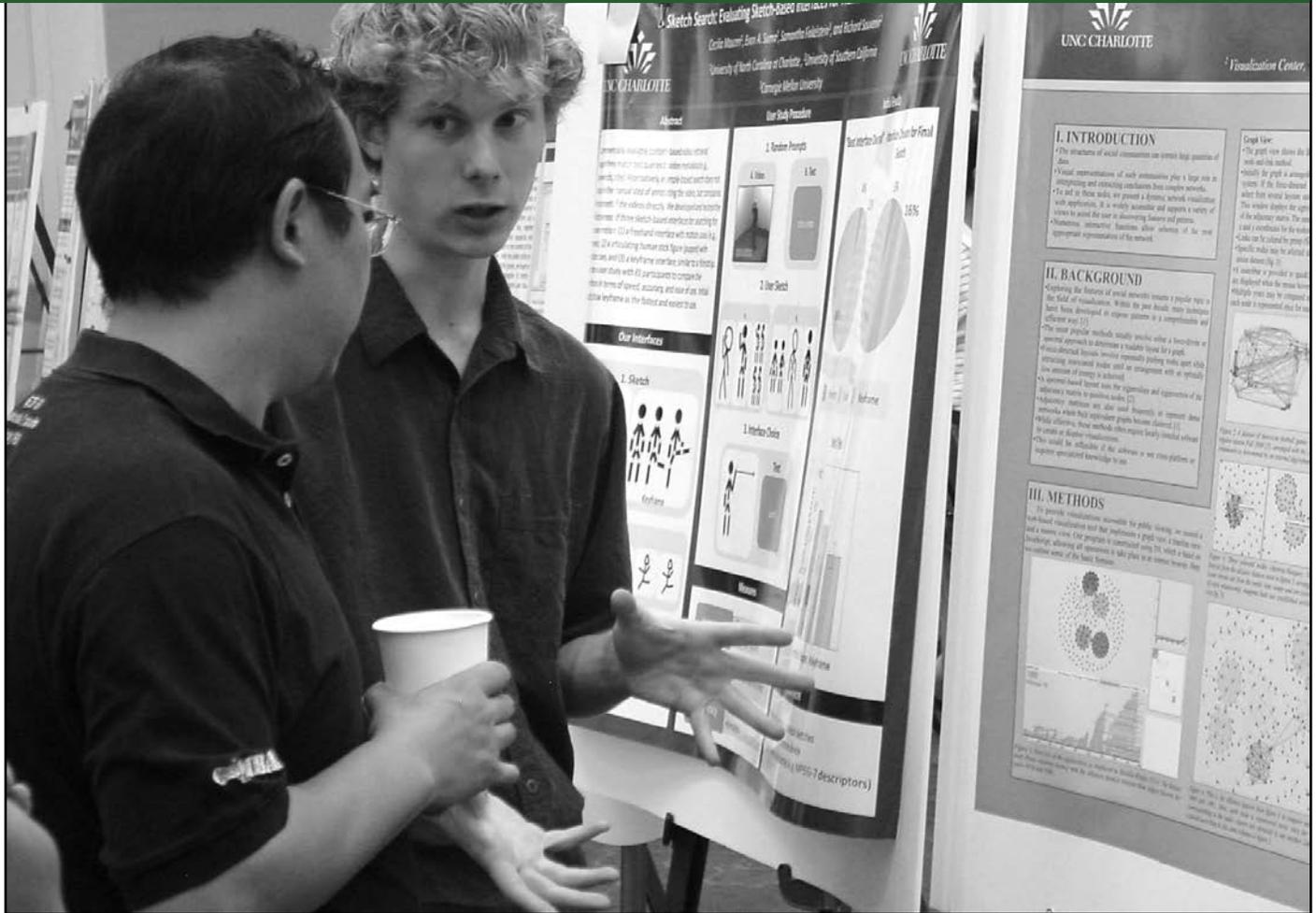


SUMMER RESEARCH SYMPOSIUM

2015 Abstract Book



Welcome to the Fourth Annual UNC Charlotte

SUMMER RESEARCH SYMPOSIUM

Wednesday, July 22, 2015
Student Union room 340

*Featuring ~100 undergraduate students and
their summer research projects*

Schedule:

9:00 AM Opening remarks

Dr. Dennis R. Livesay
Director, Charlotte Research Scholars
University of North Carolina at Charlotte

Dr. Erin D. Hopper
Research Director
University of North Carolina General Administration

9:15 AM Poster sessions and judging

12:30 PM Awards and closing remarks

PARTICIPATING PROGRAMS

First offered in 2012, the Summer Research Symposium was created to highlight undergraduate research at the University of North Carolina at Charlotte. The symposium is presented by the Charlotte Research Scholars and features participants from several other REU (research experience for undergraduates) programs. Participating programs include:

Charlotte Research Scholars Program

Summer Program to Increase Diversity in Undergraduate Research

NanoSURE REU Program

Socially Relevant Computing REU Program

Biology and Biotechnology REU Program

Mechanical Engineering Summer Research Program

Charlotte Community Scholars Program

CHARLOTTE RESEARCH SCHOLARS

The Charlotte Research Scholars (CRS) program provides research opportunities for high-achieving undergraduate UNC Charlotte students in their field of interest. Additionally, the scholars participate in weekly professional development training to build skills critical to professional success. These opportunities are not typically available in the undergraduate classroom. This *learn-by-doing* model places an emphasis on graduate education and allows the scholars to put their experiential learning into practice, preparing them to excel in their future studies and research.

The CRS is open to all areas of scholastic research. A call for 2016 faculty submitted research projects will be announced in the fall, and students will apply next spring. More information can be found at:

<http://graduateschool.uncc.edu/CRS>

The Charlotte Research Scholars are supported by UNC Charlotte's Office of Academic Affairs, the Charlotte Research Institute, the Duke Endowment, and the Graduate School.

Abstracts are listed alphabetically by the first author's last name.

BITURE REU PROGRAM

**Nanoparticle Uptake and its Effect on the Starlet Sea Anemone,
*Nematostella vectensis***

Blessing Alagba, Amy Ringwood, and Adam Reitzel

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Estuaries are nutrient rich habitats located in coastal habitats that are ecologically important as nursery grounds for commercial species. These habitats are increasingly impacted due to anthropogenic activities, including pollution due to deposits of metal and other commercial wastes, such as polystyrene. Polystyrene can be deposited from both oceanic and freshwater inputs, which can be toxic to marine animals that reside there. Plastic pollutants are known to cause damage to marine animals through suffocation or entanglement; however these negative impacts have only been studied in a few species. For this research, the primary aim is to determine the effects of polystyrene (nano and micron sized beads) on the estuarine anemone, *Nematostella vectensis*. These organisms live in the estuaries and are known to tolerate a wide range of abiotic stressors. We tested if developmental stages as well as adult anemones take up these nanoparticles and if so, if particles cross the cell membrane and cause toxicity. We exposed embryos, larvae, and juveniles, using the different sizes of polystyrene to determine if there was uptake. We used fluorescence markers to visualize the nanoparticles. We did some dose-dependent exposures to determine if there is a negative effect on development and growth. We did some histology of the adults to determine if the particles are on an intracellular level. Also, we will perform quantitative PCR (qPCR) method on heatshock proteins (HSP) in order to establish amount of toxicity in each adult. As expected we observed no signs of internalized nanoparticles in the anemone on the nano-sized level. However there were clumps that were seen on the outside. On the micron level we observed nanoparticles on the outside and also internalization in the organism. For the dose-dependent exposure, as hypothesized, there were no significant impact on growth and development. We know the anemone can take up the nanoparticles without any negative impact on them. The next step in this research would be use of metals coupled with the particles to observe if there would there be some negative impacts seen with the anemone.

The Search for a Generous Identity

Leanne Barry¹, Lisa Slattery Walker², and Shahar Gur³

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² *Department of Sociology, University of North Carolina at Charlotte*

³ *Organizational Science Doctoral Program, University of North Carolina at Charlotte*

BACKGROUND: Various measures exist for social constructs such as altruism and prosocial behavior. This project aims to determine whether generosity is its own construct separate from these, and to construct a scale to measure how people self-identify as generous.

METHODS: Items created by the researchers, as well as items pulled from various relevant scales, were compiled into a pilot survey and distributed to a convenience sample. Exploratory factor analysis was used to reduce the item count of the survey and determine what common factors were measured. The survey was revised to reflect this and the final measure was sent out to a larger random sample.

RESULTS: The final scale measures the factors of generous identity, perceptions of the generosity of others, and the boundaries of when it is appropriate to engage in generous behaviors.

CONCLUSIONS: Generosity does seem to be a construct that is separate from, although highly related to, other prosocial measures. This is largely due to the specific nature of generous behavior that involves making a conscious choice to give some commodity to someone who needs it, without the expectation of anything in return. Similarly, an individual's self-identification as a generous person is separate from, but related to, their perception of generosity in others and their assessment of when such behaviors are appropriate.

Betrayal in Close Relationships

Kaitlyn Beaver, Amy Canevello, and Nicole Hilaire

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Although most close relationships are characterized by positive behaviors that indicate care and concern for others, it is inevitable that those in close relationships will experience transgressions. Previous work on forgiveness after transgressions has focused on how people forgive, that is, their interpretations of and reactions to transgressions and the processes that lead to resolution (Finkel, Rusbult, Kumashiro, & Hannon, 2002). However, little work has examined why people forgive. Interdependence Theory (Kelley & Thibaut, 1978) suggests that commitment may play a role in the motives that underlie forgiveness. Specifically, this theory predicts that when people are more committed to relationship partners, they respond to transgressions in ways that are more constructive and less destructive. These hypotheses were supported by Finkel, Rusbult, Kumashiro, and Hannon (2002) who found that highly committed participants responded more constructively and less destructively to interpersonal transgressions. The purpose of this project is to conduct a direct replication of Finkel et al (2002) and is part of a larger effort by Perspectives on Psychological Science to replicate key findings in the psychological literature (i.e., Registered Replication Reports). Ten participants who were in relationships of at least 1 month were randomly assigned to a high or low commitment prime condition. They then read descriptions of 12 hypothetical transgressions and reported the extent to which they would respond constructively and destructively. High commitment participants showed more constructive responses, whereas low commitment participants showed more destructive responses. Finkel et al (2002) reported a correlation between sex and commitment, such that men reported stronger subjective commitment in both conditions. Inspection of means suggests that these data show a similar trend. However, due to inadequate numbers in each condition less females participated in the low priming group. These results complement previous research regarding how people forgive their partner by highlighting the role of commitment in explaining why people forgive their partner. In which, we test the hypothesis that strong commitment leads to or causes increased forgiveness (Finkel, Rusbult, Kumashiro, & Hannon, 2002). This research explains that the more individuals remain dependent on their relationships the more willing they are to forgive, in order to hold onto what they have.

The Experience of Refugee Students in Charlotte, North Carolina

Mirage Berry and Dr. Jason Giersch

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Refugee communities and individuals are unique and diverse in their experiences. In the United States a network of nonprofit and governmental agencies facilitate the resettlement of refugees into the country and community. These agencies must be aware of the variable circumstances of trauma, precarity, and subjectivity involved with being a forcibly displaced person. School-aged refugee children typically arrive in the United States lacking the formal education needed to meet national standards. As adolescents, they face distinct integrative challenges relative to their post-displacement experience in American society, especially regarding issues of acculturation, racialization, and resilience.

Our research examines the efficacy of the current refugee educational support system in the United States with Charlotte, North Carolina as a case-study. The two resettlement agencies in Charlotte are funded through public and private sources on a 'per refugee' basis to meet the basic needs of over 600 incoming refugees each year. Additional grant funding is allocated among resettlement agencies and other public entities. The refugee School Impact Grant (SIG), sparsely allocated nationwide, is available to only one agency and three school-systems in the state. This grant enables the provision of services such as extracurricular youth programs, individualized support, and family to school mediation.

Clients unaffiliated with these grantees are dependent on outreach and availability of programs from other non-profit organizations to meet their educational needs. The educational experience is a stabilizing force in the precarious adolescence of refugee children. Through a broad review of literature, a local survey of refugee families and interviews with resettlement agency staff, our research suggests that the SIG should be deemed as an essential social service to be provided on a 'per refugee' basis. National standards should be formulated to ensure that schooling and settlement for refugee students be integrative regarding procedure, organizational structure and processes, guidance and support, and curriculum.

The Contributions of Skeletal Muscle PKC theta to Obesity and Hyperglycemia

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BACKGROUND: Protein Kinase C- Theta (PKC θ) is a gene predominantly expressed in hematopoietic and skeletal muscle cells. In skeletal muscle, PKC θ is associated with impaired fat metabolism, insulin resistance, and glucose intolerance. PKC θ activity increases in response to high levels of diacylglycerol in the cell, a common outcome of chronic high fat diet consumption and obesity.

PURPOSE: The purpose of this study was to test the hypothesis that the selective deletion of PKC θ from skeletal muscle protects against diet-induced obesity and hyperglycemia.

METHODS: Mice lacking PKC θ in skeletal muscle were created using Cre-Lox recombination. At weaning, control (PKC $\theta^{\text{SkM}^{+/+}}$) and knockout (PKC $\theta^{\text{SkM}^{-/-}}$) mice were randomly assigned to regular or high fat diet (RD or HFD) groups. Mouse weights were taken weekly for 15 weeks followed by assessment of fasting glucose.

RESULTS: During the 15-week diet intervention, male PKC $\theta^{\text{SkM}^{+/+}}$ mice on a HFD gained the most weight. Knocking out the expression of PKC θ from skeletal muscle attenuated weight gain in male mice close to that of mice on a RD. In addition, PKC $\theta^{\text{SkM}^{-/-}}$ mice receiving a HFD show a mild reduction in fasting glucose. Interestingly, all female mouse groups gained a similar amount of weight independent of genotype and diet. Despite a lack of change in body weight, PKC $\theta^{\text{SkM}^{-/-}}$ female mice receiving a HFD have a marked reduction in fasting glucose compared to PKC $\theta^{\text{SkM}^{+/+}}$ mice on a HFD.

CONCLUSION: The selective deletion of PKC θ in skeletal muscle may protect against the effect of chronic high fat diet on blood glucose levels and weight gain. These effects may be sex-dependent and the mechanism remains to be determined. Importantly, these results are limited by a small sample size. Future work is aimed at increasing the sample size and examining effects on glucose tolerance.

Electrical Properties of Simple Devices Glued with D-sorbitol Doped PEDOT: PSS

M. Eli Bostian and Michael G. Walter

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Mixtures of poly (3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS) and D-sorbitol when heated to appropriate temperatures exhibit enhanced electrical conductivity as well as the qualitative properties of a physical adhesive. This combination of properties yields the possibility of employing PEDOT:PSS doped with D-sorbitol acting simultaneously as a physical attachment and Ohmic contact in certain solar-cell devices, particularly those employing nano- and microwire arrays. The electrical conductivity and adhesive-like properties of the mixture have been shown to vary with alterations in dopant concentration, layer thickness, and treatment methods. The manipulation of these variables lends the PEDOT:PSS-D-sorbitol blend the adaptability for many different applications. We develop sample devices out of various materials such as FTO-coated glass to test the electrical properties of the PEDOT:PSS-D-sorbitol mixture. Variations of PEDOT:PSS quality and device preparation techniques allow the optimization of device construction and demonstrate the potential application yielded by this mixture. Our experiments show marked improvement in device current density and area resistance when constructed devices are treated with thicker layers of mixture and purer samples of PEDOT:PSS. While electrical properties are largely replicable, glue-like properties occasionally remain undemonstrated. Given optimal device construction procedure, electrical properties are largely greater than those without the presence of PEDOT:PSS-D-sorbitol. Variations in electrical and physical properties attributed to changes in the PEDOT:PSS-D-sorbitol mixture as well as the procedure of device manufacture indicate that there is an optimal procedure and mixture for solar-cell application; additionally, a procedure and mixture have been developed that may reasonably be considered applicable to such a device even as the method and mixture stand now. Given that electrical conductivity of the devices tends to increase as thickness of the PEDOT:PSS-D-sorbitol layer increases and as the quality of PEDOT:PSS included in the mixture improves, it is conceivable that even greater procedures and mixtures exist and could be found with additional experimentation. Mild inconsistencies in the performance of the mixture as an adhesive appear to be founded on subtle differences in the anneal step of the device production and should be researched further.

Caffeine Derivatives for Potential Solar Cell Applications

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Solar energy is the most promising option for renewable energy in terms of scale because the energy of one hour of sunlight striking the earth equals the whole world's current annual energy consumption¹. The high cost of traditional silicon-based solar cells has led to research in alternate materials that could be used for next-generation cells. Much of this research has focused around copper chalcogen materials because they have low toxicity and are used extensively in our daily lives². It has also been documented that copper selenides have different phases depending on their stoichiometry ratio, each with properties that are suited for application in optoelectronic devices³. Our research is centered on caffeine selenide, which is reacted with copper for studies on the effect of caffeine stoichiometry and light absorption. Caffeine was reacted with selenium to make the ligand CaffSe^{Me}, which was reacted in different molar ratios with the copper halides CuX, (X= Cl, Br, I). Different stoichiometric ratios of caffeine selenide ligand to copper were investigated and the resulting products were characterized using a variety of analytical and spectroscopic techniques. These products were then studied for their different molar absorptivity constants, looking for complexes showing high absorptions that would be most compatible for use in solar cells. The UV-Vis studies have shown that the molar absorptivity constant of the compounds is linearly related to the concentration but also related to the ratio of ligand to copper.

