segments of the kidney, exocrine acini of the pancreas, and the small intestine were found to be positive for GDF-15. Isolated macrophages were observed in the spleen and small intestine. The collecting duct, proximal tube, distal tube, and the loop of Henle of the kidney were negative; however, the tubules surrounding the arcuate vein, and the convoluted tubules in the cortex were positive.

26. Synthesis and Analysis of Copper-Nickel Films Deposited on Indium Tin Oxide (ITO) Coated Substrates

Honick, Brian, **Marc Richard**

Chemistry

Diamond impregnated tools are used in a variety of industrial cutting and machining applications. In order to understand the wear of diamond cutting tools, a theoretical model is being developed by Dr. Edward Paul, Emeritus Professor of Chemistry at Stockton. Along with Dr. Paul, Professor Chris Evans of University of North Carolina, Charlotte is developing methods to test the model. The goal of this project is to synthesize films of copper-nickel (Cu-Ni) alloys to test the proposed model at UNC Charlotte. Copper-nickel films of the desired compositions are not available commercially. Indium tin oxide (ITO) is a coating valued for its electrical conductivity and transparency. ITO coated surfaces can be used as electrodes for electrodeposition of metals. In this study, a zinc electrode (anode) and an ITO coated

surface (cathode) were connected to a power supply and immersed in a solution of Cu and Ni salts. The Cu-Ni films were produced by varying the concentration of the solution (5–30% Cu) and the resistivity of the ITO substrate (60–100?). Analysis of the films was performed using X-ray diffraction. Vegard's law was used to approximate the composition of the films. The deposited films were crystalline and Cu was found to plate preferentially. Plating solutions of 5% Cu produced films with approximately 20–30% Cu. Solutions of higher Cu content produced almost pure copper films. Further study is needed to determine the optimum plating conditions to obtain the desired Cu-Ni ratios. Future work will include production of films on fluorine-doped tin oxide (FTO) glass and optimization of deposition conditions.

27. Engineering Improved GluR2 Antagonist to inhibit the effects of Traumatic Brain Injury

Isak, Abraham, Keval Patel, Karan Arora, **Earl Benjamin III, Ellis Benjamin**

Chemistry

A major detrimental effect of traumatic brain injury has been found to arise from a dramatic increase in glutamate receptor (GluR2) production and a decrease in the inhibitory GABAergic proteins of excitatory interneurons. The overproduction of GluR2 increases the likelihood of uncontrolled interneuronal excitation resulting in a seizure. Inhibition of the GluR2 receptor could prove to be an effective treatment for the limitation or the elimination of seizure formation initiated by traumatic brain injury. This research sought to engineer improved GluR2 antagonist by gaining a better understanding of highly effective structural motifs and incorporating them using click chemistry. This project used a series of computational techniques to determine important structural motifs for their incorporation into improved GluR2 antagonist. A total of 1172 molecules separated into a series of 8 drug targeting groups that included alkaloids, imides, lactams, lactones, NSAIDS, sulfanilamide, flavonoids and FDA approved pharmaceuticals were selected and ran through series of computational docking programs including IGemDock and Pyrx - Autodock Vina to determine binding energies when compared to standard GluR2 pharmaceuticals. Highly effective motifs were incorporated via click chemistry into novel GluR2 antagonist for improved efficacy over currently used GluR2 pharmaceuticals. A series of highly effective motifs including several alkaloids were shown to have improved docking interaction over the standard GluR2 pharmaceuticals and were thereby included in novel antagonist. A series of structural motifs were tested to determine their binding efficacy towards GluR2 receptor. Highly efficient motifs, when compared to current GluR2 pharmaceuticals, were incorporated into novel antagonist using click chemistry. These novel antagonist are current being tested computationally for further analysis. If shown effective these molecules will be synthesized and biologically tested.