¹Crabtree, G. W.; Lewis, N. S. *Phys. Today*. **2007**, *60*, 37–42.

²Zhao, Y.; Burda, C. *Energy Environ Sci*. **2012**, *5*, 5564-5576.

³Choi, J.; Kang, N.; Yang, H.; Kim, H.; Son, S. *Chem. Mater*. **2010**, *22*, 3586-3588.

Calibration of Rotary Axis using Laser Interferometry

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BACKGROUND: A rotary table is a device that is used in metalworking for precise positioning. The operator can use the table to drill or cut metal at intervals around an axis. Rotary tables are used in numerous machining operations. They can be found on milling and CNC (computerized numerical controlled) machines. Laser interferometry was used to calculate positioning error's for each rotary axis. Interferometry is a method for measuring distances in requirement of high accuracies. The AG Davis calibrator, Moore precision tools rotary table and HAAS rotary table positioning errors were established. Different equipment setups were used to find and calculate the positioning errors in these tables.

METHODS: To set up the experiment, the laser head was connected to the laser display. The laser was pointed towards an angular interferometer. The interferometer is known as the "beam splitter". The beam was split into two different beams. These beams were then be pointed towards a dual retroreflector. The beam reflected back towards the interferometer and then to the laser head. The displacement was measured and converted to an angle. The retroreflector and interferometer were glued with an epoxy to prevent movement. The HP laser head, HP display and Renishaw optics were used in calculations of the Moore rotary table and AG Davis calibrator. The Agilent laser and HP optics were used in the calculation of the HAAS rotary table. A program was created to rotate the HAAS table on the CNC (computer numerical controlled) machine. After the equipment was set up, measurements were recorded. The laser display was reset and read approximately zero. The manual rotary stage was rotated 5 degrees counterclockwise. The laser display read an arc distance, which was recorded. The next step was to rotate the calibrator 5 degrees clockwise to reach back to "zero". This measurement was also recorded. The difference between the starting reading when both stages were zero and the reading when both stages were at 5 degrees is the error between the two. This process was repeated up until 360 degrees were reached on both the manual and calibrator stage. Three trials were taken. For the HAAS rotary the Agilent laser was connected to a computer. The program kept track of the data after each measurement. The exact same process as the manual stage was used and 5 trials were performed.

RESULTS: Averages, residuals and standard deviations were calculated to determine positional error. Residuals were between approximately -0.4 and +0.6 arc seconds for the calibrator, between -4 and +3 arc seconds for the manual stage and between -4 and +4 arc seconds for the HAAS stage. It was determined that the manual rotary stage was manually positionable to 6.6 arc seconds, the calibrator stage was accurate to 1.1 arc seconds and the HAAS stage was accurate to 9.1 arc seconds. The position errors fluctuated at various increments as these numbers are an averaged range of their "peak to valley" positional errors.

What Spatial Resolution of Remote Sensing Data is Sufficient for Urban Forest Carbon Mapping?

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BACKGROUND: Estimation of carbon sequestered by trees in urban regions provides useful information for climate change mitigation and urban forest management. However, the large numbers of urban trees, many of which grow on private lands, prohibit a timely and cost effective mensuration through field approaches. Remote sensing (RS) technologies, such as LiDAR (light detection and ranging), allow a spatially-explicit (a.k.a. wall-to-wall) tree mapping across an entire area. But, finer resolutions of RS data produce larger volumes of data files (i.e. Big Data) and require more time and resources to process. In this work, we address the question, “*Will coarse resolutions of RS data have similar performance in forest carbon estimation as those from fine resolution data in an urban setting?*”

METHODS: We compared 16 carbon estimation maps made from varying resolutions of aerial photographs (1m, 5m, 10m, and 20m) and LiDAR data (1.0 pts/m, 0.8 pts/m, 0.4 pts/m, and 0.2 pts/m) for Mecklenburg County, NC. We further employed statistical analysis to evaluate the differences of carbon estimates among four types of residential densities: low, PBU (percent built-up) $\leq 15\%$; medium-low, $15\% < \text{PBU} \leq 25\%$; medium-high, $25\% < \text{PBU} \leq 40\%$; and high, $\text{PBU} > 40\%$. Correlations were developed to link the variance of carbon estimates and urban spatial patterns, quantified using landscape metrics.

RESULTS: The statistical analysis of the carbon estimation maps showed: i) 0.74 to 0.97 correlations in low residential density neighborhoods; ii) 0.69 to 0.96 correlations in medium-low residential density neighborhoods; iii) 0.89 to 0.98 correlations for medium-high residential density neighborhoods; and iv) 0.95 to 0.99 correlations in high residential density neighborhoods as compared to the finest resolution data, 1 m at 1.0 pt/m. We found that the average carbon value varies by the degree of build-up level, with the highest degree of build-up having the least variability in carbon estimation averages. The average standard deviations by neighborhood density were: i) low 5.32; ii) medium-low 4.70; iii) medium-high 4.42; and iv) high 2.95. The variance of carbon estimations did not produce correlations to any single landscape metric at all levels of residential density. Links between carbon estimates and urban spatial patterns are dependent on residential density level.

CONCLUSIONS: In an urban setting, coarse resolutions of RS data can have similar performance as fine resolution data in forest carbon estimation. This is particularly true in high density residential neighborhoods which have the least amount of variability in carbon estimations. During the statistical analysis of the RS data, the coarser resolutions' smaller file sizes sped up the calculations. The finer resolution RS data required longer processing time.

Scrabble Club: Enhancing Word Learning through Engagement

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BACKGROUND: Communities in Schools launched a pilot program in some elementary schools in 2014-2015 in attempt to engage students (grades 3-5) in a language study through Scrabble clubs. Informal evidence suggests positive impact on vocabulary as well as word formation. Our goals are to help CIS determine if Scrabble clubs are benefiting the students' growth in reading and language, determine how to measure the effectiveness of the Scrabble Club for the students, and to create instructional resources to strengthen the Scrabble club as well as training materials for leaders and students.

METHODS: Our work has both qualitative and quantitative components. We held interviews with two Scrabble coordinators, two Scrabble club students, and a Charlotte Mecklenburg Schools (CMS) MAPS coordinator. The CMS MAPS coordinator has access to the information we would use to track the improvement from some Scrabble club students. With the access to those records we would then be able to view test scores of those students who participate in Scrabble Club to determine whether playing Scrabble has helped improve in daily school curriculum.

RESULTS: As part of our resources to continue this program, we have created quantitative measures including pre and post-surveys for the students and coordinators at the beginning and end of the year for more data. We also have created a set of assessments to track the progress of students participating in the actual club using word building assessment scores. We also created training outlines in the form of Power Points to help leaders and students learn the rules Scrabble as well as strategies for improving their success. This phase of the project is developmental. Additional qualitative and quantitative data will be gathered during the 2015-16 academic year.

CONCLUSION: We believe these evaluation tools (the assessments and surveys), the training materials (Power Points) and instructional materials (Scrabble strategy and practice materials) will enhance the program and once the program starts up again in the fall, the coordinators will be able to gather this quantitative data.

Buckling Behavior of Boron Carbide Nanowires on Pre-strained, UVO Treated PDMS Substrate

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Nanomaterials, having one or more dimension within 1–100 nm, are of growing interest due to their potential usefulness in many different applications, such as miniaturization of electronic devices. Nanowires, which are pieces of material having two dimensions in the nanoscale and one dimension much longer, attract particular interest. When buckling, nanowires can assume folded or sinusoidal forms. This is useful for applications such as in stretchable or wearable electronic systems. We investigate the buckling behavior of boron carbide (B_4C) nanowires, approximately 40 nm in diameter and up to 10 μm in length. Polydimethylsiloxane (PDMS) sheets are first stretched just below their fracture strain, remaining within the region of elastic deformation. While under this strain, the PDMS is placed under an ultraviolet lamp to produce ultraviolet/ozone (UVO) treatment, which increases the static friction force between nanowires and the PDMS substrate. Nanowires are placed on the PDMS and the substrate is relaxed, compressing the nanowires and inducing buckling. From the shape of the buckled nanowires, measurements of the shear force between the PDMS substrate and the nanowires can be made. This shear force is affected by the length of time that the UVO treatment is applied to the PDMS. Also under investigation is whether there is any difference in the buckling behavior of nanowires with axial faults (AF) versus those with transverse faults (TF).

**Dabbing and Butane Hash Oil:
Tracking Emerging Trends through an Online Drug Forum**

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The use of butane hash oil (BHO) extracts in a form colloquially referred to as dabbing has been labeled a potential threat. These products contain a high THC concentration and are vaporized rather than ignited. Dabbing results in less material having to be consumed to obtain a more potent high, but a greater danger may be in its production. Amateur production has resulted in a number of fires and explosions. This pilot study attempts to evaluate the potential emerging trends of dabbing and home-production of BHO extracts using online forum discussions. Tracking drug forum posts can assist with the development of a preliminary understanding of developing trends. Though online trends are unlikely to perfectly mirror usage, they do provide information on drug interest and the techniques being used to administer and create BHO products; online forum tracking can provide the first evidence of a growing trend long before self-report surveys have had time to assess usage. Drugs-Forum is a popular online forum where members describe their experiences, ask questions, and seek help regarding drug use. The site hosts 210,000 members and has 3.6 million visitors on a monthly basis. All posts containing one of six key terms (BHO, butane, honey oil, dabbing, dabs, dab) were coded and evaluated. This pilot study provides a foundation for comprehensive research that could allow the criminal justice and public health community to make informed decisions regarding policy and division of resources before usage can be assessed via traditional avenues.

Biodegradation of Marine Pollutants with Hydrocarbon Degrading Bacteria

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² *Department of Biological Sciences, University of North Carolina at Charlotte*

Bioremediation utilizes naturally occurring organisms to degrade pollutants into less toxic or nontoxic substances. Hydrocarbon contaminated marine environments are prime targets for bioremediation, and blooms of hydrocarbon oxidizing bacteria have been documented from marine environments contaminated with oil. Biodegradation of hydrocarbons by microbes depends on the composition and concentration of the hydrocarbon as well as temperature, oxygen, and nutrient availability in the environment. Marine microbial communities represent a vast amount of genetic information, bioactive compounds and biomaterials with potential applications of societal and environmental interest. Marine microorganism diversity and their ecological role are still largely unexplored. The objective of this study is to obtain pure cultures of marine microbes for physiological and genomic characterization. This study was conducted with seawater collected from Huntington Beach, South Carolina. We added cyclohexane, benzene, hexadecane or crude oil, and incubated at 4 degrees and 28 degrees C in shaking and non-shaking incubators. Following incubation, bacterial cultures were isolated through multiple transfers into artificial seawater media and then plated to obtain pure cultures. We extracted DNA and measured DNA concentrations as an indicator of microbial growth. 16S rRNA gene sequencing will be conducted to analyze microbial community composition in the different hydrocarbon and incubation treatments. We expect to find that microbes degrade hydrocarbons differently under different laboratory conditions and these laboratory conditions affect the growth rate and types of microbes that grow.

CHARLOTTE RESEARCH SCHOLARS PROGRAM

Monopolizing Money: Congressional Leaders' Use of Fundraising Organizations

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This study observes the nature of joint fundraising committees (JFC's), specifically how they are being used in a similar way as leadership political action committees. By looking at contributions to US House members with and without leadership positions from the 2012 and 2014 elections, we are able to see the effects that the *McCutcheon v. Federal Election Committee* case has on JFC's. Because the *McCutcheon* case eliminated limits on aggregate federal campaign contributions, we expect to see a rise in the use of JFC's. In addition, we are able to track donor behavior based on an ideological score from Bonica's Codebook for the Database on Ideology, Money in Politics, and Elections. This gives us insight to how candidates are using different accounts to maximize fundraising.

Towards Monitoring the Uptake of CPAs by Single Cells using Confocal Laser Tweezers Raman Microspectroscopy

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² *Department of Physics and Optical Science, University of North Carolina at Charlotte*

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BACKGROUND: Dry preservation of organisms is an attractive, cost-effective alternative to cryo-preservation. It has been shown that some stress-tolerant organisms are able to survive freezing and dehydration by producing sugars such as trehalose. Unfortunately, cells of clinical interest such as T cells, sperm, and eggs cannot produce trehalose; the protectant must be loaded using techniques such as endocytosis, poration, and microinjection. A significant step in advancing this process is to identify and characterize a cell's ability to load trehalose. Optical trapping of small particles due to radiation pressure from a tightly focused laser is a powerful tool for the manipulation and investigation of small cells. This tight laser focus is also well suited for Raman microspectroscopy. Using these techniques, coupled with confocal signal filtering, the study of concentration change inside of single, trapped cells can be studied at higher speeds and greater flexibility than traditional methods such as HPLC and coulometry which require a large number of cells and only provide an average concentration.

METHODS: We use an inverted confocal Raman microscope to study the Raman spectrum of individually trapped and levitated polystyrene microspheres for the verification of general equipment function and calibration. The collected image is either sent to a digital camera for imaging or to a monochromator and CCD for spectral analysis. Manipulating the width of the entrance slit and number of active pixel rows on the CCD provide a confocal arrangement and offers a degree of discrimination between the focused image and the out-of-focus sample region.

RESULTS: Successful trapping and levitation of 3 μm polystyrene microspheres has been demonstrated. Additionally, significant increase in spectral resolution and reduction of background signal has been achieved by decreasing the entrance slit of the monochromator to 10 μm and activating 10 rows (260 μm) of pixels on the CCD. This arrangement defines a range smaller than the beam spot size within the sample; allowing the polystyrene bead to be clearly imaged with very little background fluorescence from the surrounding region and coverslip. Single T cells and feline sperm have also been trapped and imaged.

CONCLUSIONS: Optical trapping can be combined with confocal Raman microspectroscopy to provide a high-sensitivity method to image single particles in a small confocal volume. The technique of using a narrowed entrance slit and a small number of binned pixels to define a confocal aperture provides higher resolution of sub 10-micron sized particles; enabling imaging of the internal material of similar sized cells of interest.

Serving Students Facing Food Insecurity

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BACKGROUND: According to the USDA, food insecurity can be defined as a household-level economic and social condition of limited or uncertain access to adequate food. Food insecurity has become more relevant among the college student population due to factors such as yearly rising tuition and lack of financial assistance. It is estimated that 29% of students on American college campuses face some sort of food insecurity. A fairly new solution to this issue is college campus food pantries. The University of North Carolina at Charlotte opened Niner Student Pantry in the fall of 2014, and has since distributed approximately 10,000 food items to over 800 student clients. Who are the students being served by Niner Student Pantry? What is the pattern of use among these students?

METHODS: We analyzed preliminary data which was obtained during the food pantry's first year of operation. Upon arrival at the food pantry, student clients were asked to fill out an intake form which asked questions on their demographics as well as their need for assistance. They were then asked to sign a pledge on the form which confirmed their honest need for the assistance before proceeding to gather the items of their choice. Clients were allowed to return to the pantry once a week during operation hours.

RESULTS: Data revealed that the Niner Student Pantry has served a total of 825 clients since opening on 9/29/14. Of those clients reporting their student status, 49.8% were graduate students. 48.9% indicated they experienced food insecurity "occasionally" while 16.8% experienced it "frequently." Clients reported living in households comprised of between 1 and 8 adults, with 45.5% living alone and 12.1% living with just one other adult. Pantry records indicated that the largest number of students served was on opening day, and the average number served from October through June was 14.1 clients. Data revealed that more clients used the pantry on Thursdays (M=18.5) than Mondays (M=10.4) but little difference in Pantry usage was observed on university holidays (M=12.2) when compared to regular hours of operation (M=14.4). The percentage of clients who utilized the pantry more than once was 38.9%, while 20% utilized the Pantry between 3 and 5 times.

CONCLUSIONS: The current study provided vital information about the first year of operation. We now better understand who we are serving and our client's pattern of Pantry use. This information will guide Pantry leaders as they develop processes to better serve existing clients, while reaching out to unserved students who are struggling with food insecurity. Because we have served under 2% of the total UNC Charlotte population, there is a considerable gap between students served and the estimated 29% who may be struggling with food insecurity. Future research will identify ways that might help to close this gap.

CHARLOTTE COMMUNITY SCHOLARS PROGRAM

Bridge to Engineering

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BACKGROUND: Bridge to Engineering is a service-learning program that introduces underrepresented students to the engineering process through a community-oriented project. Our mission is to recast engineering careers as socially engaging by highlighting the link between engineering practice and the social impact of an improved quality of life. This enhanced perception of engineering careers is expected to attract a broader and more diverse body of students to STEM fields with particular impact in underrepresented groups. The program develops engineering skills and confidence in their abilities by challenging individual students to work in teams to understand, design, and construct a water collection system. The system sustains a local garden and has the social impact of reducing hunger in the community. The program is designed to be repeated by a variety of organizations that have an interest in attracting students to STEM careers.

METHODS: To allow the four-week program to be replicated, we created a step-by-step template of workshops and activities that are available on our website. Each component of the template provides the appropriate information and resources required to understand and design a solar-powered rainwater collection system. To create a strong link with the community benefit of the project, we partnered with a local program, Friendship Gardens, to provide background on the issue of hunger and fresh foods within the community. In order to improve the program, we studied an example of a previous installation of the water collection system has been in service for over a year. The existing garden installation allows future mentors and students to visualize the process and to see the system's real world benefits.