28. Structural Changes in the Series of Sulfur-Phosphorus Mixed Molecules

Jensen, John, **Boris Averkiev**

Chemistry

We report a theoretical investigation on the eight-atom sulfur-phosphorus mixed molecules $S_{8-x}P_x$ (x = 0–8). It is well known, that the structure of S_8 has a crown geometry, where each sulfur atom is connected to two neighboring sulfur atoms. The global minimum for group containing eight phosphorus

corresponds to two P_4 tetrahedral molecules; in said tetrahedra each phosphorus atom is connected to three neighboring phosphorus atoms. The purpose of our research was to follow the change in structures of sulfur-phosphorus molecules, when one gradually substitutes the sulfur by phosphorus atoms S_8 molecule. The unbiased searches for the global minimum structures of the clusters with x ranging from 0 to 8 were conducted using the Coalescence Kick program utilizing B3LYP/3-21G method. The obtained low-lying isomers were then reoptimized with a B3LYP/6-311G(2d) method. Henceforth, for each stoichiometry we calculated not only global minima structure, but also other possible isomers. The structure of one of the members of the series at x=4, P_4S_4, is already known experimentally, hence the reliability of the calculations can be estimated from the comparison of the calculated and experimental geometries of S_8, P_4S_4, and P_8 molecules. The obtained results let us observe and analyze the structural transition between chain molecules with sulfur atoms to molecules with phosphorus atoms, which can be described as cage structures.

29. Two-year Emergence Patterns and Distribution of Overwintering Wood Frogs (*Lithobates (Rana) sylvatica*)

Johnson, Thomas, Alex Melchiore, **William J. Cromartie**

Environmental Sciences

The wood frog (*Lithobates sylvatica*) utilizes wetland and upland forest habitats for portions of its lifecycle. Wetlands are protected from development by specific buffers, but upland forest is treated as inherently developable. This report covers the second year of a study to sample wood frogs moving towards a breeding pond at Richard Stockton College of New Jersey to determine whether a reduced 175 ft. or the standard 300 ft. wetland buffer zone protects the majority of the wood frogs' winter habitat. Three concentric rows of drift fence and pitfall traps were constructed February, 2014. The first row was near the edge of the breeding pond, the second row was 175 ft. away and the third row was 300 ft. away. In 2014, forty-four percent of total captures occurred at the outer two fences, showing that a significant portion of the population spent the winter farther than 175 ft. away from the breeding pond. In 2015, the first 4 males were captured March 9 and on March 10, 309 males and 55 females were recorded. The last male was caught March 26. Over the entire period of movement to the ponds the totals by fence were Inner 159 males, 35 females; Middle 161, 56; Outer 92, 23. Sixty-three percent were caught in the outer two fences. Thus, the findings of 2014 are repeated and strengthened.

30. Metagenomic Analysis of Marine Sediment from a New Jersey Shipwreck

Kheirkhah, Rahil, **Tara Harmer Luke**

Biochemistry and Molecular Biology

Sediment samples were collected from the site of the shipwreck *Almirante* off the coast of Atlantic City, NJ. The genomic DNA from these samples was then isolated and sequenced using the Ion Torrent Personal Genome Machine, a Next-Generation Sequencing platform that allows speedy and cost effective sequencing of very large amounts of genetic data. We sequenced rRNA genes from thousands of individual organisms in these samples. The goal of this project is to explore the microbial composition of sediment samples from off the coast of New Jersey, and characterize those communities. These

analyses could lead to the discovery of new species in such communities. With such a large amount of data, this project could take years to complete, but so far, we have identified some of the organisms that live in the environment, including Proteobacteria, Firmicutes, several species of Stramenopiles, Rhizaria, and Archaea, some of which have known sequences while others do not. Phylogenetic trees were constructed in order to understand how these organisms are related, and to help with the understanding of some of the unknown DNA sequences that were found.

31. A Study into the Impact of Physical Structures on the Runway Velocity Field at the Atlantic City International Airport

King Jr., David E., **J. Russell Manson, Joseph J Trout**, Nicholas DeCicco, Manny Rios (Federal Aviation Administration (FAA))

MSCP

Wake vortices are generated by airplanes in flight. These vortices decay slowly and may persist for several minutes after their creation. These vortices and associated smaller scale turbulent structures present a hazard to incoming flights. It is for this reason that incoming flights are timed to arrive after these vortices have dissipated. Local weather conditions, mainly prevailing winds, can affect the transport and evolution of these vortices; therefore, there is a need to fully understand localized wind patterns at the airport-sized mircoscale. Here we have undertaken a computational investigation into the impacts of localized wind flows and physical structures on the velocity field at a typical small airport: Atlantic City International Airport. The simulations are undertaken in OpenFOAM, an open source computational fluid dynamics software package, using an optimized geometric mesh of the airport. Initial conditions for the simulations are based on historical data with the option to run simulations based on projected weather conditions imported from the Weather Research & Forecasting (WRF) Model. Sub-grid scale turbulence is modeled using a Large Eddy Simulation (LES) approach. The initial results gathered from the WRF Model simulations and historical weather data analysis are presented elsewhere. Presented here are the initial results from part of a research grant, "A Pilot Project to Investigate Wake Vortex Patterns and Weather Patterns at the Atlantic City Airport by the Richard Stockton College of NJ and the FAA."

32. LES Simulation Around Aircraft

King Jr., David E., **J. Russell Manson**

MSCP

Turbulence is a transient phenomenon that exists on nearly all scales. Turbulence eddies poses a challenge when computationally modeling fluid/gas flows as it becomes difficult to compute the energy contributions of these eddies across all scales of the simulation. Energy is generally dissipated by transfer from the largest scales to the smallest scales. Large-Eddy Simulation (LES) modeling eliminates small-scale turbulence from the solution while continuing to model that turbulence on a subgrid-scale model while large-scale turbulence is retained for the solution and calculated by standard means. Thus, LES simulation effective acts as a low-pass filter for the solution. LES simulations are less computationally intensive than direct numerical simulation (DNS). This makes LES simulations a viable

choice for very complex geometries, very large models and turbulence injected models where we would expect to see high levels of eddy formation. These models, undertaken in DNS, would not be possible. Here we made use of LES simulation modeling jet and drone aircraft.

33. Metabolis Response of *Chlamydomonas reinhardtii* to Temperature Shock

Landicini, Zachary, **Elizabeth Pollock**

Chemistry

C. reinhardtii is a unicellular green algae. The entire genome has been sequenced and there is a vast collection of mutants available. *C. reinhardtii* has a simple life cycle and is easily grown and maintained. The algae's photosynthetic system is very similar to that of plants. In tandem these attributes makes *C. reinhardtii* a popular model organism. The goal of this study was to determine how temperature shock affected metabolite production in *C. reinhardtii*. Cells were grown in liquid culture at 20° C and brought down to 10° C. Samples were taken out of 10° C and prepared for extraction at specific time intervals. Quantitative data was produced in the form of NMR spectrum. This study consisted of two trials that varied in exposure times. Evaluation of data from the first trial suggested that a change in metabolite formation occurred between hours two and four of cold growth.

34. In-vitro Examination of Bactericidal and Bacteriostatic Agents on *B. subtilis* and *E. coli*

Le, Phuong, Karem Cristobal, Sehar Saleem, Favad Akhtar, Rahatul Ain, **Ellis Benjamin**, and **Earl Benjamin III**

Chemistry

Antibiotic resistance is a problem that has far reaching implications. The exponential growth of antibiotic resistance is emerging faster than new antibiotics can be discovered. Although there is ongoing research for new antibiotics, current treatments use high doses of last line antimicrobials for resistant infections. Ultimately, the target treatment should be achievement of a good clinical outcome with the least toxicity. It is generally believed that bactericidal and bacteriostatic drugs should not be combined in vivo. This study used disc diffusion assays with a series of well-established bactericidal and bacteriostatic broad spectrum antibiotics (Ampicillin, Chloramphenicol, Streptomycin, and Tetracycline) individually as well as in combination to develop models for antibiotic effectiveness on both gram positive (*B. subtilis*) and gram negative (*E. coli*) bacteria. Each effect was classified as either synergistic, additive, no effect, or antagonistic.

35. Exploration of Pig's Feet Putrefaction Using Various Soil Conditions

Lippman, Andrew, Yesenia Feliciano, Marley Crowley, Xavier Graham, Jeanette Wittmer, **Ellis Benjamin**, **Earl Benjamin III**

Chemistry

The ability to locate decaying bodies is a major problem in forensic science. Traditionally, this task is left to cadaver dogs with varying levels of success. The goal of this research is to examine the effect of environmental conditions has on the putrefaction of pig's feet as a model for cadavers. Our research used a series of soil samples to determine pig's feet breakdown. The samples were [1: control] pig's feet with no soil, [2: soil control] soil without pig's feet, [3: soil experimental] pig's feet in soil, [4: sand experimental 1] pig's feet in sand with no water, [5: sand experimental 2] pig's feet in sand with water. Results found that the pig's feet in sand with water [sand experimental 2] significantly decomposed relative to the pig's feet in sand with no water [sand experimental 1]. This result suggests that water plays a major role in the decomposition of cadavers.