RESULTS: Our program is highly accessible for any organization to become involved. The resulting product provides users with any level of engineering experience to easily deploy a similar service-learning project. This provides mentors and students across the globe access to real-life engineering experience while benefiting their community. Upon completion of the Bridge to Engineering program, students with unique backgrounds and skills will become aware of a broader set of career opportunities.

CONCLUSION: By working to develop our four-week program and becoming involved with our community partner and its students, we have seen a potential to improve the engineering field by diversifying its members. We seek to take students who have never considered engineering and highlight their potential to make a positive social impact through engineering. Because these students have unique interests and backgrounds, they have unique perspectives and skills. We have found this to be invaluable to creating powerful solutions. Our hope is that we can inspire some of these students to become future engineers and make an impact on their communities.

CHARLOTTE RESEARCH SCHOLARS PROGRAM

**An Exploratory Study of Administrators', Teachers', and
Students' Perceptions of an Early College Engineering School**

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Early college high schools, a concept made popular by the Bill and Melinda Gates Foundation, exist to prepare interested and motivated students for a successful future in the fields of science, technology, engineering, and mathematics. The culture within these schools proves to be a keystone to success. This study seeks to explore the challenges and successes of a first year early college high school located in the Southeast region of the United States on a university campus currently serving rising 9th and 10th graders. For the purpose of this qualitative study, two separate focus groups were conducted first with all six teachers and then with 10 randomly selected students representative of the larger, diverse school demographic. The audio-recorded focus groups were first transcribed and then analyzed and coded using constant comparative method for trends related to the culture within the new school. Themes likely to emerge after completion of the data analysis phase of the study include a family like atmosphere, high expectations for teachers and students, and intricate academic supports. All of these themes describe school culture and were positively perceived by the participants. This study is significant because it uses the direct words and opinions of the participants to compare the similarities and differences between teacher and student perceptions of school culturing in a first year early college high school.

You Can't Always Get What You Want, But Do You Get What You Need? Self-Pleasure and Social Support Needs Predict Choice Behavior on the Dictator and Ultimatum Tasks

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BACKGROUND: Economic games such as the Dictator and Ultimatum tasks are regularly used to investigate fairness and altruism. Previous studies have shown that the pleasure an individual feels about a Dictator and Ultimatum offer predicts choice, and that participants can be grouped according to whether acting fairly on Dictator and Ultimatum tasks gives the participant pleasure or not. Importantly, the pleasure a participant feels about acting fairly and the choice to act fairly may be moderated by an individual's social support experiences and needs. The objective of the present study is to analyze how social support experiences and needs moderate the relation between the pleasure an individual feels when acting fairly and their Dictator and Ultimatum Task choice.

METHODS: 170 students completed computerized versions of the Dictator and Ultimatum tasks in which prior to making their choice they rated how pleasurable each choice option was. The pleasure ratings were correlated with absolute fairness to create a fairness-pleasure value. Each participant also completed a Social Connectedness Scale (SCS) assessing family instrumental support, family emotional support, wanted instrumental support, and wanted emotional support. A series of moderated regressions were conducted in which fairness-pleasure, social support (family instrumental support, family emotional support, wanted instrumental support, and wanted emotional support), and their interactions were entered as predictors of Dictator and Ultimatum task choice.

RESULTS: Analyses reveal that family support (emotional or instrumental) did not impact choice or significantly interact with fairness-pleasure to predict Dictator and Ultimatum task choice. However, wanted social support (both instrumental and emotional) significantly moderated the relation between fairness pleasure and choice on these tasks. In both tasks, if the pleasure-fairness correlation was high, wanting more support did *not* affect choice behavior. However, when the fairness-pleasure correlation was low, wanting more support significantly impacted individual's choice behavior. Specifically, if an individual with low pleasure-fairness correlation wanted more, they acted more selfishly on both tasks. If however an individual with low pleasure-fairness correlation wanted less, they acted more altruistically on both tasks

CONCLUSIONS: These findings suggest that individuals who experience pleasure in acting fairly will act fairly and altruistically no matter what their personal need. Results also partially support the reciprocity theory of altruistic behavior as participants' choices aligned with both their needs and experiences.

Gender Disparities in Critical Acclaim in the Music Industry

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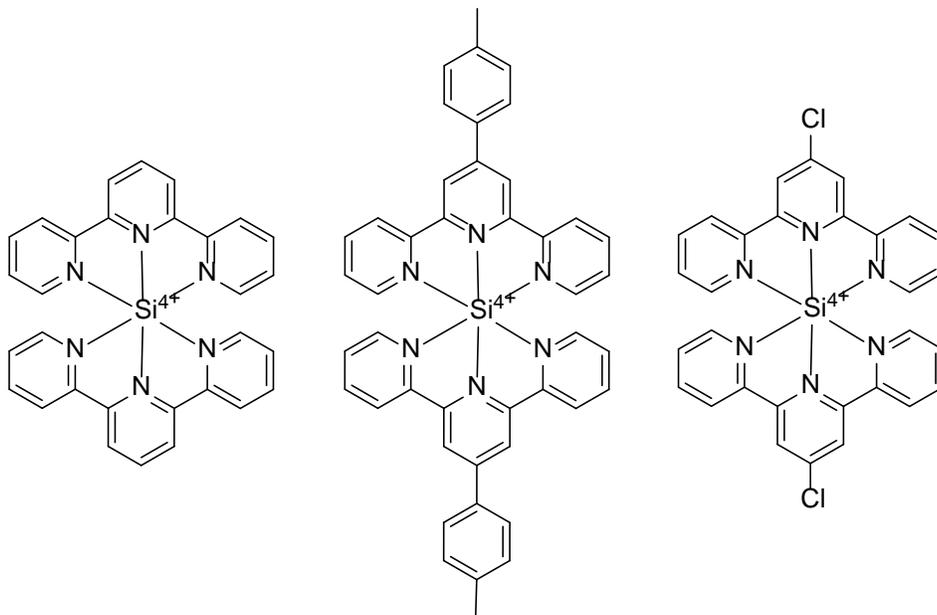
Previous research has shown that women in the music industry are often marginalized in a number of ways. In particular, female musicians have historically struggled to receive as much media attention and critical acclaim relative to their male counterparts. Furthermore, when they do receive media attention they are more likely to be evaluated in gender-stereotypical ways (e.g., their physical appearance or personal relationships are more likely to be discussed). This lack of critical acclaim negatively affects the reputations of female musicians and reduces their chances to be consecrated among the all-time greats. In this project, we aim to measure ongoing gender disparities in the contemporary music industry by studying critically acclaimed and commercially successful albums released from 2008 to 2014. Since 1971, *Village Voice* has published a year-end list of the best albums as determined by hundreds of music critics. By comparing critics' picks with *Billboard's* list of the most commercially successful albums, we consider whether female musicians' critical acclaim is on par with their popularity. We find that, although female artists are releasing albums and receiving more praise from their fans and peers than in previous decades, they continue to receive less acknowledgment from music critics. In addition, our analysis of reviews of critically acclaimed men and women shows that the talents of female musicians are often overshadowed by long lists of contributing artists, producers, and family members followed by descriptions of their physical appearance. While female musicians are being written about in this way, male musicians are often given more credit as the creative source of their music. They are also noted for transcending male stereotypes by showing more emotional range. Identifying the reasons why female musicians are overlooked by music critics can lead to a change in the way critics write about all artists and give them a more equal opportunity to be recognized, appreciated, and consecrated.

Synthesis and Electrochromism of Bis-terpyridylsilicon (IV) Complexes

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Electrochromic materials have the ability to change color reversibly when exposed to an electric field due to the redox reaction that occurs. Electrochromic materials may be used in display technologies, lenses, light-filtering applications, and color-changing windows. Bis(terpyridyl)silicon (IV) complexes, specifically bis(terpyridyl)silicon(IV), bis(4'-chloroterpyridyl)silicon(IV), and bis(4'-p-tolyl-terpyridyl)silicon(IV) were the electrochromic materials explored based on previous research, with an interest in determining how electro-withdrawing and electron-donating substituents affect the electrochromism of the complex. The bis(terpyridyl)silicon (IV) complexes were synthesized by combining the specific ligand of interest and silicon tetraiodide with either pyridine or 2-picoline as a solvent under an inert atmosphere. These were sealed in an ampoule and heated at 125°C for either 3h or overnight. After purification of the product, characterization of these bis(terpyridyl)silicon(IV) complexes was performed using ^1H NMR, IR, ESI-MS, EA, UV-Vis, GC-MS, cyclic voltammetry (CV), and spectroelectrochemistry.



BITURE REU PROGRAM

Investigating Serum Survival of *Vibrio vulnificus*, an Opportunistic Human Pathogen, as a Potential Method for Determining Virulence

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Vibrio vulnificus is a marine bacterium found in estuaries around the world. This bacterium is responsible for 95% of all seafood-related deaths in the United States. While most pathogenic bacteria employ a single mode of transmission, *V. vulnificus* has two routes of infection. Ingestion of raw or undercooked seafood, particularly oysters, can cause rapid septicemia resulting in multi organ failure, which carries a 50% mortality rate. Additionally, entry of this bacterium into an acquired or existing wound can cause necrotizing fasciitis, which often leads to the loss of limbs. There are three different biotypes of *V. vulnificus*, with biotype 1 strains being the main cause of human disease. Biotype 2 strains are mostly identified as eel pathogens while biotype 3 strains have only been found in tilapia farms in Israel. Biotype 1 strains can be further divided into two genotypes, named from their most common source of isolation. C (clinical) strains are most often pathogenic and isolates are 93% correlated with disease, whereas E (environmental) strains are commonly regarded as non-pathogenic and predominate in estuarine environments. Genotype is determined by examining a single-nucleotide polymorphism (SNP) in the virulence correlated (*vcg*) gene, with C-genotypes possessing the *vcgC* allele, and E-genotypes the *vcgE* allele. However, it has become increasingly apparent that a subset of environmental strains are the cause of human wound infections; these strains have been designated to be a “W” genotype. Human serum resistance is currently the best quantitative way to determine the virulence of *V. vulnificus* strains. Previous studies have shown that C-genotypes have the ability to survive human serum, while E-genotypes typically die. Interestingly, these studies also showed that E-wound isolates are also able to survive this challenge. In this study we compared resistance to human serum of strains from multiple biotypes and the distinct genotypes of biotype 1 strains of *V. vulnificus*. We utilized a serum survival assay in which we were able to quantify cells every 20 minutes. We found that clinical (C), wound (W), and biotype 3 strains were able to survive and in fact grow in human serum, while environmental and biotype 2 strains tended to die off in the serum. Assuming that human serum resistance is a valid method for estimating human virulence, we can conclude that biotype 3 and wound strains are potentially as virulent as clinical strains of *V. vulnificus*. We propose that serum survival is an effective way of determining virulence, and coupled with new detection methods, could be a powerful tool for assessing virulent strains in the environment.

Mathematical Modeling in Dimensional Metrology

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Speckle patterns form when a rough surface is illuminated by coherent light, such as a laser, and produce complex and unique intensity distributions. At the advent of the laser, speckle distribution was seen as a hindrance but was later discovered to be useful for various measurements. This research analyzes speckle image correlation to find an absolute method of relative position across an optically rough surface; in which this scale can be fast, low-cost, and used on mechanical machinery. A database of speckle pattern images is collected at each position on the surface and is measured in 1 μm intervals linearly from a starting position. Through vectorization of red and green laser speckle images, various Matlab programs are designed to analyze the correlation of any randomly selected image and a reference image to determine the absolute position on the surface between the two images. By using such a program, it is hoped that an absolute position on a surface can be determined without a large number of pre-recorded database images; and can allow for accurate determination of position regardless of an images distance from the reference image and regardless of whether a random image has been rotated by any degree.

Synthesis and Characterization of Alkylated Porphyrins for Use in Plasmon-Enhanced Bilayer Solar Cells

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BACKGROUND: Effective plasmonic solar devices experience not only efficient absorbance but also maximize light scattering across the surface of the cell. This is achieved by the dispersion of metallic nanoparticles throughout the cell surface. Enhancement of surface plasmon resonances around metallic NPs allows for the improvement and spectral tuning of the absorption of the cell. The optical properties of gold NPs can be tuned by modifying their size. Their resistance to oxidation also contributes to longer device life. By surrounding gold cores with semiconducting metals, the plasmon resonance of a coreshell NP can be manipulated. CdS/Au and ZnS/Au coreshell nanoparticles with surface-bound 5-(4-carboxyphenyl)-10,15,20-tritolylporphyrin (TTPa) are embedded in random configuration in a layer of some alkylated tritolylporphyrin to minimize potential recombination losses, shorten and simplify exciton path lengths, and funnel charge through the cell through decreasing bandgaps. Such a device is illustrated below in Fig. 1. Porphyrins are especially promising for this purpose over commercially available dyes due to their photostability, ease of synthesis and functionalization, ideal diffusion lengths, and facile increase of absorption coefficients via plasmon coupling with metallic nanoparticles.

METHODS: TTPa is stirred with excess thionyl chloride under nitrogen to produce acyl chloride functionalized porphyrin. Any remaining thionyl chloride is immediately vacuum distilled off. Immediately excess anhydrous pyridine, an anhydrous alcohol (here, 1-octanol is used), and dry dichloromethane is added and stirred under nitrogen for a minimum of 24 hours, but up to 48, to generate the desired alkylated porphyrin in reasonable yield. The product is characterized using UV-Vis Spectroscopy, TRPL, and MALDI.

RESULTS and CONCLUSIONS: Two products resulted from this reaction, one of which was immediately identified as TTPa in low yield. The second product is currently being characterized. The presence of TTPa indicates that it is likely the reaction did not go to completion in the time allowed and is unlikely the result of hydrolysis of the acyl chloride group early on. Preliminary results show promise that the second product described is the desired eight-carbon alkylated porphyrin. However, further investigation is required to confirm the identity of this species before construction and testing of thin films.

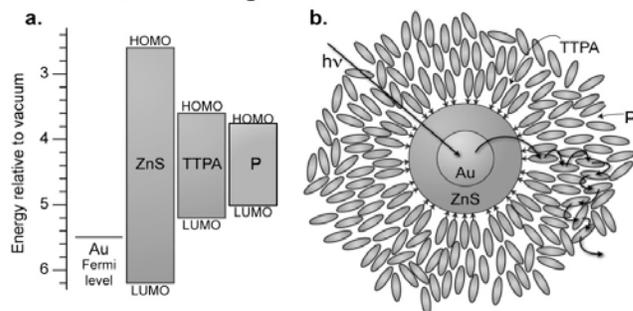


Figure 1: (a) The approximate band alignments of ZnS, TTPA and the alkylated porphyrin (P). (b) A cartoon schematic of the binding of TTPA to Au/ZnS in a film of P. The series of arrows indicates a possible energy diffusion pathway after photoexcitation of the Au/ZnS nanoparticle.

Engineering Behavior of Slurry Consolidated Fly Ash Samples

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Fly ash is a residual product of burning coal and other fossil fuels. The vast volume in the United States typically comes from coal-fired power plants. About 86 million tons of coal ash is produced annually in the United States where 78% of that amount is fly ash. There are different methods to help mitigate the potentially harmful effects of fly ash including reusing the ash for construction materials or using wet storage of this material in “ash ponds.” This research focuses on the wet deposition of fly ash in coal ash ponds. Fly ash is mixed with water to form a slurry in order to reduce the amount of dust that is produced, and to ease the pumping of the sluiced ash into the pond. Although ash ponds are still commonly used because of its relatively low cost and ease of construction and management, in recent years there has been major concerns related to the stability and possible failure of these ponds. An example of such a failure is the Kingston ash spill of the Tennessee Valley Authority. Failures of ash ponds can have serious environmental consequences and endanger livestock and humans located downstream of the failure. Related to the environmental consequences besides surface damage, the chemicals contained in the fly ash have the potential to seep into soil and reach the groundwater which can cause major health and environmental risks. In order to prevent future spills, there are several research efforts to improve the stability of fly ash ponds. For this we need a good understanding of the engineering properties and behavior of fly ash. This research focuses on characterizing the properties of a fly ash from a power plant located in Belews Creek, North Carolina. Additional to characterization of the ash, we present slurry consolidation tests to understand the behavior of consolidation expected at an ash pond. Consolidation tests were carried out using two approaches. The first approach used gravity as the driving force to settle the fly ash particles. A 12” tall and 6” in diameter transparent cylinder was filled with water and a specified amount of fly ash was spooned into the container. Once thoroughly mixed, the falling elevation of the ash sample (mudline) was recorded over time, and the normalized height of the ash vs. time as well as the total unit weight vs. time was plotted. The second approach used a pressurized cell to densify the ash within the range of unit weights seen in the field. Pressure ranging from 20-60 psi was applied to an 8 and 12 lb sample to drain the excess water. Similar to the first approach, the mudline was recorded over time. Based off of the final height of the ash sample, the final unit weight was determined and checked to see if it fell within the target range. Samples were extracted using small shelby tubes to be used for future static and dynamic Triaxial tests. The layering and heterogeneity of the samples will be carefully studied by sampling the sediment ash at the top, middle, and bottom layers of the sample. The ultimate goal is to use the measured engineering properties of the slurried ash as a function of water content and density to help assess the stability of typical ash pond facilities.

PbSe/CdSe Core/Shell Quantum Dots Absorption Spectra and Quantum Yield Over Time

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PbSe quantum dots have piqued the interest of many scientists because their tunable bandgaps lie in the near infrared range of the electromagnetic spectrum. This range allows them to be used in many photovoltaic applications as well as bioindicators. However, PbSe quantum dots are susceptible to oxidation and therefore require a protective outer shell before they can be used in solar cells or biological systems. To address this issue we created the PbSe/CdSe core/shell quantum dots by initiating a cation exchange process between the Pb ion in the core and the Cd ion in a Cd(OA)₂ solution. The quantum dots were characterized using a fluorimeter and UV-vis-IR absorption spectrometer to measure the absorption and emission spectra of the quantum dots. The absorption spectra of the core/shell quantum dots show a blue shift relative to the core only quantum dots as expected from the reduction in core size. Over time, however, the core/shell particles underwent a subsequent redshift, suggesting that the initially asymmetric CdSe shell was becoming increasingly concentric over time. The quantum yield of the quantum dots increased with the growth of the CdSe shell as expected. Remarkably, over the course of two weeks, the quantum yield of the PbSe/CdSe core/shell quantum dots further increased and we aim to understand this process by determining the change in excited state lifetimes using time-resolved fluorescence spectroscopy.

The Impact of Sex Education on African American Adolescents

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BACKGROUND: Scholars in various disciplines consider the Black adolescent population to be at great risk due to an increase in cases dealing with HIV/ AIDS, STDs (sexually transmitted diseases), and STIs (sexually transmitted infections), unplanned pregnancies, and other sexual risk behaviors. This paper will examine and identify the impact of sex education on African American adolescents, sex education curriculum provided to the adolescent population, including those of different racial and ethnic groups, and also focus on the positive and negative outcomes based on the knowledge, beliefs, and risk behaviors of the African American adolescents. Literature on sex education often only acknowledges certain sub categories within the population, leaving out research that cover the whole population

METHODS: The project uses secondary analysis also referred to as research analyses with existing data. I used publicly accessible information and data to generate my hypothesis, and then used intersectionality as a theoretical framework to analyze the data and information gathered. The theory of Intersectionality was formally introduced by American feminist scholar, Kimberle Crenshaw in the 1980's. Intersectionality is the study of intersections between forms or systems of oppression, domination or discrimination, and commonly used in the field of sociology to examine how social and cultural structures (race, class, gender, sexual orientation, religion, etc.) interact with one another.

RESULTS: Existing data from selected sociologists show that discussions in the area have been focused on three specific issues that have plagued black communities: the high rate of HIV/ AIDS, STIs and unplanned pregnancies. There is also evidence that there is a common misunderstanding of what sex education actually consists of. The literature also focuses on the two most common curriculums of sex education, which are comprehensive programs, and abstinence only programs, as well as the common misunderstanding of the term sex education sole purpose is to educate on abstinence only methods or prevention methods only. The proper definition of a sex education The evidence also suggests that comprehensive programs are more effective and possibly more suitable for Black communities.

CONCLUSIONS: Without the use intersectionality to guide scholars in their research they have missed key social and demographic characteristics of Black communities that may require strategic methods for the implementation of sex education programs. There should be further research on the current curriculum content of sex education provided to African American adolescents, and also the need to determine if there may be a relationship between the adolescents' social experiences and the sex education provided to them.

Dynamic Error Testing of a Laser Tracker

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BACKGROUND: Since the invention of the laser tracker in 1986, they have become the precision instrument of choice for industrial measurements with an accuracy of 25 micrometers at distance of several meters. Unlike other precision instruments, laser trackers were never held to a standard for accuracy until B89.4.19-2006 standard was introduced. The standard however did not include any information on how to ensure accuracy while using a laser tracker for dynamic measurements. In an attempt to begin the process of creating a dynamic standard, I have studied the dynamic accuracy of laser trackers with two main variables: speed and distance.

METHODS: To test the laser tracker's accuracy during dynamic measurements, tests were setup that would attempt to eliminate all variables except range and rotational speed. The laser tracker was placed at three different distances, suggested from the B89 standard, from an air bearing spindle that was turning a carbon fiber ball-bar uniformly clamped to the center. The bearing was controlled by a Labview program that adjusts and reads the rpm of the bearing. On each side of the ball-bar were two magnets that held two identical optical reflectors called spherically mounted retroreflectors (SMRs) that contain corner cubes in the design. One of the SMRs was used to collect the data, while the other was used as a counterweight. Placement of the laser tracker at approximate distances of 1, 2, and 4 meters from the bearing was next. I then collected data at three different speeds (25rpm, 50rpm, and 75rpm), in both clockwise (CW) and counter clockwise (CCW) rotations. The data collected was through a looped, spatial scanning measurements profile of approximately 800-1000 points in one 360 degree rotation. Once all the data was collected I then processed the data using an Excel spreadsheet.

RESULTS: My initial prediction was that the CW and CCW results would overlap, however, the data varied more significantly than expected. As the distance and speed increased the data appeared to become less accurate. Upon further inspection, the graphs and the data showed that the speed of the rotations created a larger error when increased compared to the increase in the distance. Analyzing the data sets, it appears that the CW tests fit the theoretical circle more accurately then that of the CCW tests.

CONCLUSIONS: The data collected showed fairly accurate results but is affected by different instrument errors such as the angular errors, as well as tracking error. One issue is that of the Labview program, which controls the air-bearing spindle rpm's, was known to have lag and stability issues. However, speed variation does not affect the accuracy of the circular path of the SMR, so the measurement data was very adequate for the purpose of the dynamic testing of laser trackers.

Hunger and Food Insecurity among College Students: Understanding the Problem and Identifying Solutions

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BACKGROUND: Food insecurity occurs when consistent access to adequate food is limited by a lack of money and other resources, according to the United States Department of Agriculture. In the past couple of decades, multiple studies have been conducted on the effects of food insecurity on students' performance at the K-12 level, but very little had been done to investigate effects at the college level. Recently, however, several studies have been initiated on college campuses and all suggest that the level of food insecurity among college students may be greater than the national average (14.5%).

METHODS: An exhaustive literature review was conducted to determine average levels, causes and effects of food insecurity at the college level. Qualitative methods, such as interviews with pantry founders and observations of food banks, were also used to determine the type of practices that exist and the type of resources that are offered.

RESULTS: The causes of food insecurity among college students appear to be directly linked to finances, specifically the rising cost to attend college, the lingering effects of the 2008 recession, and the lack of financial and food management skills. The effects of this food insecurity are adverse, negatively impacting academic performance, mental and social health, and dietary choices. The most common solution currently used to help alleviate this problem is campus food pantries. In the past five years alone, dozens of pantries have begun to pop up on college campuses across the United States. Not only do each of these pantries provide free food, but many also provide hygiene products and clothing items. Several well-developed pantries have even begun to offer nutrition or financial management classes, and still others have developed referral services with other programs that help students obtain useful resources such as food stamps or free housing.

CONCLUSIONS: Although previous studies have suggested that high rates of food insecurity exist at the college level, each study assessed insecurity by different methods. Moving forward, it would be beneficial to conduct a uniform study of food insecurity on campuses across the nation, providing us with a better picture of the overall problem. And while campuses have begun to address food insecurity by establishing food pantries, it is also necessary to expand research to further assess the causes and effects of food insecurity among college students. Doing so will enable campuses to identify best practices and offer expanded resources that will better meet students' needs.

CHARLOTTE COMMUNITY SCHOLARS PROGRAM

Race and Racism within the Community

Marcus Gaddy

University of North Carolina at Charlotte

Race and racism are complex concepts and can include facets of social construction, context, explicit individual racism/bigotry, unconscious/implicit bias, institutional effects, disproportionality, and disparity. U.S. communities face racial tension between law enforcement and community members, judges and teenagers, teachers and students, social workers and children. We seek to explore these topics in Charlotte-Mecklenburg.

In order to best understand race and racism, it is helpful to have a thorough race analysis. This project was conducted by researchers trained in such a race analysis. Scholarly literature, as well as secondary and primary data serves to inform the work. The goal of the study was to explore community stakeholders' understanding of and experience with race and racism especially before and after participating in a two-day intensive training/race analysis. Primary data are drawn from an online survey of 42 workshop participants (22 identified as White, 17 as African American/Black, 2 as "Other," and 1 as Asian; the two respondents who chose "Other" identified as Hispanic/Latino as did one respondent who identified as White; 7 identified as male, 35 as female, 0 as other; by age, 3=20-29, 16=30-39, 12=40-49; 9=50-59, 2=60+; by field, 23 in education, 7 in the courts/justice, 5 in other fields, 3 in social services, 2 in law enforcement, 1 - student, and 1 - not currently employed) to assess their consideration of race, racism, unconscious/implicit bias, institutional racism, disproportionality, and disparity before and after a two-day training/race analysis.

We found that participants 1) more narrowly define racism as individual acts of meanness/bigotry before the training and demonstrated a broader understanding of race and racism after the training, 2) had not explored unconscious/implicit bias prior to the training and saw the role of these elements after the training, 3) had limited knowledge of institutional racism, disproportionality, and disparity (often only in their particular field) and following the workshop better recognized the influence of racism across systems, and 4) attributed a better overall understanding of and commitment to dismantling racism to the training/analysis provided.

A clear understanding and acknowledgement of racism and its effects in America is essential to an equitable society. To that end, regardless of personal experience or individual race/ethnicity, we conclude that having a race analysis helps stakeholders see racism as bigger than individual acts of meanness and begin to explore their own implicit biases and the disparate outcomes within their agencies and institutions in order to dismantle racism and its effects.

CHARLOTTE RESEARCH SCHOLARS PROGRAM

iPads in Higher Education: An Exploratory Study

Spencer Gallant, Donna Lanclos, and Mendy Ozan

J. Murrey Atkins Library, University of North Carolina at Charlotte

In recent years, schools and higher education institutions have been increasingly implementing mobile technology in the classroom. This study examines the impact of iPad minis in the higher education sector. The purpose of this pilot project was to observe and describe the impact of mobile technology, specifically iPad minis in the classroom experience of students and faculty. Participants in this study involved a cohort of Kinesiology students as well as members of faculty and staff. Students were issued institutionally owned iPads at the beginning of the 2014-2015 academic year. Our research included conducting field observations in classrooms, labs, and clinical settings. The analysis reveals that iPad utilization is largely dependent upon which academic environments were best suited for the need of the device. The motivation and decision to use iPad minis varied across each context the students were in. Implications for the potential use of mobile technology in active learning and teaching are evaluated and contrasted with passive learning environments. In addition, the research obtained in this study will provide an insight as to how future health and human service classrooms can better manage and organize strategies using mobile technology to meet the educational needs of the students.

Growth and Electrochemical Analysis of Silicon (111) Micro-Wires

Alexander Gold, Jennifer Kessel, and Dr. Michael Walter

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Silicon micro-wires have the potential use as a flexible solar-generative material. Arrays of micro-wires have the application to be embedded in polymer and used to cover windows in order to generate energy from solar radiation. The structure of the micro-wire arrays allow them to be much more flexible than common silicon solar panels and possibly have a broader spectrum of solar absorbance due to a greater surface area. Other than their solar activity, the process and materials by which these silicon micro-wires are grown is important. We wanted the micro-wires to be grown in straight, patterned arrays and to the desired dimensions, 100 microns in length and 3 microns in diameter. If the wires are grown to this quality, they can be embedded in a polymer and light will transmit through the polymer in the areas where are no wires, an extremely important characteristic for use on windows. The wires were grown using copper catalyzed chemical vapor deposition of silicon 111 at temperatures near 1000° C. One main objective was to develop a procedure to grow the micro-wire arrays as desired in the reactor we used. Different factors in the growth process such as temperature, gas flow rate, number of samples in reactor, and time allowed to grow, all affect the way the wires grow. Depending on the reaction procedure used, some wire samples were mostly comprised of straight wires while others had wires going in many directions. The wires grown were later analyzed electrochemically to determine the doping of the wires and to test their efficiency as a solar device.

CHARLOTTE RESEARCH SCHOLARS PROGRAM

Mansplaining or Candidate-Splaining: A Large Scale Text Analysis of U.S. Senate Debates

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BACKGROUND: Political debates are a rare moment when candidates are asked direct, specific questions that they must respond to on the spot. Debates also allow for the candidates to interact with one another in a public venue where voters can witness their interactions. They are ideal situations to evaluate a candidate's unconscious language use, more specifically to determine if word choice hinders or helps a candidate's presentation of self to the voters. While there are thousands of research articles about debates, very few have examined more than one or two debates at a time. Banwart and McKinney (2006) conducted groundbreaking research wherein they compared the gendered language use of candidates in four different debates (two gubernatorial debates and two United States Senate debates). Their research concluded that female and male candidates adopt a different word choice style when debating. We greatly expanded the scope and ability to differentiate gendered candidate statements using text analysis software; we were able to compare more debates allowing for a more in depth analysis of the word choice of candidates. The research question for this analysis is; what are the differences in word usage between male and female U.S. Senate candidates in their responses to debate questions? Our hypothesis is that the female candidate's word usage will be different from the male candidate's word usage, even when controlling for incumbency, political party, and the type of statement the response was (policy oriented versus a trait oriented statement). Using 15 debates with different kinds of candidates (divided into statements) allowed us to more effectively analyze gender differences in the candidate's presentation of self.

METHODS: Looking at debates from the 2014 and 2012 election cycles, available from the C-SPAN archive, we evaluated whether a difference exists between the two genders in debate. To do this, we cleaned the closed captioning transcripts from each debate chosen¹ and then used Linguistic Inquiry and Word Count (LIWC) software, created by James W. Pennebaker, Roger J. Booth, and Martha E. Francis to parse out the differences among candidates' speech patterns. The unit of analysis is statements in the form of responses to debate questions regarding various issues within the debates.

¹ Selected using Kim Fridkin Kahn and Edie N Goldenberg's categorical groupings to obtain a relatively equal amount of all types of debates, i.e. male v. female, incumbent republican v. democrat challenger, etc.

National Cruise Missile Proliferation

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Weapons proliferation has been a long-standing concern since World War II. In a time when nuclear, chemical, and biological weapons are deployed domestically and internationally, it is of utmost importance to analyze who gains capabilities and how those capabilities influence international security. Cruise missiles are most often defined as unmanned, self-propelled vehicles that destroy themselves in an attack. A state fully capable of cruise missile technology might act more aggressively than a state possessing little to no capabilities. How advanced a missile is can also play a direct role in the number of casualties during conflict and war, as there is no trained personnel traveling with these vehicles, different warhead types and sizes carry different blast levels, and their travel range in addition to level of accuracy can decide how many people die in an attack. With the ability to better control the amount of casualties and the increased ability to strike a target safely from afar, cruise missiles can heavily impact who wins. These weapons have long been overlooked when evaluating the relationship between weapons proliferation and state actions, with precedence often given to ballistic missiles and unmanned aerial vehicles (UAVs). By analyzing when and how those capabilities were attained, we can not only fill in a missing gap of information but also see how great a role cruise missile technology plays in state action and international security. While we know who has them, we do not holistically know the exact capabilities of such missiles, when they were acquired, or who is buying and selling them. What more is that finding this information is difficult to track as these weapons are relatively inexpensive to produce and keep, in addition to the low number of personnel required for operating and maintaining them. Our focus is to define cruise missiles, to collect this information, and to code the multiple variables of cruise missiles into a dataset. They are categorized based on mission (land-attack or anti-ship), range, circular error probably (CEP), production (domestically produced or imported), and year of procurement. To find this information, we search through sources including but not limited to the internet, newspapers, and peer-reviewed articles in order to gather the best picture possible of what capabilities each state has as well as when and how they acquired said capabilities.

End User License Agreement (Eula) For Mobile Apps

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Time-Resolved Photoluminescence Properties of Thiazolothiazole Porphyrins

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With ever-rising demands for energy on the world market, there has been a call for improved renewable energy sources. Solar energy is an ideal candidate to solve the world's energy crisis. Photovoltaic devices are devices that absorb incident light and convert it to electrical energy. Currently, silicon-based solar cells dominate the market due to their relatively high photoconversion efficiencies (PCE), but costs of manufacturing make these devices an expensive option. Since organic materials have favorable optoelectronic properties (such as high molar absorptivities) they make a promising alternative to silicon for photovoltaic devices and the low-cost of manufacturing organic solar cells make them an economical substitute. The main disadvantage of organic devices is their relatively low efficiencies due in part to poor charge mobility. When a photon is absorbed by a chromophore, an electron in the molecule is excited to a higher energy level, leaving a "hole" in its place. This coulombically bound electron-hole pair is known as an exciton, which has a very short lifetime before the electron and hole will recombine, thus ending the excited state and the possibility of energy generation. In order to harvest energy from the system, the exciton must diffuse to an electron donor-acceptor interface, where the excited electron and hole can be separated into free charge carriers and each can move to its respective electrode. To improve organic solar cell PCE, new photoactive materials have been designed. By coupling electron deficient thiazolothiazole (TTz) and electron rich Porphyrins to create novel electron donor-acceptor-donor (D-A-D) systems, these excited electrons can be funneled to the electron deficient portion of the molecule enabling better charge separation and therefore improved charge mobility. This project conducts preliminary analysis of the photophysical properties of 2,5-diphenyl-thiazolo[5,4,d]thiazole, 2,5-dithienyl-thiazolo[5,4,d]thiazole, [5,15-Bis(trimethylsilyylethynyl)-10,20-bis(2,6-dioctoxyphenyl)porphinato] zinc (II) and [15-Bis(trimethylsilyylethynyl)-10,20-bis(2,6-dioctoxyphenyl)porphinato] zinc (II) to be used in D-A-D/A-D-A motifs. The absorption and fluorescence spectra of have been obtained and fluorescence quantum yields have been calculated. Time correlated single photon counting was also used to determine the excited state lifetimes of these molecules.