36. Studying biological diversity in composting systems using a metagenomic approach

Lyman, Audrey, **Ron Hutchison**

Biology

Using currently available technology, it is possible for households to generate as much energy as they use in a year (net zero energy) and to utilize local water sources sustainably (net zero water). Sustainable use of nutrients remains problematic. Composting systems, however, can allow the return of nutrients to the terrestrial biological cycle. The organisms involved in the transformation of compost to soil have not been fully cataloged. The purpose of our study is to elucidate the genetic diversity in soil by identifying and comparing the inhabitants of compost, aged compost and soil. Our ultimate goal is to put together a sort of timeline of inhabitants during the compost's journey to becoming soil. Deoxyribonucleic acid (DNA) was isolated from separate soil, compost, and aged compost samples and amplified using PCR. It was then sequenced in a massively parallel sequencing instrument which will allow us to identify the organisms present. Once the sequences were obtained, they were searched in a DNA database using a basic local alignment search tool (BLAST). Using the information provided by the BLAST we can get a good idea of what may be living in our samples. This study will gather information that may prove useful in understanding the compost process, and hopefully begin to answer questions about compost, soil and the organisms that live in it over time.

37. TSC1 knockout drives NSCs activation

Mahoney, Colleen, **Nathaniel Hartman**

Biology

Studies have indicated that differentiation of neural stems cells (NSCs) found in the neonatal subventricular zone are activated by the mammalian target of rapamycin complex 1 (mTORC1); however, this does not indicate an increase in proliferation. Similar to the conditions seen in the neurological disorder tuberous sclerosis, the removal of TSC1, which suppresses mTORC1 activity, did not appear to have affected the proliferation of NSCs, but did induce differentiation. Conditional mTORC1 activation in NSCs of mice 3-4 weeks old resulted in the dilution of non-integrating plasmids and the production of daughter cells and neuroblasts at the expense of the NSC population. The results indicate that mTORC1 promotes the differentiation of NSCs, but not proliferation of the NSCs. Taken together these data suggest that hyperactivity of mTORC1 could lead to the progressive loss of NSCs during aging.

38. Controlling Networks of Nonlinearly-Coupled Nodes using Response Surfaces

Malatino, Frank, **Jason Shulman**, Alexander Mo, Killian Ryan, Gemunu H. Gunaratne

Physics

Control of complex processes is a major goal of network analyses. Most approaches to control nonlinearly coupled systems require the network topology and/or network dynamics. Unfortunately, neither the full set of participating nodes nor the network topology is known for many important systems. On the other hand, system responses to perturbations are often easily measured. We show how the collection of such responses –a response surface– can be used for network control. Analyses of model systems show that response surfaces are smooth and hence can be approximated using low order polynomials. Importantly, these approximations are largely insensitive to stochastic fluctuations in data or measurement errors. They can be used to compute how a small set of nodes need to be altered in order to direct the network close to a pre-specified target state. These ideas, illustrated on a nonlinear electrical circuit, can prove useful in many contexts including in reprogramming cellular states.

39. Examining the Transcriptome of *Astrangia poculata* and the Effects of External Electrochemical Charge

Mitchell, Sage, **Tara Harmer Luke**

Marine Science, Biology

This research examines the impact of induced electrochemical current on the growth rate of Northern Star Coral (*Astrangia poculata*) through expression of mRNA. The health of coral reefs is a notable

environmental indicator, as they represent an incredibly diverse ecosystem and support approximately one third of all marine fish species, clearly presenting as vital elements in the ecosystems around the globe. Despite this, global warming and climate change has destroyed or threatened nearly 70% of reefs around the world, and global ocean temperatures and acidity rise yearly. However, determining ideal conditions that would permit growth, or regrowth, of these corals would be extremely beneficial to many ecosystems, and could lead to global initiatives to restore coastal and deep-water reefs. Two separate groups of coral polyps were reared in an *in situ* control tank, and an experimental tank with a constant electrical current of 450mV. Two harvests were taken one month apart and samples were kept at -80°C. Total RNA was isolated from each sample, followed by an isolation of mRNA for final comparison of mRNA expression.