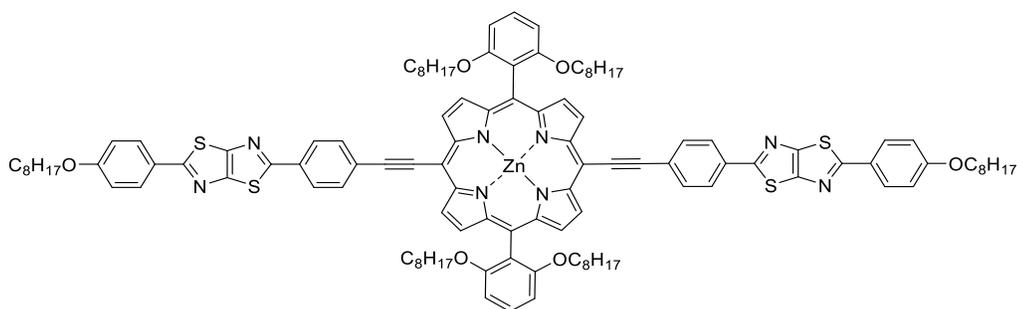


Figure 1. A-D-A motif utilizing diethynyl porphyrin (Zn) and diphenyl TTz

Microscale ruling for the manufacture of biomimetic optics

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BACKGROUND: Optics in nature have structures over multiple scales that perform optical functions ranging from focusing light to anti-reflective coatings to polarization sensitivity. The manufacture of such optics presents significant research challenges since it requires the production of structures with a size scale less than the wavelength of visible light on curved surfaces that may be many millimeters in dimension. In this project a “zero-stiffness” passive ruling device is designed and tested. The device has the potential for producing sub-wavelength structures on optical surfaces that may be spherical, aspherical or even freeform in nature. Applications include infrared imaging, surveillance, and consumer electronics.

METHODS: Several device concepts such as flexures and inclined planes were examined. A design consisting of a balanceable rotational inertia on an air bearing support was chosen by down-selection. The air bearing used had radial and axial stiffnesses of 2.3 N-m/mrad and 17 N/micron respectively. The air bearing error motions of ± 1 micro-inch at 40 psi with flight height of 3.7 micron. A single crystal diamond tool with a so-called “dead-sharp” tip (less than 100 nm nose radius) was mounted on the center inertia and balanced using precision screws. The system was mounted on a Moore Nanotechnology 350 FG diamond machine tool for testing. By introducing a small imbalance using a precision 3/16”-254TPI Fine Adjustment screw, a force as low as 0.5 milli-Newtons was introduced at the tool tip. The tool was brought into contact with a newly diamond turned naval brass 464 surface and moved along the surface using the machine axes to generate micro-scale features.

RESULTS: The device was mounted on the machine. A round nosed diamond tool was first used to diamond machine an optical quality test flat. The force level on the device was set at four different levels: 0.25 mN, 0.5 mN, 1 mN and 10 mN. The tip of the device was brought into contact with the workpiece at each force level. The tip of the device was then moved over the workpiece to nominally make linear structures separated by: 0.1 μm , 0.5 μm , 1 μm and 10 μm . Results of the tests were measured in the SEM.

CONCLUSIONS: A zero-stiffness ruling device can be used to draw sub-wavelength features on an optical surface. However, the following challenges remain: (1) damping tool oscillations; (2) calibration the force level and depth of the features produced; (3) testing the device for cutting features on curved optical surfaces.

Cultural Adaptations of Behavioral Interventions for Binge Eating in African-American Women – The Meaning of Food

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BACKGROUND: Binge eating is defined as “eating, in a discrete period of time, an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances,” accompanied by a sense of lack of control. Diagnosis of binge eating disorder is classified as having at least one episode per week for three months. Most research on binge eating has focused on White, middle-class women, but there is a gap in the literature about the experiences of binge eating in minority women. Social and cultural factors are likely to influence binge eating behaviors and the symptoms experienced by women.

METHODS: Secondary data analysis of a previous study at UNCC was conducted. Eight African-American women were recruited from local community and service organizations as well as the UNC-Charlotte campus to participate in one of three 2-hour long focus groups. Informed consent was obtained and participants were provided a book entitled *Overcoming Binge Eating* (Fairburn, 1995). Three weeks after the book was provided, focus groups were held, recorded, transcribed, and manually analyzed for common themes.

RESULTS: This project identified two consistent themes with regard to the meaning of food for African-American women: food as an expression of love and food as a self-portrait.

CONCLUSIONS: Binge eating is a significant problem in African-American women, but current interventions could potentially be more effective if they took into consideration cultural differences within minority populations. This project highlighted that some of the practices surrounding food in its social context may present barriers to African-American women who are trying to prevent binge eating.

Producing Works: Divergent Thinking in Teens

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When Bloom's taxonomy was revised (2001), 'create' became the new cognitive summit expressed in thinking, innovation and scholarly work (Simmons & Daley, 2013). Our nation depends on our youth's creativity and innovation, however the education system "seems to place increasing emphasis on acquiring knowledge through traditional approaches. An implicit assumption appears to be that "knowledge should come before creativity"(Department for Education 2013). Influential scholar and advocate for the importance of creativity in the educational system, Ken Robinson explained divergent thinking was hard to encourage in the classroom because of time and assessment, but advocated for the arts as "a ripe forum" for fostering divergent thinking (Robinson, 2008). Though multiple studies support the effectiveness of arts integration as a tool for divergent thinking across the curriculum using the arts as a tool, divergent thinking skills are at risk in mainstream education (e.g. Burnaford 2007). In alliance with the "Cotton and Collards" project, I explore how arts-based activity supports creative or divergent thinking in teens. "Cotton and Collards" asked teachers to develop projects for their students that attempted to uncover stories about our connections to the earth through food and fabric using arts-based strategies. Focusing at the culmination of the pilot phase, I use discourse analysis (Gee 1988) of student interviews and presentation as well as artifact analysis to identify themes and patterns. Teacher prompts and instruction are analyzed as well. Analysis codes reveal patterns in both student and teacher facets. Student codes emerged as: art words, identity/perspective, approaches to abstraction and interpretation tools. Teacher codes emerged as: intentions, verbs in explanations, examples and strategies. The contribution of this inquiry at the pilot culmination includes a series of recommendations to foster divergent, symbolic thinking in the next phase of in-classroom activity as well as a sequence of three recommended activities to prompt divergent thinking through the arts in the project, and potentially beyond it.

The Effect of Notch and Exercise in Aged Skeletal Muscle

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As skeletal muscle ages its ability to grow and repair itself declines. This loss in muscle mass and performance associated with aging is termed Sarcopenia. Sarcopenia is the degenerative muscle disease in older adults that affects muscle mass as well as muscle strength. Statistics indicate that after age 50, muscle mass decreases at an annual rate of 1-2% [2]. The burden of this disease varies by population, however, on average 5-13% of elderly people aged 60-70 years are affected by sarcopenia. The numbers increase to 11-50% for those aged 80 or above [2]. While there are many biological and environmental factors that contribute to sarcopenia, this research is devoted to the interaction of Notch and Wnt signaling pathways in relation to muscle regeneration. Notch and Wnt signaling have been noted to play a critical role in cell fate during embryonic development [1]. With this information, the concept of this project has hypothesized that Notch and Wnt are important for postnatal myogenesis in aged skeletal muscle. Unlike previous research performed on this topic, this current study takes a new approach by using physiological stimuli (exercise) to induce injury. In the past, research has only used artificial models such as localized freeze injury of a muscle. The use of physiological stimuli presents a more holistic approach to muscle regeneration in aged skeletal muscle. The methods for this project were physiological stimuli induced in aged mice through down-hill running. Notch inhibitor and Phosphate Buffered Saline control were injected into the left and right gastrocnemius muscles respectively. Once muscle tissue was harvested, immunofluorescence was performed using antibodies directed to Wnt signaling markers (ABC and Lef1). In conclusion, findings of this project indicate that Notch inhibition appears to increase skeletal muscle damage and reduce the overall ability to repair itself. This indicates the significance that the Notch cell pathway has on the muscle repair process. Additionally, this information may open new doors for the role of Notch and lead to further investigation of Wnt signaling.

1. Arthur, S. (2012). The Effect of Physiological Stimuli on Sarcopenia; Impact of Notch and Wnt Signaling on Impaired Aged Skeletal Muscle Repair. *International Journal of Biological Sciences*. Retrieved July 7, 2015.
2. Von Haehling, S., Morley, J., & Anker, S. (2010, December 17). An Overview of Sarcopenia: Facts and Numbers on Prevalence and Clinical Impact. Retrieved July 7, 2015.

Utilizing Community Engagement in the Development of an Online Culturally-Based HIV Prevention Intervention for Young Black MSM and Transgender Women

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BACKGROUND: The U.S. Centers for Disease Control and Prevention estimates that approximately 50,000 people in the United States are newly infected with HIV each year; at the end of 2012, an estimated 1.2 million persons aged 13 and older were living with HIV infection in the United States. Young black men (ages 18 to 30) who have sex with men (MSM) and black transgender women who have sex with men (WSM) are shown to have a higher rate of HIV incidence when compared to other racial and age groups. There is a need for programs which are culturally-based, rather than adapted, to better serve these populations.

METHODS: We developed a new, culturally-based HIV prevention intervention online (*Statusboiz/Statusgurlz*). The web-based program includes a private social networking website for members of the focus community that contains culturally grounded information related to mental, sexual, and overall health and wellness. The project's website follows a holistic approach of varied health content, including: HIV/STD information, career/education advice, education related to safer sex practices, and a video series about sexual risks created by the target population. To increase its acceptability and impact, members of the targeted populations were engaged in its design and implementation.

RESULTS: Currently, there are 440 users registered on the project's website. Of those, 65 met the study's original screening criteria (*between the ages of 18 and 30, identify as Black, assigned male gender at birth, have sex with men*). Based on feedback from young Black transgender WSM in the focus community, an additional site was created (*Statusgurlz*) to be both inclusive of transgender women in our outreach efforts, but also to respect their unique needs as separate from the MSM involved with the project. Multiple time-series data collected over 7 months indicates that about one-third of the study group has at least some college education, most earn \$30,000 or less annual gross income, and about 82% have been tested for HIV. Additional data, including relationship statuses, were collected as well.

CONCLUSIONS: Involving members of the project population is critical in understanding and addressing the specific needs, strengths, and vulnerabilities of the targeted group. The creation of a collaborative council to provide leadership from the community assisted in the validity of the data collected, in addition to helping acknowledge the differences among and within sub-groups. Data collection is ongoing and we will continue to establish effective ways to distinguish MSM and transgender WSM as two separate populations, despite their potential for similar risk behaviors.

Hydrocarbon Degradation in Marine Microorganisms

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BACKGROUND: Bioremediation is defined as “the process in which microorganisms are used to systematically destroy contaminants by breaking down the organic material in contaminated soil and water.” Bioremediation is a very important process that relies heavily on the help of hydrocarbon degrading bacteria to break down the organic contents, especially in marine environments, in response to oil spills. Since there are a limited number of marine hydrocarbon degraders in pure culture, we want to culture more of these microorganisms for physiological and genomic characterization.

METHODS: We collected seawater from Huntington Beach State Park, South Carolina. To maximize the diversity of hydrocarbon degraders, we added four different hydrocarbons: crude oil, benzene, cyclohexane, and hexadecane. In addition, we incubated cultures under four conditions: 4°C Shaken, 4°C Not Shaken, 28°C Shaken, and 28°C Not Shaken. We incubated for three weeks before extracting DNA to quantify microbial growth and analyze microbial community composition. 5 ml from each culture was transferred to artificial seawater media and then to agar plates to ultimately isolate microbial colonies.

RESULTS: The crude oil and hexadecane hydrocarbon treatments had the highest DNA concentrations and showed the most rapid growth, as measured by culture turbidity, but cyclohexane and benzene treatments also showed consistent growth. Cultures are currently growing on plates and will be isolated by successive transfers.

CONCLUSIONS: We succeeded in growing cultures in lab and will analyze microbial community composition with different conditions.

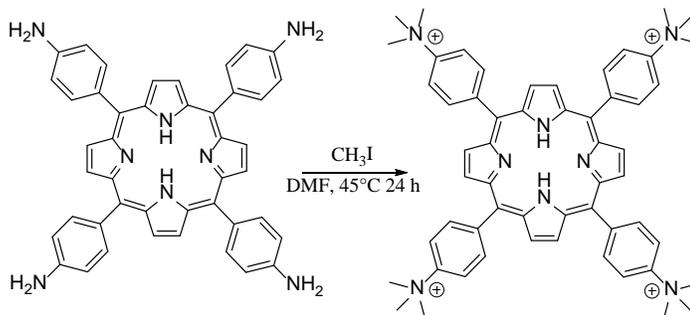
Cationic Tetraaryl Porphyrins for Use in Photodynamic Inactivation: Synthesis and Characterization

Jessica Hovey¹, Alexandra Hurst², and Juan Vivero-Escoto²

¹Department of Chemistry, Oakland University

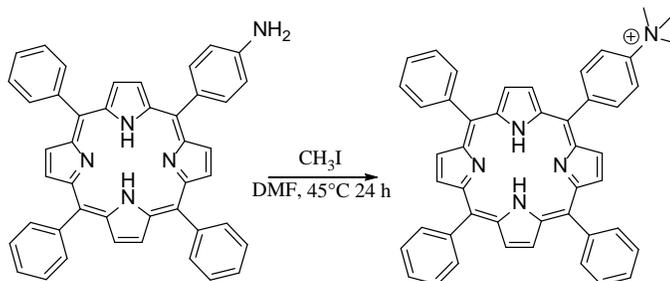
²Department of Chemistry, University of North Carolina at Charlotte

Photodynamic inactivation (PDI) provides an effective way to eliminate localized infections in the body without the use of antibiotic drugs. This novel method features the transport of a photosensitive molecule or photosensitizer (PS) to the infected site. The PS is then activated by the irradiation of visible light (600-800nm) to produce singlet oxygen which then induces oxidative damage to microbial pathogens. The PSs of interest in these experiments involved two cationic porphyrins: 5,10,15,20-Tetrakis(4-N,N,N-trimethylanilinium)porphyrin and 5-mono(4-N,N,N-trimethylanilinium)-10,15,20-triphenyl porphyrin. These molecules were synthesized by an alkylation reaction from the corresponding aminophenyl porphyrin compounds. The cationic porphyrins were characterized by using ¹H NMR (nuclear magnetic resonance), ¹³C NMR, IR (infrared) spectroscopy, singlet oxygen generation, fluorescence spectroscopy, UV-vis (ultraviolet visible spectroscopy), and MALDI-IMS (matrix-assisted laser desorption ionization as mass spectroscopy imaging). The antimicrobial properties of these compounds will be tested *in vitro* using *E. coli* cells.



Methylation of 5,10,15,20-tetrakis-(4-aminophenyl) porphyrin.

E c



Methylation of 5-(4-aminophenyl)-10,15,20-(triphenyl) porphyrin.

Interferometric Measurement of Surface Roughness

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Form, waviness, and roughness are components used to describe surfaces. Each of these components are spanned over different spatial wavelengths of the surface features. The cutoff wavelength for these components varies, however, for this research, the cutoff wavelengths are based on ISO 4287. Form is the shape of an object, and has a spatial wavelength cutoff of 2 mm. Waviness is the imperfections on a surface of spatial wavelength with a cutoff between 0.8 and 2 mm. Roughness is the imperfections on a surface with a spatial wavelength cutoff at 0.8 mm. There are several different methods that are used to characterize form, waviness, and roughness. Interferometry is the method that is used for this research. There are two types of interferometers used to measure surfaces in this research: LASER Fizeau and a scanning white light interferometer (SWLI). A Fizeau interferometer measures the entire optic being examined, allowing the form and the waviness to be measured. A SWLI examines a small part of the surface, allowing the roughness to be measured. An interferometer uses a light source, white light or a HeNe LASER in this case, to take a measurement of the surface. A Fizeau interferometer sends a laser through a reference surface, and when the beam is reflected off of the surface, detects the phase difference. In the SWLI, much like a Michelson interferometer, a beam splitter separates the light into two waves, one continues to the surface, and the other towards a reference mirror. Both beams reflect back and the phase difference is measured. Using the measurements, a computer program uses a filter to sort through data, and compiles a matrix of data points based on the height of the surface. The results of this research were encouraging. The processes being examined removed waviness from the surfaces by a factor of about 10 percent, without changing the roughness of the surfaces drastically. Future work for this research includes more inquiry into processes that alter the waviness of optical surfaces, without affecting the form and roughness.

Preservation of Dried Liposomes in Sugar-Based Protection Formulations

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BACKGROUND: Long-term storage of biologics, such as cells and tissues, significantly benefits areas such as human reproduction and conservation of species. Even though cryopreservation is currently the main approach used, dry storage is proposed to be a low-cost alternative. Liposomes are known for their use for drug delivery and, are often used as a model system for cells. Here we established a high throughput screening method to evaluate the effects of different sugar-based stabilizers on the membrane integrity of dried liposomes.

METHODS: A serial dilution of carboxyfluorescein was performed and then tested on a plate reader to determine when self quenching occurs (Figure 1). A 1,2-dipalmitoyl-*sn*-glycero-3-phosphocholine (DPPC) liposome suspension was prepared by combining 10 or 20mM DPPC with 100mM Carboxyfluorescein (CF), 1mM HEPES buffer and different concentrations of trehalose (Tre) (0 and 500mM). Subsequently, the liposome suspension was extruded through a 100nm filter. The liposome suspension was filtered through a Sephadex G-50 spin column. The extra-liposomal CF, trehalose, and HEPES were separated from the suspension based on size exclusion chromatography. The loaded liposomes pass freely through the column and are collected in a 1mL centrifuge tube. If trehalose was used initially it was added to the filtered liposome suspension so the trehalose concentration was the same on both sides of the liposomes. The filtered liposome suspension was dried in a 96 well plate for 48 hours (50 μ L droplets in each well). Half of the dried samples were rehydrated with 0.1% Triton-X to induce membrane destruction and the other half were hydrated without Triton-X. The CF retention was calculated by subtracting the amount of CF leaked from the amount of CF total, and then dividing by the total amount of CF.

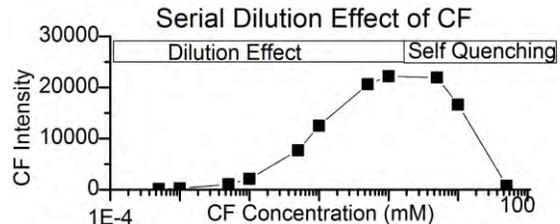


Figure 1: Dilution series of CF demonstrating self quenching which begins at 5mM CF.

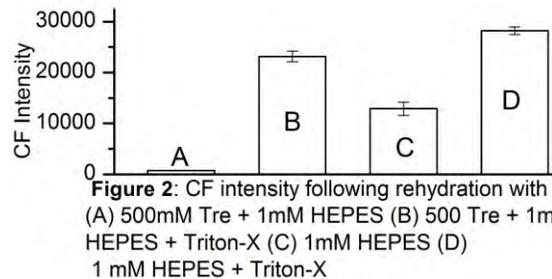


Figure 2: CF intensity following rehydration with (A) 500mM Tre + 1mM HEPES (B) 500 Tre + 1mM HEPES + Triton-X (C) 1mM HEPES (D) 1 mM HEPES + Triton-X

RESULTS: When we air dried liposomes in a plate reader it was discovered that uneven drying occurs. However, air drying using only the second outer rim of a 96 well plate resulted in even drying. It was demonstrated that trehalose preserved membrane integrity with 96% CF retention (Figure 2). In conclusion, trehalose was shown to stabilize liposomes during drying.

Lock-In Detection Using a CCD Camera for Spectroscopy Applications

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BACKGROUND: Traditional lock-in detection measures a very weak optical signal through amplification of a single detector such as a photodiode. This signal is filtered by a specified frequency and phase. Detection of signals of different wavelengths requires a very inefficient scanning mode where wavelengths are tested one by one. A CCD camera, charge coupled device, is a two-dimensional array of photodiode detectors. These dimensions can be used to detect a range of wavelengths instead of a single wavelength. By using a CCD camera, consisting of approximately 500,000 pixels, multiple wavelengths can simultaneously undergo lock-in detection. The ability to simultaneously measure multiple weak optical signals has many applications in the field of optical engineering and subsequent science disciplines.

METHODS: An optical chopper, which is like a rotating fan, converted a continuous laser or light signal into an alternating or chopped signal at a specific frequency. This signal hit a sample, and the resulting optical signal was sent to an optical spectrometer. This spectrometer has a grating to disperse the different wavelength components of the optical signal to different pixels of a CCD camera. The signal generated by each pixel can be converted into in-phase and quadrature parts. Phase and amplitude plots could then be constructed by manipulating the in-phase and quadrature measurements. Each pixel functions like a lock-in amplifier, and a CCD camera is turned into an array of approximate 500,000 lock-in amplifiers for parallel weak signal detection.

RESULTS: Time varying electrical signals appeared at multiple wavelengths or frequencies, which demonstrated proof of concept by showing that chopped light caused the signals. The sampling rates for these spectra, however, were inadequate for data analysis, such as isolation of in-phase and quadrature components. The maximum recorded sampling rate was .625 Hz while the desired rate was 10 Hz. This issue prevented isolation of in-phase and quadrature components as well, but can be resolved either through software modification or hardware replacement.

CONCLUSIONS: Preliminary analysis predicted dramatic improvements in the signal to noise ratio which has been confirmed in other studies. Some physical and software limitations in data collection prevented quantitatively confirming improvements in the signal to noise ratio as well as mapping illuminated areas. These issues can be avoided in future experiments by acquiring a frame grabber and creating a customized program to acquire data from the CCD camera. The potential for improved contactless sample maps are invaluable in industries such as for solar and computer applications. Further exploration in lock-in detection will lead to faster contactless mapping

CHARLOTTE RESEARCH SCHOLARS PROGRAM

**Adaptive/Assistive Technology for Children with Developmental Delays:
Automated Astronaut Training Board**

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While there is a significant amount of research related to technologies to assist people with physical disabilities, there is little research on the effects of technology in aiding people with developmental delays. The first objective of this research project was to identify applications where embedded technology would be useful in aiding children with developmental delays or other mental disabilities. Secondly, the application that proved more beneficial in assisting and developing the learning skills for the students' education and futures would be chosen as the main focus for this program.

The chosen area that was determined would benefit from embedded technology research was the Astronaut Training Board (ATB) from Astronaut Boards LLC. The program can actually help prevent some developmental delays from occurring by utilizing the post-rotatory response of a person, which thereby forces the visual system to be exercised. However, the boards currently available on the market must be operated manually. By automating these devices via embedded systems, parents/guardians and occupational therapists that work with children facing developmental delays and other mental disabilities will have more optimized tools, thereby furthering children's capabilities, and therefore their education. A prototype of the automated ATB was then to be engineered and designed as the final phase of this project.

Charlotte's Butterfly Highway

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BACKGROUND: A combination of climate change, habitat degradation, and pollution has caused the diversity and population numbers of butterflies and other pollinators throughout Charlotte to significantly decline. When observed, urban areas of low socioeconomic status are prone to less green spaces and, as a result have low species diversity. Through individual ecological research activities, such as documenting pollinator species within three neighborhoods, a baseline for biodiversity in Charlotte will be created. Then to engage with the community, a social research objective has asked participants to maintain a garden plot and document which butterfly species frequent. The developments of both aspects of the Butterfly Highway Project aims bolster the formation of pollinator species habitats within Charlotte's underserved communities.

METHODS: 1. Ecological: I completed Pollard walks within three neighborhoods (Enderly Park, Washington Heights, and Graham Heights), documented the location of every garden (floral and vegetable) and every site of a butterfly sighting with a GPS; sunny days with low wind activity were optimal. I utilized this information to create a standard for pollinator species within these areas. 2. Social: Butterfly gardens were planted at the homes of residents who lived within five Charlotte neighborhoods (Druid Hills, Enderly Park, Graham Heights, Northwood Estates, and University Park). The gardens consisted of native butterfly plants, including Milkweed, Tickseed, and Aster, that are necessary for species survival. Participants who received gardens were also asked to document sighting of pollinators and report their findings back to me. When I returned to participant homes to collect their findings I would conduct an interview and take field notes on the health and maintenance of the garden plot, but also inquire about any other personal observations that were made.

RESULTS: 1. Ecological: I have found that more established neighborhoods with at least one garden, that may or may not incorporate native plants, per two houses have more instances of butterfly activity than newer developments. 2. Social: I have found that residents with established floral or vegetable gardens that incorporate native plants, and receive partial sun are more likely to see pollinators. This contrasts residents with only the planted butterfly highway garden.

CONCLUSIONS: Due to the amount of green spaces already within Charlotte, pollinator species will continue to frequent the city. However if those green areas were to incorporate native plants that are beneficial to pollinator survival, especially in underserved communities, an increase in populations and diversity is likely to occur. The awareness established through community engagement, paired with the development of Pollard walks and a Charlotte baseline from my research may be used to supplement future examinations on the subject.

One-dimensional Nano-cable Heterostructures for Enhanced Solar Energy Harvesting

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The long term goal of this project is to develop one-dimensional (1D) nano-cable heterostructures based on transparent conductive oxide (TCO) nanowires for high-efficiency solar energy harvesting. During this summer project, growth of indium tin oxide (ITO) nanowire arrays has been explored to realize controlled growth using a home built chemical vapor deposition (CVD) system. Effects of different growth parameters, including source material, heating temperature, catalyst, and flow rate, have been studied to reveal the growth mechanism. The growth of ITO nanowires can be explained by the vapor-liquid-solid (VLS) and vapor-solid (VS) mechanisms. The as-synthesized samples were characterized using scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDX). The ITO nanowires developed in this project will serve as the cores for the further development of nano-cable heterostructures using multiple CVD steps.

A Novel Miniaturized and Integrated Endoscope Tip for Laser Lithotripsy

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It has been demonstrated that fiber laser technology can be used to deliver high power through ultra-small, flexible, and biocompatible silica optical fibers (with diameters smaller than a human hair) for rapid and precise minimally invasive surgery. This practice has been adopted for endoscopic fragmentation of kidney stones during laser lithotripsy procedures in patients who suffer from kidney stone disease. Currently available flexible ureteroscope tips generally range from 5.3 Fr (1.8-mm-OD) to 8.7 Fr (2.9-mm-OD), often with even larger proximal shafts and working channels on the order of 3.5 Fr (1.2-mm-ID). Current laser lithotripsy procedures involve full anesthesia and possible dilation, frequently requiring significant associated costs. Development of a miniaturized ureteroscope with a sufficiently small diameter may allow for laser lithotripsy to become an outpatient, office-based procedure, with potential to reduce operating costs up to 80%. A prototype ureteroscope tip was constructed out of polyimide tubing with a 4.5 Fr (1.5 mm) outer diameter, housing 5 cylindrical channels: a central channel with an inner diameter of 200 μm for small optical fiber insertion and 4 surrounding channels each with 510 μm inner diameters for instrumentation, irrigation, imaging, and illumination, respectively. Stone retrieval basket insertion through the instrumentation channel was demonstrated with a 1.3 Fr (450 μm) diameter basket sheath, with the basket itself opening to an 10 mm maximum diameter once the channel had been cleared. Guidewire insertion through the working channel was also achieved with hydrophilic guide of 18/1000 inch (450 μm) diameter. Irrigation flow rate tests were conducted using an I.V. bag saline drip, revealing the need for pump-assisted irrigation. Irrigation rates of 3-4 ml/min were measured with gravity flow versus 30-40 ml/min for manually assisted syringe pump irrigation. This endoscope design exhibits potential for imaging with currently available small industrial borescope image bundles inserted through one of the working channels. Borescope systems at this diameter (0.5 mm) can achieve 3,000 to 6,000 pixel resolution. Future imaging experiments will help to determine whether this resolution is adequate for resolving hard (stone) and soft (ureter, kidney) tissues during lithotripsy. Illumination studies were conducted with 400- μm -core (430 μm outer diameter) optical fibers with both 0.22 and 0.48 numerical apertures illuminated with a 150 Watt quartz halogen light source. A photodiode detector was used to determine power levels from the load resistance, output voltage and responsivity of the light source-diode system. The power values calculated were then used to determine power density results for both fiber optics. This data collected will be compared with future imaging experiments to determine optimal illumination parameters for the endoscope design.

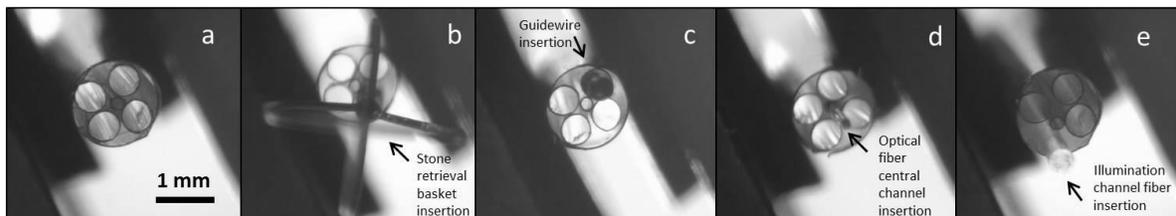


Figure 1. a) Prototype five channel ureteroscope tip design with 510 μm inner diameter working channels and a 200 μm inner diameter central channel. b) A 1.3 Fr (450 μm) stone retrieval basket device inserted through a working channel and then deployed to a 10 mm diameter. c) Insertion of an 18/1000" (450 μm) hydrophilic guidewire through a working channel. d) A 100- μm -core (170 μm outer diameter) optical fiber inserted through the 200 μm inner diameter central working channel. e) Insertion of 400- μm -core (430 μm outer diameter) illumination fiber through working channel.

Planning Memory and Heritage: The Private Side of Public History

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BACKGROUND: The privatization of public spaces leaves the authority to interpret history in the hands of people who potentially have different goals for their interpretation than would a wholly government-funded institution. The National Heritage Area (NHA) Program designates 49 areas nationwide as important to the heritage of American culture, and under this program many parks and museums have become partially privatized while still able to apply for federal funding using their affiliation with the NHA program to appeal to the National Park Service for financial support. The resulting changes in historical interpretation are based in a museum's motive for interpretation, whether it be for historical preservation, land conservation, for profit, or for the sake of encouraging tourism and stimulating the local economy. By investigating specific sites affiliated with the NHA program, this study aims to assess to what degree the privatization of public spaces has impacted their interpretation of history.

METHODS: Four NHA's were selected for examination. The Erie Canalway National Corridor in New York was chosen for its significance to the unprecedented progress of infrastructure in a newly industrialized area. The MotorCities NHA in and around Detroit, MI, focuses on a similar theme in their interpretation of automotive history in the birthplace of the assembly line. Another intersection assessed in this study is the transition of power and how it since has affected the local populace. The Tennessee Civil War NHA commemorates the many bloody battles fought and lost by Confederates on their own land. The Northern Rio Grande NHA serves as a unique case study of how certain elements of a culture remain after a change occurs in the governing body; the junction between three cultures, Native, Spanish, and American, is specific to the American Southwest and is explored by the Northern Rio Grande NHA. Reading management plans and selecting museums to look at within each NHA allows questions about funding and the specifics of historical interpretation to be answered.

RESULTS: Some sites are geared towards children rather than adults; however, regardless of intended audience, museum dichotomies more often than not will leave out controversial histories so as to promote a history that is digestible by the largest possible audience. Public histories are written to inspire pride among the local community, which serves to keep people interested and coming back.

CONCLUSIONS: In the Erie Canalway, due to rapid and consistent industrialization, land conservation is most important among their listed initiatives. In MotorCities, an area that has suffered greatly from the recession, economic stimulation through tourism is its primary goal. In both Tennessee and New Mexico, the NHA's most prevalent agenda is the historical preservation of dying cultures, (i.e. Confederates and The Spanish/Natives, respectively).

A Computational Study of Buried Pipelines Subjected to External and Internal Pressures

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Earthquakes, landslides and other seismic events can cause severe damage to underground structures such as fiber-optic cables, electric cables and the pipelines used to transport natural gas and oil. Therefore, it is important to understand the response of these structures due to sudden ground motion in order to better design the structures. The present study examines the behavior of a buried pipeline caused by the external pressure exerted by the surrounding soil and the internal pressure exerted by the gas carried by the pipeline. The finite element method has been selected as the tool for examining the response of the buried pipeline. For the present work, the soil medium is replaced by the external pressure that it exerts on the pipe. In the analyses, first, the pipeline with only the external pressure is considered. Following this, the pipe response due to the presence of both internal and external pressures is considered. The pipeline is assumed to be made of APIX65 grade steel. The material behavior is assumed to be governed by J2, rate-independent plasticity theory with strain-hardening included. A three-dimensional finite element model of the pipeline has been developed using the commercial finite element software ABAQUS 6.11-3. The pipeline is discretized using shell elements and the analyses are carried out as quasi-static problems. In the present study shell mode of buckling is observed and purpose is to set criteria for onset of local buckling. For determining the onset of buckling two parameters have been taken into account: 1) Total Energy 2) Axial Strain. It has been observed that the total energy plot starts fluctuating and the plots of axial strain go down when buckling starts.

**Women and STEM Majors:
Does a Concern For Family Flexibility Steer Them Away?**

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BACKGROUND: The purpose of the study is to determine whether female students avoid STEM (Science, Technology, Engineering, and Mathematics) majors out of concern for family flexibility. The current enrollment in most STEM majors across the continuum of higher education shows a disproportionate ratio of males to females. This is evidenced not only in the numbers of women in those majors, but also in terms of enrollment in schools where STEM majors are the main focus of the University. This study will investigate some of the factors behind these trends.

METHODS: We use a series of interviews from a convenience sample of Community College students across the spectrum of age, sex, and background. The interviews include questions on each subject's background (both economic and familial), major, and, if possible, reasons for choosing that major. After the interviews are conducted, audio recordings of the interviews are transcribed. The data is then processed and studied in an effort to find patterns that might emerge out of the interview transcripts.