40. Hydrology and Water Budget for a New Jersey Coastal Plain Lake

Nardoza, Alex, **Emma Witt**

Environmental Sciences

Quantifying the relative contributions of groundwater and surface water to streams and lakes on the New Jersey coastal plain can be difficult. The objective of this research is to measure the surface water inputs and outputs from Lake Fred, an impounded lake in Atlantic County, New Jersey. Three dataloggers which measure water level on a fifteen minute interval were deployed in March of 2015. Dataloggers located in Cedick Run approximately 100 feet upstream from where it empties in Lower Lake and at Morses Mill where it crosses Pomona Road provide data on the water inputs to Lake Fred. An additional datalogger located downstream from the Lake Fred dam measures the outflow of water from Lake Fred. At each monitoring point the cross sectional area of the stream was measured and used to calculate discharge. Discharge from input streams was compared with discharge from the output streams as well as the volume of Lake Fred. Results will be used to estimate the groundwater contributions to Lake Fred.

41. Wildlife Habitat Management

Palumbo, Emily, **Daniel Moscovici**

Environmental Sciences

The aim of our research project was to attract local cavity nesting species, many of which are endangered due to habitat loss caused by human land use. We aimed to attract these species – such as the wood duck, flicker woodpecker, kestrel and others - through the use of man-made habitat boxes. Desired species were researched to determine their ideal environment and nesting requirements. Species were monitored at nesting sites using a retractable camera to evaluate nesting success. With the use of a Trimble handheld GPS and ArcGIS technology all sites were plotted and recorded on a map of Stockton University's campus. Long term goals of our project are to develop guidelines for future research and to foster continued nesting of critical species.

42. Population demographics and tube repair rates of the magnificent feather duster worm, *Sabellastarte magnifica*, on two coral reefs in Bocas del Toro, Panama

Panyi, Apryle, **Elizabeth Lacey**

Marine Science

Suspension feeding in coral reef environments removes particulates from the water, which maintains coral health and enables reefs to provide valuable ecosystem services to the community. In Bocas del Toro, Panama, a region with coral reefs heavily impacted by tourism, the magnificent feather duster worm, *Sabellastarte magnifica,* is an important suspension feeder. Despite the importance of this tube-building polychaete worm, there is a lack of information on differences in distributions, morphology, and tube repair rates. Tube repair rates are an important parameter to estimate filtering efficiency as access to particulates increases ability to repair tube damage and resume filtering capabilities. Pete's Reef and Punta Caracol, two sites of varied distance to mangrove particulates and human influence, were compared for differences in worm density, crown spread size, and tube repair rates. Results showed that density and tube repair rates were significantly higher at Pete's Reef, a site closer to mangroves; however, there was no significant difference in the crown spread size between the two sites. In all cases, a mucus plug was observed within twenty-four hours after simulated damage. This study is the first to report the presence of this mucus plug in the field and difference in repair rates, which may impact the filtering ability for this important coral reef organism.

43. *Xenobalanus globicitpitis:* Occurrence patterns and use for stock identification in New Jersey bottlenose dolphins (*Tursiops truncatus*)

Panyi, Apryle, **Jacalyn Toth**

Marine Science

Atlantic bottlenose dolphins, *Tursiops truncatus*, occur off the eastern coast of the United States from New Jersey to Florida. Management of *T. truncatus* is based on stock membership, often times determined through a combination of photo-identification surveys, satellite tagging efforts, and genetic studies. Currently, these studies define at least seven stocks on the US Atlantic coast which differ in spatial extent, behavioral patterns, and physical characteristics. In these studies, presence of the pseudo-stalked barnacle, *Xenobalanus globicipitis*, is a potentially useful feature to differentiate stocks. The purpose of this study was to collect baseline data on the relationship between *T. truncatus* and *X. globiciptis* in Cape May, NJ, and assess the efficacy of *X. globicipitis* occurrence in New Jersey bottlenose dolphin stock analysis. Boat-based surveys aboard the Cape May Whale Watcher were completed two times per week throughout the summer of 2014 (June-August). Data was collected on *T. truncatus* group sizes, location, and presence/abundance of *X. globicipitis* on dorsal fins. Photographs of individual dorsal fins were analyzed for *X. globicipitis* abundance (light 1-5, medium 6-10, or heavy >10), and location on individual dorsal fins (quadrat 1, 2, 3, or 4). Results showed that quadrat 3 had the highest abundance of *X. globicipitis* most often. Significantly heavier amounts of *X. globicipitis* were found on *T. truncatus* that were farther from shore (distance from shore >3.44 km, $p<0.05$, df=3) compared to dolphins closer to shore (distance from shore <0.966 km). It was also noted that *X.*

globicipitis was never found on juveniles or calves. These results suggest that distance from shoreline may be a consistent factor in *X. globiciptis* occurrence on *T. truncatus* within the study area, and thus may be indicative of a coastal bottlenose dolphin stock boundary. Genetic studies will confirm if *X. globiciptis* occurrence/abundance is a reliable estimate of stock membership in New Jersey; if these results concur, this could be a cost effective technique to help delineate (and manage) *T. truncatus* stocks off New Jersey's coast.

44. Identification of Sex, Ancestry, and Age of Cranial Remains

Popowitz, Adam, **Margaret Lewis**

Biology

The practice of forensic anthropology remains crucial to the process of characterizing and identifying individuals by inspection of their skeletal remains. Although some forensic specialists may rely on experience to ascertain characteristics upon observation, use of systemized analysis that employs measurements and non-metric characters provides for a more scientific methodology, yielding more precise results. This study sought to characterize sex, ancestry, and age of three unidentified skulls from the osteological collection at Stockton University. The skulls were hypothesized to have belonged to elderly, White females, due to the high likelihood that Stockton acquired these skulls via an anatomical supply company, and the indication by studies that the majority of individuals who have donated their bodies to medical science fall within this group. Metric and non-metric methods were utilized in combination with discriminant function analysis to assess the most likely sex, ancestry, and age of the specimens. Skull A was determined to be a White female of young adult age, Skull B was found to be either a male or female Native American of old age, and Skull C was determined to be either a Black female or Native American male of young adult age. As always, the field of forensic anthropology does not yield definite results, especially since race, as a representation of ancestry, is not a biological category. However, this study permits narrowing of the gap in knowledge regarding the composition of the cranial remains within the osteological collection at Stockton University. Future steps may include use of additional measurements, non-metric characters, and discriminant functions to increase the pool of data from which to form conclusions. The numerous pathologies present on the specimens also warrant further investigation.

45. Depth Studies of Emitted Gases of Decaying Pigs' Feet in Sand and Soil using Chemical Sensor Detection

Potts, Jessica, Katie Malikowski, **Earl Benjamin III, Ellis Benjamin**

Biology, Chemistry

The determination of decaying body location is often left to the heightened sense of a cadaver dog's nose. In times of emergencies and or dangerous situations the use of a dog may not be a viable option for the identification of a corpse. Our research used a series of chemical gas sensors to identify the

breakdown gases of decaying pigs' feet for emergency situations. Previous research found that the chemical sensor can detect gases which are emitted from decaying pigs' feet. The previous study was limited to gas sensor placed within 6 inches of the pigs' foot. The current research sought to determine gas production of six chemical sensors (CO_2, Ethanol, Thiol, Methane, Carbon Monoxide, and Smoke) at increased depth (18 inches) of sand and soil. The parameters demonstrated in this experiment were used to simulate outside environmental conditions. The data found that absorption of the gases in the increased soil and sand limits the sensors effectiveness except for CO_2 and Methane. Additional research found that the pigs' foot decay is relatively slow according to the gas sensors, while upon discovery the moisture in the soil and sand promoted rapid decay not detected by the sensors.

46. Raccoon (*Procyon lotor*) Disease Control Through Vaccination Systems in Wildlife Rehabilitation Centers

Revay, Rebecca, **Ron Hutchison**

Biology

Controlling disease in a wildlife rehabilitation facility is difficult because of the close quarters all the wildlife is kept in. Most workers in these types of facilities are one term summer interns and once weekly volunteers so training must be quick in order to get anything done. An organized system for raccoon vaccination that is easy to follow could help a wildlife rehabilitation center in keeping disease among raccoons in check while allowing almost anyone being able to follow it in a short amount of time. Here I created a system of keeping track of all the raccoons in a wildlife center and their vaccinations. Then I compared the release rates of raccoons of the years the system was in place to the years previous that had to system in place. The results showed that there was a higher release rate of raccoons in the years with the vaccination system in place.