RESULTS: Through the process of using, as a baseline, both male and female subjects, the hope was that the research would reveal a possible link between a female's choice of major and the flexibility that major would offer the subject either currently or in the future in terms of family. Therefore, the key issue is whether women steer away from STEM majors because those majors do not offer careers that enable a female a flexible schedule that would allow for the care of that subject's family. While the results did not produce enough evidence to make a connection between a women's choice of major and her concern for family flexibility, a common theme quickly emerged within the interviews. The interviews illustrated a rather large connection with a student's confidence in her ability to succeed in the field of mathematics and her decision to choose a STEM major.

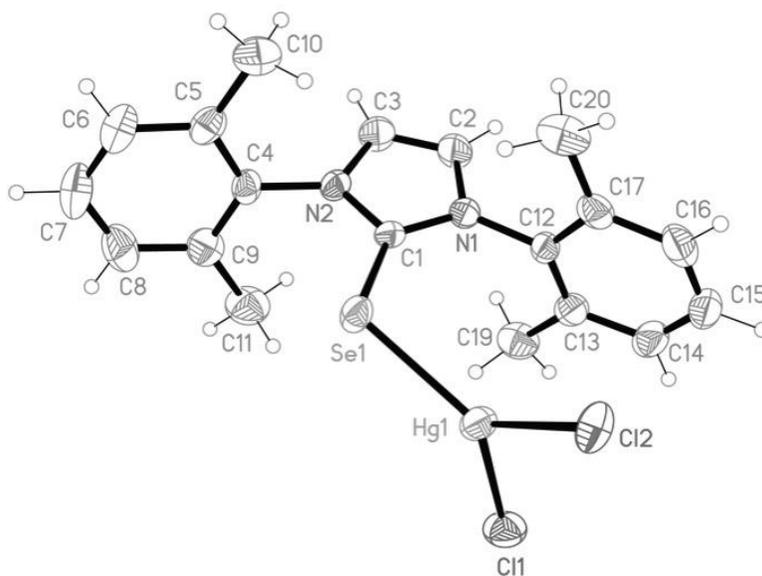
CONCLUSIONS: While women have come to the forefront of higher education in recent years, there remains a gap in the population of women in STEM majors. The initial goal of the study was to identify whether this gap is the result of any preconceptions that women have an extra obligation to care for a family in addition to preparing for a career. Instead of finding a clear connection between women and family flexibility, a common theme emerged with regard to a student's preconceived ability to succeed in Mathematics. Students who had high levels of confidence in their ability to succeed in Mathematics chose STEM majors more often than those who had a low expectation to succeed in Math.

Understanding the Toxicity of Mercury in Biological Systems

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Mercury is known to have high binding affinity for selenium, which is an essential trace element that is utilized in enzymes and amino acids, and may be the most important antioxidant element in the human body. Binding of Hg(II) to the active sites of selenoenzymes inhibits their functions and is one of the suggested mechanisms for toxicity of mercury. In view of several suggestions that the toxicity of mercury is linked to the biochemical roles of selenium, it is relevant to further develop the coordination chemistry that features mercury in a selenium environment. N-heterocyclic selenone (NHSe) ligands make great model compounds to study mercury(II) complexes since they are analogous to the amino acid derivative Se-methylselenoneine, which has been recently found in human urine and blood. NHSe ligands are air stable, moisture resistant, and electron-donating ligands that form strong metal-ligand bonds. These ligands offer versatile coordination binding modes, and variation of the substituents affects the coordination character of these ligands. The ligands IXYSe, IMesSe and IPrSe were synthesized and characterized prior to the study of their reactivity and binding modes. Then NHSe ligands were used to prepare LX₂ derivatives (L = IXYSe, IMesSe, IPrSe; X = Br, I) and their molecular structures were obtained via X-ray diffraction. Dihalogen complexes also have many applications, such as use in studies of treatment of hyperthyroidism, antithyroid drugs, dissolution of noble metals, and include superconducting properties. Nine complexes of general formula LHgX₂ (L = IXYSe, IMesSe, IPrSe; X = Cl, Br, I) were synthesized and characterized by a combination of analytical and spectroscopic methods. These complexes include mononuclear or dinuclear species with three- or four- coordinate mercury centers.



Quantifying In-Stream Habitat Complexity in Forested Urban Watersheds

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BACKGROUND: U.S urban forested watershed ecosystems have experienced an upsurge in restoration projects since 1987 due to amendments in the Clean Water Act. Mainly due to human infringements these habitats became a weak and insufficient environment. Joining the watershed restoration movement, scientists relied on benthic macroinvertebrates species richness and community density to prove health in a stream bed. Macroinvertebrates generate a vital role in all parts of the food pyramid as they work to cycle organic matter to microorganisms and are preyed upon by predators. Restoring and maintaining these macroinvertebrates is imperative for maintaining healthy watersheds. Since they spend most of their life span in the stream, it is key to have a diversity of habitats to sustain these organisms. We assessed Reedy Creek, a forested urban stream, to quantify habitat quantity and quality. These data will be used to evaluate the effectiveness of restoration for restoring habitat for macroinvertebrates.

METHODS: We sampled 150m reaches at 10 sites of Reedy Creek, NC. At each site we quantified numbers of pools, sand banks, riffles, and bends, as well as numbers of sticks, branches, root wads, and wood debris obstructions. Photos exemplified watershed transitions every 10m totaling 16 transitions for each site. Six sample habitats were quadrated at each site by $.61\text{m}^2$ to quantify pebbles, cobbles, sticks and branches that were available. Inventory was taken by the following measurements of diameter, pebbles $> 6\text{-}35\text{mm} < 63\text{-}5\text{mm}$, cobbles $> 63\text{-}5\text{mm} < 254\text{mm}$, sticks $> 6\text{-}35\text{mm} < 25\text{-}4\text{mm}$, branches $> 25\text{-}4\text{mm}$.

RESULTS: The habitats among all 10 sites were relatively similar. Creek beds carried more shifts in sandy to cobbled beds with more bends overall in the watersheds of agriculture land-use and the control watershed. Watersheds with less varied streambeds included the urban developed land-use, the pond influenced site, and the Reedy Creek main stem. Wood debris amounts were unusually high at the pond site watershed, in contrast to the main stem watersheds which confined particularly low amounts of wood debris.

CONCLUSIONS: Based on an earlier feasibility study (Charlotte-Mecklenburg Storm Water Services), reaches at Reedy Creek have been graded as poor to fair/good based on macroinvertebrate communities. Our results suggest differences among habitats present within the 10 sites to support healthy macroinvertebrate communities. The pond site watershed has large amounts of organic materials which may be due to previous flood bank instability as there were 21 root systems outgrown over the banks. Lower main stem sites lacked organic material potentially due to lack of stream bends and simple stream beds. The control site (which will not be restored) had the most average and varied of all measures counted. We find that the difference of landscape and overall damage to individual sites heavily impact the ability of the sites to continue to benefit the environment.

Building a Raspberry Pi Robot

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The Raspberry Pi is an inexpensive and small credit-card sized computer developed by the Raspberry Pi Foundation in the United Kingdom to make computing and programming accessible to everyone. The Raspberry Pi can run the open source Linux operating system, and also supports the Python programming language to make it easier for people to learn programming. The Raspberry Pi has been used for many applications including home security systems, portable Wi-Fi radio, and as a cheap mini-laptop. This project builds a low-cost mobile robot using the Raspberry Pi 2, which has an ARMv7 processor. It is intended to provide an understanding of physical components (e.g., motors, sensors), and interfacing and controlling hardware from computers. The robot is capable of driving forward, backward, and turning left and right. The robot also supports the ability to take video and pictures with an onboard camera under computer control. The construction and programming of the robot provides students with a basic understanding of electronics, computer programming, and robotics. In addition to education applications in physical computing, this robot can potentially be used as an inexpensive telepresence robot.

The Impact of Sunscreen and Other Chemicals on Water Quality in Public Water Features

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BACKGROUND: After a large-scale breakout of severe intestinal illness due to the presence of a water-borne parasite called *Cryptosporidium* in a New York State sprayground, disinfection systems for public aquatic facilities have started to be examined under a new light. The UV (ultra violet) disinfection system, which mutates the DNA of pathogens without adding more chemicals into the water, has emerged as a way to safely raise the standard of water quality.

METHODS: We used a two-fold approach to discover if and how much of the components of sunscreen were possibly getting to UV disinfection systems. In the lab, samples were analyzed for varying sunscreens and other ingredients in the sunscreens to determine solubility. The second part involved collecting samples from pools in the community and testing of them for sunscreen, UV absorbance, clarity, pH, and free chlorine concentration.

RESULTS: Operating under the distinction that anything dissolved will pass through a 0.4 micron filter, the tests in the lab showed that while it might not always be visibly obvious, the components of sunscreen are indeed dissolving into the water. Water samples collected from local pools and spray parks led to this conclusion, as they showed obvious signs of the presence of chemicals that are active ingredients in sunscreen. In most cases, the UVT decreased as the summer progressed, dropping 1-4% from the original value. While swimming pools tended to have UVT in the mid to low 90%'s, the spray parks were found to have UVT below 70%.

CONCLUSIONS: Throughout testing, it was shown that the active ingredients of sunscreen were dissolving into the pool water, either by way of reaction with the water itself or in response to the other components of the sunscreen in which they existed. Although much of the visible lotion was staying at the surface of the water, the active ingredients were not. Because these ingredients are dissolving and spreading in the pool water, they are also in the water going through the disinfection system. This becomes an issue when the pool water is treated/sanitized by a UV disinfection system. Since these chemicals are made to absorb UV light, their existence in that system will significantly lower the efficiency of the disinfection process. The typical recommended UVT of a pool using a UV disinfection system is 75% or greater, otherwise the UV light will have difficulty penetrating through the water. This leads to the risk of bacteria passing through the disinfection system unharmed, providing a potential health risk to anyone who comes in contact with the water.

The Evolving Capacity of International Human Rights Law: Argentina's Dirty War and Possible Accountability of Former US Policy Makers Under International Law

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During the 1970's and 1980's a Latin American joint intelligence operation code named Operation Condor targeted political opponents throughout Latin America, Europe and the United States. The military dictatorships of Argentina, Chile, Uruguay, Paraguay, Bolivia and Brazil participated in the illegal extraterritorial collective effort to silence left wing guerrillas, political dissidents, and anyone who may have had vague ties to socialism or "communism". Tactics included the utilization of state sponsored disappearance, torture, and extrajudicial execution of subversives. In the context of the Cold War, the United States government had many strategic interests in maintaining its relationship with these southern cone countries. The containment and end of communism was of the highest priority on the U.S. security agenda, and this is reflected in U.S. influence on these South American countries at this period in time. The true nature of the relationship between the U.S. government and the military dictatorships responsible for Operation Condor is becoming more clear as information is released. At minimum, U.S. foreign policy at the time allowed Operation Condor to continue. As new evidence comes to light, however, the nature of the relationship seems to be far more direct, with the U.S. not only approving of Operation Condor but also condoning its methods and providing intelligence and logistical support. This proposed project deals with the search for accountability of key United States decision makers during the time period of Operation Condor and Argentina's Dirty War through archival research on newly declassified documents. In the past 50 years international law has evolved in its capacity to hold individuals accountable for grave violations of human rights and the crimes committed by U.S. officials during Operation Condor have not gone unnoticed in the international arena. Although evidence is fragmentary, the use of various sources such as original U.S. documents recently released under the Freedom of Information Act allow for the piecing together of valuable information as to the involvement of the United States in these past human rights abuses. Documents reveal a new and much needed narrative that we believe will incriminate former high ranking U.S. officials in the supporting and harboring of a transnational state terror apparatus. The results of this research could suggest that former high ranking officials such as Secretary of State Henry Kissinger could be extradited and tried for his participation in the crimes that were committed during Operation Condor.

What are the Safety Concerns of Enderly Park Residents? Understanding the Problem and Identifying Solutions

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BACKGROUND: CHARP -The Charlotte Action Research Project - is a service learning program that forms partnerships between UNCC and low-income, minority neighborhoods in the Charlotte region. Our mission is to recognize neighborhood values and assets to incorporate teaching and action research to reduce inequality. We help encourage neighborhoods to be self-supportive, and create neighborhood organization. Since 2009, we have been working with Greater Enderly Park on research and neighborhood improvement projects to help encourage neighborhoods to be self-supportive, and create neighborhood organization. Through CHARP's sustained engagement with Greater Enderly Park, issues of safety and crime were continually brought to the forefront as primary concerns. The Women's Safety Audit (WSA) project tool is used to document neighborhood assets and concerns. Because of the proven value of the WSA and its alignment with the neighborhood's goals, CHARP researchers and residents embarked on this research project.

METHODS: We used Action Research Methodology. The project was designed to be mutually beneficial: residents were able to address their concerns with the support of CHARP researchers while CHARP could better understand how residents perceive the issues of safety in their surroundings. Within the WSA process, Greater Enderly Park residents were co-researchers, exploring their unique lived experiences. Our work predominantly focused on community engagement activities (neighborhood meetings, neighborhood cleanups, energy/sustainability summits, participatory mapping, distribute flyers, etc.) Engaging with the community stakeholders (community center, neighborhood advocates/resident, police lieutenants, district city council members, business owners, etc. we are working to implement change to the issues identified in the safety audit. The best solution building towards community engagement was the planning of the community festival. Additional data will be collected during a focus group with residents to evaluate the process.

RESULTS: Safety issues revolved around several common themes: including environmental concerns, crime and police relations, isolation, maintenance and appearance, transportation infrastructure and structural inequality. The festival will be held on July 25th, 2015, and includes food, refreshments, games, music, guest speakers, and various fun activities.

CONCLUSIONS: Structural inequality refers to the social imbalance of access to resources experienced by low-income communities. Synthesizing that structural inequality is what the Greater Enderly Park is experiencing, The Women's Safety Audit and community engagement initiatives, such as the community festival, are great starts to help channel the gap and produce awareness of disparities within the neighborhood, to the greater community. Creating engaged active leaders, resources, and support from community stakeholders will better help meet the needs of the Enderly Park community.

Embryogenesis of the Eastern Oyster, *Crassostrea virginica*, In The Presence of Polystyrene Particles and Coal Ash

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Eastern oysters, *Crassostrea virginica*, are vital foundational organisms that are essential for a thriving estuarine ecosystem, and are a valuable bioindicator species that aids in assessing the health of an ecosystem. As filter-feeders, oysters will take in water and organic materials that are surrounding them, and are readily exposed to contaminants. It has recently been realized that engineered plastic particles as well as breakdown products from plastic garbage may be significant environmental concerns. Moreover, many other pollutants bind readily to plastic particles, perhaps making them concentrated vectors of other metal and organic pollutants. The purposes of these experiments were to examine the potential toxicity effects of these emerging and legacy pollutants to identify potential consequences of the release of these pollutants. Coal ash was hypothesized to have the most negative effect on embryogenesis due to the metals associated with fly ash, while the plastic particles were expected to have less negative adverse effects. Different sized polystyrene particles were used to investigate the effects of particle size on embryogenesis and survival into the veliger stage. During the initial embryo development stages, embryos may be most susceptible to smaller particles. As the oyster develops into the veliger stage, the larger particles become a potential hazard due to the ability to feed in this stage. The 3 μm polystyrene beads are near the ideal food size for oysters, which could impact larval feeding and success. The 50 nm particles could be small enough to either penetrate the embryonic membrane, or could be brought into cells through endocytosis. Studies were also conducted with coal ash (from the Kingston TN spill) to investigate the potential toxicity of coal ash, and also to consider how coal ash and plastic particles together might affect toxicity. Experiments were conducted in which oyster embryos were exposed to varying concentrations of 50 nm and 3 μm polystyrene particles, and coal ash suspensions, along with varying concentrations of a coal ash and 50 nm polystyrene particle mixture. Multicellularity and normal development into veliger larvae were measured to determine the effects of the contaminants on normal embryogenesis. While there was some evidence of reduced development at lower concentrations, no statistical differences were found in the individual concentrations of the polystyrene particles and coal ash suspensions. Analyses of coal ash particle size were conducted which indicated that most of the coal ash (>70%) consisted of particles that were > 20 μm . These results suggest that particle size may be an important determinant of toxicity. Interestingly, the 100 ppb 50 nm + 10 ppb coal ash mixture resulted in significantly better development. More work is needed to consider the potential interactions of multiple pollutants in combination as well as individual pollutants, but these results suggest that plastic particles may modulate the toxicity of other pollutants. These kinds of studies are important for characterizing the potential impacts on oysters and other aquatic organisms, as well as estuarine ecosystems.