47. Determination of Zinc Chelation Bonding Energies of Hydroxamic Acid

Ruiz, Ryan, **Earl Benjamin III, Ellis Benjamin**

Chemistry

Hydroxamic acid is an important functional group for chelation of Zinc ions to inhibit the enzymatic activity of important proteins such as Tumor Necrosis Factor a Converting Enzyme (TACE) or ADAM-17. The inhibition of TACE is able to block the release of the TNFa into the bloodstream thereby decreasing the inflammation response and disease progression. The understanding of energy differences in Zinc chelation is an important aspect of selectivity of zinc over other ions. This work sought to understand the energies ab-initio (DFT-B3LYP-631++G, and DFT-B3LYP-321-G) differences between apo and Zinc chelated modified benzenes. Differences between the apo and zinc chelated benzenes found energy differences of -1779.17 au for all molecules.

48. Evaluating On-Line Books for Use in Undergraduate Physics Classes

Rundgren, Evan, **Joseph Trout, Jason Shulman**

Physics

A free, on-line Physics book, published by the OpenStax project, was evaluated for use in undergraduate physics courses. The quality of the book was evaluated using online pre-quizzes, student reading assignments, and on-line post quizzes. The students also gave their opinion on the effectiveness of the book through surveys.

49. Finfish community composition at Graveling Point (Mullica River-Great Bay Estuary, NJ) with progress towards synthesizing a long-term seining database

Schkeeper, Caroline, **Mark Sullivan, Matthew Landau, Steve Evert**

Marine Science

The Mullica River-Great Bay estuary is home to a diverse array of finfish species, portions of which use the estuary as juvenile nursery habitat. Beginning in the fall of 2006, two Stockton University Marine Science courses (Introduction to Marine Biology and Ichthyology) began quantifying finfish data from 18m beach seine collections at various locations throughout this system. This project focuses on synthesizing data from one location, Graveling Point beach, in order to initially describe the data set and provide a baseline for future study. In total, 109 individual hauls spanning 19 field trips over 9 years were entered and quality controlled. 19,131 individuals from 46 different species were inventoried - ranging in size from 665 mm (*Anguilla rostrata*, American eel) to 6 mm (*Menidia menidia*, Atlantic silverside). *Menidia menidia* was the most abundant species collected (n = 12,007) – while other species, notably southern expatriates (*Chaetodon ocellatus*, spotfin butterflyfish n=1, *Lutjanus griseus*, gray snapper n = 5), were rare. Analysis of length frequency distributions revealed multiple species (typically found offshore as adults), using this site as possible juvenile nursery habitat - *Tautoga onitis* (Tautog) n = 205, average length 72 mm; *Centropristis striata* (Black sea bass) n = 44, average length 76 mm; *Menticirrhus saxatilis* (northern kingfish) n = 122, average length 127 mm). Of particular note was an exceptional recent recruitment event of *Pogonias cromis* (Black drum) n = 331, average length 155 mm (301 individuals were collected in 2014 alone). The synthesis of this long-term data set will allow for more formal hypothesis testing revolving around individual species and community-level change over time.

50. Oyster Reef Site Selection through Seabed Classification in the Mullica River

Shields, C.A., **Peter Straub, Steven Evert**

Marine Science

Oysters are a vital economic resource, hold a major role in many food chains, can help to create habitats for other species, and benefit water quality. A decline in the population of oysters in the Mullica River has caused the Department of Environmental Protection to plan to build an oyster reef in this area. Using bottom classification, research showed that sonar data and bottom classification can be used to determine an ideal location, within Mullica River, to build an oyster reef and help restore the oyster population. Various sediment compositions were identified using Sonar Wiz and after sample collection, their specific composition was determined using particle size analysis. The compositions were compared and parameters on which various sediment types are determined were identified. The program was able to identify three separate sediments. Two of these were similar in particle size composition, but one of them contained organic matter and the other did not. The third sediments was found to have a high composition of gravel when samples were collected. This shows that the program was able to identify the different sediment types within Mullica River, which could be used to identify an ideal location for an oyster reef.

51. Measurement of proteins and branched chain amino acids (BCAA) in milks and protein supplements

Starner, Victoria, **Kelly Keenan**

Biochemistry

Americans spend billions of nutritional supplements each year and one type are protein supplements which contain BCAA. Most protein supplements are made of whey protein which is made from milk. The goal of this project was to measure the level of protein and BCAA in various supplements as well as milks from different sources. In order to measure the BCAA, an enzyme assay method was employed and it required free amino acids; for this reason, proteins had to be hydrolyzed. Protein levels were measured on both the samples and the hydrolyzed samples using the Lowry assay. In addition, the types of proteins were characterized using sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS PAGE). The BCAA levels were measured using the leucine dehydrogenase enzyme assay. The results show that the protein values are similar to what the manufacturer's claim but the level of BCAAs are reduced.

52. **Analysis of prenatal development of quail's length, femur, humerus, and beak in respect to different corticosterone crosses**

Torres, Alex, Rishi Patel, Melissa Cornelius, **Guy Barbato**

Biology

Coturnix japonica, the Japanese quail, has been a model organism in several fields, including developmental biology and behavioral science. During the past few years, we have used quail as a model organism while investigating the effect of stress on prenatal development. Two lines of quail were obtained from Dr. N. Anthony (University of Arkansas) that had been divergently selected for high and low levels of plasma corticosterone. It was observed that the high strain (HS) eggs hatched earlier and developed at a faster rate, whereas the low strain (LS) hatched later and developed at a slower rate. In this study, we made reciprocal crosses between the two strains, in order to differentiate between direct genetic and maternal effects (in this case, corticosterone exposure) on embryonic development. We hypothesized that the maternal stress would greatly influence the rate at which quail embryos would develop. Forty-eight eggs in total were incubated at 77% humidity and the developing embryos were removed between 7-16 days after incubation during their 18-day development period. The total length of the embryo along with the femur, beak, and humerus lengths were measured at each age using ImageJ software. The high (HH) strain had a similar growth rate to the low-high (LH) cross, with logarithmic curves of $\log(y)=2.19\pm0.14x$ and $\log(y)=2.01\pm0.15x$ respectively. Further, the low (LL) strain was observed to have a similar growth rate to the high-low strain, with logarithmic curves of $\log(y)=2.55\pm0.11x$ and $\log(y)=2.43\pm0.11x$, respectively. In these results it was observed that rate of development corresponded with the maternal strain in both crosses. In addition, further analysis suggested that the percentage of growth of the humerus and the femur appeared to be consistent with the maternal lines. Both the HH strain and LH strain were similar, and the LL strain and HL strain were found similar as well. The data collected from this study supports that the embryo's development is largely influenced by the maternal effect and is not a genetic one.

53. **Water quality monitoring on the Fitney Bit Oyster Reef, Great Bay, NJ**

Zimmermann, Aaron, **Mark Sullivan, Steven Evert, Elizabeth Zimmermann**

Marine Science

The Mullica River-Great Bay estuary is a part of the Jacques Cousteau National Estuarine Research Reserve (JC NERR) established by NOAA in 1996 and supports one of the last Atlantic Coastal Bay oyster populations in the Mid-Atlantic States. The NOAA NERR systems throughout the country each host a System-wide Monitoring Program (SWMP) that provides water and meteorological monitoring stations at select sites along their system's salinity gradient. There are four sites in the JC NERR, however, a key area at the mouth of the river has not been monitored due to the lack of a structure to house a datalogger. In the spring of 2014, a buoy designed to house a datalogger was installed at this location through collaboration with the NJDEP Bureau of Marine Water Monitoring. Long term monitoring of the

physico-chemical parameters in this area of the estuary will provider resource managers with data on environmental triggers such temperature changes that drive shellfish diseases including *Vibrio*, a bacterial agent that is a human health hazard. In addition, the effect of changes in pH and its impact on larval bivalve recruitment and survival is another area of interest. In this first season, seasonal trends in salinity, temperature, dissolved oxygen, pH and turbidity was collected and compiled. Weather events such as heavy rains and a Nor'easter and their impact on these parameters were also noted. Data collection and analysis is slated to resume in the beginning of the spring of 2015.