Meeting the Needs of Youth Entering Protective Custody: Examining Utilization of Strengths within Assessments

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Historically, mental health organizations have used a deficit-based framework, with an emphasis on identifying problems and providing appropriate treatment. In recent years, however, the focus has shifted to allow for a strength-based approach to mental health assessment, treatment, and prevention. Although evidence supports successful outcomes of strength-based practices, and multiple authors and policy-makers have advocated for strength-based assessment and intervention (Cowger, 1994; Fostering Connections to Success and Increasing Adoptions Act of 2008; Tedeschi & Kilmer, 2005), little evidence exists regarding the actual utilization of strength-based approaches. Teen Health Connection, a comprehensive integrated care organization, conducts Independent Psychological Assessments (IPAs) in order to determine the needs and abilities of youth entering protective custody in Mecklenburg County, N.C., due to maltreatment concerns. Such concerns, including neglect and physical, emotional, and sexual abuse, leave children at risk for complex emotional and behavioral health problems. This study sought to determine the degree to which these youths' strengths are 1) identified in the assessment findings, and 2) built on in the recommendations for services and supports. Qualitative coding was used to analyze a representative sample of 100 archival IPA recommendations (from July 2014 to January 2015) for the presence or absence of strengths across various domains, such as living environment, family dynamics, and academics/vocational. Just over half of all IPAs included a strength-based recommendation; the narrative assessment findings for this subsample were then coded for the prevalence of strengths using the same qualitative process. Results indicated that, across all domains, strengths were more frequently included among assessment findings than incorporated in the recommendations; that is, although a strength may have been indicated in the assessment findings, it was not necessarily utilized to make a strength-based recommendation. In the narrative findings, strengths relating to extracurriculars and interpersonal attributes were most common, while extracurricular strengths were most commonly integrated in the recommendations. These findings hold practical significance for Teen Health Connection and the IPA process because they point to an opportunity for greater focus on strengths and resources as a way to gain a more holistic understanding of youth. Being mindful of youths' strengths, especially when making recommendations, may empower youth with a sense of hope and well-being, provide for a greater range of cost-effective service options, and increase the potential for successful outcomes. Use of a formal strength-based assessment tool is a potential way to increase awareness of youths' strengths. Follow up research is needed to explore the prevalence of strengths, resources, and related factors across the full sample of IPAs conducted at Teen Health Connection.

Development and Testing of a Turbulence-Based Calculation of Dissolved Oxygen Reaeration in a Three-Dimensional Water Quality Model

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Dissolved oxygen (DO) is a vital water quality parameter in maintaining aquatic life in water systems. The physical process that introduces DO into a system is known as oxygen reaeration. This process primarily takes place as a gas-transfer of atmospheric oxygen through the water surface. EPA, state, and local regulations set a minimum DO level for water systems, requiring that the concentration be under the minimum value no more than 10% of the time. In order to predict if DO concentrations will meet these standards, water quality models are used to simulate water systems and the associated parameters. For this project, we developed and tested a new calculation for oxygen reaeration relating local turbulent energy dissipation and the dissolved oxygen mass transfer coefficient. We conducted a literature review to find relevant data correlating the two parameters. The turbulence-based reaeration coefficient equation was added to the Environmental Fluid Dynamics Code (EFDC), a three-dimensional water quality model. The model incorporates the relationship using a proportionality constant, KRO, in order to calculate the DO concentration. A model of the Lower Cape Fear River Estuary, obtained from previous simulations, was used and compared to field data collected from January 1, 2002, to February 14, 2003. Simulations of the model were run to empirically determine the KRO constant. In addition, data collected from the literature search was used to determine a theoretical KRO value of 23.15 m/day. The sediment oxygen demand (SOD) input values were adjusted to calibrate the model to best fit the empirical data. The results of these two sets of simulations were then compared against the results of previous EFDC runs of the Lower Cape Fear system that used the traditional reaeration calculation method. We believe that the new model, using the theoretical KRO, will show increased variability in DO concentrations. Compared to the previous model, the new results will likely increase the occurrence of low DO values in the simulation. As environmental standards monitor the minimum DO values and not the upper values, we believe that this model will be more accurate in predicting whether a water quality system will meet regulations or not.

Digital Wayfinding Within J. Murrey Atkins Library

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BACKGROUND: J. Murrey Atkins Library at UNC Charlotte is the largest library in North Carolina and is visited regularly by its 30,000+ member population. The aim of the current project is to improve the libraries ease of use by creating interactive digital maps. These digital maps are designed to depict ever increasing levels of detail based on patron needs.

METHODS: A particular emphasis was given to space resources and availability like: group study rooms, and student spaces; electronic resources: computer and laptop availability; physical resources: over 2 million monographs and periodicals. We used **Leaflet** (<http://leafletjs.com>) an open-source mobile-friendly interactive maps software to map the digital space of the Atkins library. Digital floor renderings were created based on the existing blueprints of the floors using **Google's Sketchup** software. This allowed an effective and accurate display of the Aktins architecture in 2D. Furthermore, we used the **Leaflet.draw** plugin to create interactive functionality by transposing the static features into geocoded objects. To increase performance and create zoom and pan capabilities the map data is organized in tiles (**GraphicConverter 9**, <http://www.lemkesoft.com>) handled via a tile display system. Atkins map harbors directions and navigation capabilities implemented using an open-source API **PathFinding.js** (<https://github.com/qiao/PathFinding.js>) with A* shortest distance. Collapsing navigation panes display only the relevant information with the interactive map responding at the hovering of the mouse. For consistency we implemented a similar signage system currently found in Atkins.

RESULTS: As designed the portal manages the data in an efficient manner avoiding overloading the digital floor rendering with unnecessary information. It can also be easily utilized on mobile devices and connected to existing databases and software available at the Atkins Library.

CONCLUSIONS: The Atkins Library is paramount to student and faculty success at UNC Charlotte ergo the availability, access and administration of its resources is crucial for the university. This platform constitutes the basis of an interactive library portal and at the same time opens new avenues for developing the navigation system in the 3D realm. Furthermore, Google analytics can be used to collect a wealth of real time information on how students access resources consequently creating opportunities for social, anthropological, and library research studies.

Structural Elucidation of Sleeping Beauty Transposon System via NMR Spectroscopy

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The Sleeping Beauty (SB) Transposon system is the most widely used DNA transposon and is currently the only DNA transposon in clinical trials for human gene therapy. The evolution of the SB transposon has been dependent on homology and biochemical data. The goal here has been to establish a more mechanistic approach to understanding the SB transposon. The DNA-binding domain of the SB transposase consist of two paired subdomains, PAI and RED. Much is understood about the PAI subdomain's function, however, there is very little understood about the RED subdomain's function. Here structural elucidation is being conducted to gain insight into the function of the RED subdomain of the SB transposon via NMR spectroscopy data analysis. NMR data of the SB transposon in solution allowed for 1H-15N HSQC spectra to be utilized for the identification of NH groups in the primary structure of the SB transposon. CBCA(CO)NH and HNCACB spectral data was used to link the NH groups with their C α , C α -1, C β , C β -1. After backbone assignment the 15N-TOCSY spectral data was used for side chain assignment to determine the H α , H β and H γ , H δ , if present in the particular amino acid. Lastly, the 13C-NOESY-HSQC and 15N-NOESY-HSQC spectral data was used to find structural restraints for the SB transposon. Understanding the mechanics of this DNA transposon opens the door for applications of the SB transposon to areas of molecular biology, cell biology, and genome engineering; to list a few.

A Fully Coupled Fluid-Structure Interaction Analysis of the Stresses in Steam Turbine Blades

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Turbine blades in steam and gas turbines experience several different modes of loading (centrifugal, bending, and thermal) during operation. Bending loads are generated from the gas expanding on the blade, this expansion is the mechanism that converts the thermal energy of the gas into mechanical. This work uses computational methods such as the Finite Element Method and Finite Volume Method to analyze the stresses in a steam turbine rotor blade from the expanding gas. Abaqus/CFD will be used to simulate the fluid domain and Abaqus/Explicit will be used to model the solid domain. For the simulations, it was assumed that the fluid has steady flow inlet conditions and does not include the thermal energy transport equations in the model. It is expected that the highest stresses will be located in the root of the blade, similar to that of the centrifugal stress profile. It is also anticipated that the bending stresses will be much smaller than that of the centrifugal stresses, even though these stresses are typically what cause failure in blades due to vibrations from unsteady flow.

Comparison of Sampling Techniques for Metagenomic Experiments in a well-characterized Colorectal Cancer Cohort

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BACKGROUND: The human gut contains trillions of microbes which make up the microbiota. The microbiota is crucial for colorectal health as it aids in processes such as digestion and immune function. Different studies sample the gut microbiota in a variety of ways and it is unclear how these various sampling approaches might impact conclusions drawn about gut microbial community composition. In this project, we compared whole-genome metagenome sequences from stool, swab, and tissue samples from 50 human subjects.

METHODS: We obtained whole-genome metagenome sequences from 99 stool samples (from 50 subjects), 28 swab samples (from 14 subjects), and 16 tissue samples (from 8 subjects). Human contamination was removed by aligning the sequences with the human genome using the Burrows-Wheeler Alignment and removing reads that aligned to the genome. BLAST was then used to align the sequences to the KEGG database. HUMAnN was used to find the relative abundance of gene families, KEGG modules, and KEGG pathways for all samples. In order to see if there is any separation between tissue, stool, and swab samples, multidimensional scaling (MDS) was performed. An ANOVA was conducted on each of the coordinates as well as on the gene families, modules, and pathways. Additionally, a paired t-test was conducted on each of the coordinates, gene families, modules, and pathways comparing stool and swab samples.

RESULTS: We found the most human contamination in the tissue samples (55.11% to 78.64%) and the least in the stool samples (0 to 16.8%). The MDS ordination showed separation between the tissue, stool, and swab samples for the gene families, KEGG modules, and KEGG pathways. Moreover the results of the ANOVA show that a great deal of the gene families, modules, and pathways are significantly different between tissue, stool, and swab samples.

CONCLUSIONS: Inferences made about the gut microbiota of a human subject could differ between stool, swab, and tissues samples. In our ongoing analyses, we will determine if these differences between sampling techniques impact our view of which taxa and gene families are associated with diseases such as colorectal cancer.

Fabrication of (Au/Polyelectrolyte)_n/CdSe Films for Enhancement of QD Emission

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Quantum dots (QDs) are semiconductor nanocrystals that exhibit size tunable optical properties. It has been shown that excitons, resulting from excited state electrons in the QDs, can interact with the surface plasmons, or oscillating free electrons, found in metal nanoparticles; however, the dependence of this plasmon-exciton interaction on multiple gold layers and the interlayer distance is not well understood. The goal of this project is to control the surface plasmon resonance (SPR) in gold nanoparticles, and to maximize the plasmon-exciton coupling in order to enhance the QD emission by varying the distance between multiple layers of gold. This is accomplished by adding polyelectrolyte spacer layers, or charged polymers, between gold nanoparticle layers to vary the distance, and finding the maximum distance at which fluorescence is optimized. Spin-assisted layer-by-layer assembly is primarily used for the addition of layers onto the films, which will be characterized using atomic force microscopy, and will be further studied using UV-Vis spectrophotometry and steady-state fluorescence spectroscopy. So far it has been observed that the addition of polyelectrolyte spacer layers on top of a monolayer of gold results in an increase in absorbance as well as a red shift in the SPR. Once a second monolayer of gold is added, there is expected to be a broadening as well as a redshift in the SPR peak. The addition of multiple layers of gold in the films allows for new coupling interactions between the QDs and gold nanoparticles; this has the potential to enhance QD absorption and emission rates, which could be seen as useful for future applications such as light-emitting diodes, electronic devices, and biosensors.

Finite Element Modeling of Thermal Conductivity of Composites Using ABAQUS

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BACKGROUND: The thermal conductivity of materials is important to many industries such as manufacturing, aerospace, and motorsport. Maintaining a traditional, physical lab to create and test the thermal properties of various combinations of materials is expensive and time consuming. Using computational tools, such as ABAQUS, it becomes feasible to simulate the micro-structure of various compositions subject to temperature changes to best approximate real-world testing. Accurate computational models could reduce the time and costs associated with developing new materials with desired thermal properties.

METHODS: ABAQUS is a proprietary software for using finite element analysis. The micro-structure of a composite is modelled in ABAQUS by creating a two-dimensional matrix with circular inclusions defined with a specific density and thermal conductivity to simulate a physical composite material. The composite is subjected to temperature changes and the heat flux is recorded and used to determine the thermal conductivity of the mixed material. The dispersion of the inclusions or particles can impact the thermal conductivity of the composite, thus a series of randomly generated models are averaged to yield the result. Many features of the model are changed such as particle size, temperature difference, and filler volume to provide insight into how thermal conductivity varies in a composite.

RESULTS: The accuracy of the models built using a two-dimensional approximation of a composite vary depending on the constituent materials used. As expected there is a direct relationship between the thermal conductivity of a composite and the amount of filler particles added to the matrix. However some material combinations perform better than others suggesting additional factors need to be considered in the general model. While many two-dimensional models aren't accurate to real world data, each simulation captures the relevant trends.

CONCLUSIONS: Additional parameters such as particle shape, agglomeration, dispersion, and orientation need to be added into the model to better approximate experimental data. Also differences in the accuracy of models depending on the composite suggest additional interactions between materials may need to be accounted for. The two dimensional model doesn't always perform well thus precipitating the need to build more realistic three dimensional models. Combining the three dimensional model with additional constraints on the filler should yield more accurate results.

Structure-based Prediction of Transcription Factor Binding Sites

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Transcription factors (TFs) regulate gene expression through binding to specific DNA sequences, called TF-binding sites. TF-binding site prediction is a challenging computational biology problem. Here we present a novel structure-based method for TF-binding sites prediction. In addition to genome scale annotations of TF-binding sites, structure-based methods can help us better understand the mechanisms of specific protein-DNA interactions and the effects of mutations in both transcription factors and target sites. Our novel approach includes a hybrid energy function for binding affinity calculations and a unique algorithm for selecting true binding sequences. The hybrid energy function combines two atomic-level energies, hydrogen bond energy between protein residues and DNA bases, and electrostatic energy of π -interactions between aromatic residues and DNA bases, with a statistical knowledge-based residue-level potential. The rate of change of the calculated energy scores is used for true binding sequence selection. Our results indicate improved prediction accuracy when tested on a non-redundant dataset with representatives from several TF families.

CHARLOTTE RESEARCH SCHOLARS PROGRAM

The Anatomy of Racism: A Dissection of Racial Oppression and Social Injustices in the Work of Contemporary African American Poet Wanda Coleman

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Contemporary African American poet Wanda Coleman represents a unique addition to the African American literary canon through her didactic poetics. Her poetry is a reflection of her experiences growing up in poverty, surrounded by images that contrast the American Dream. Raised in L.A., and not formally trained in academic poetry, Coleman has been recognized for addressing issues of class, gender, and family in American society, while her adamant stance against racism has not been the central focus of much scholarly research. By identifying that racism is more than judging someone by the color of his or her skin, or using the “N” word, Coleman educates her audience through the poems “Drone,” “Business as Usual,” and “Late Broadcast News,” about the specific features of racism, including economic inequality, poor access to and quality of health care, and the unwarranted killings of African American men and women. It is important that both consumers and producers of the African American literary tradition recognize the subtle markings of racism, that it is systematically embedded into the pores of a nation that has historically profited from the dehumanization of African Americans. Only then, can enthusiasts of the tradition and literary scholars reexamine the historical context which originally placed blacks at the bottom of society’s chain, and be propelled towards social activism to challenge the current system of oppression inflicted upon minority groups.

Automatic Tracking of Honeybees in Video

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BACKGROUND: Honeybee tracking and behavior analysis is a significant part of research attempts to understand the sociology and group behaviors of bee colonies. Automating this process would save time and record more data without human error.

METHODS: Color tags on the bees improve the accuracy and reliability of detection by classifying the image based on the colors used for the tags. We use color classification to label the color tags on the bees and to differentiate from background colors. Every pixel in an input image is mapped to one of the labels based on highest probability of likeness to each color. The output image from classification can then be separated using connected component labeling to get final output images containing connected components representing only one color. We remove noise by size based filtering. We implemented a frame-by-frame tracking method which uses a graph structure to contain all locations of every bee over a specified number of frames. This method requires the user only to input the start and end location of each bee. Data association based method is used to link detections in each frame based on color and motion.

RESULTS: Detections of bees, even with color tags, proved to be quite challenging. Darker colors used for tags provided significantly better results because illumination has a lesser impact on them, lighter color tags suffered from white balancing and brighter illumination. The average of the best precision and recall for all colors was 0.823 and 0.727 respectively. Testing on the tracking algorithm is in progress.

CONCLUSIONS: The use of color tags provides a solution but also brings on a host of other problems. Lighting in the area of the hive and can distort colors making classification based on color a more difficult task. Future work could include eliminating error caused by the environment of the experiment by minimizing glare and reflection, and normalizing the lighting conditions across camera inputs for consistency. High accuracy for darker colors suggests that detection could be significantly improved if these conditions in the environment could be improved. Continued work on tracking may also provide enough data to be able to fill in for error caused by the experiment environment.

Measuring Reference Outcomes: Meeting Student Needs

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The Internet can produce over a billion results about a topic in a matter of seconds. Today's researchers are faced with this robust and uncontrolled information environment that is overwhelming and challenging to navigate. Libraries offer face-to-face and virtual reference services to help researchers better articulate their questions, access sources and assess their merit. These reference services have become an even more important and integral facet of the modern library. Libraries rely heavily on assessment to learn about patron information-seeking behavior and serve patrons' unique needs. Previous literature on reference service assessment has focused primarily on individual services from either the user or service perspective. This case study from the University of North Carolina at Charlotte analyzes chat and email transcripts, desk and phone data, and a library customer service survey in the greater context of the reference service system. Our goal is to evaluate the types of questions students ask through each reference service and determine if the system can produce more accurate, timely or direct answers. In doing so, we will contribute to a better understanding of the administrative balance of reference services in the twenty-first-century academic library.

Arts Engagement in the Library: How Performances and Artist Residencies Benefit the Academic Library

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BACKGROUND: Libraries are not just a warehouse for books anymore. They have developed from their traditional academic role to encompass a prevalent social presence. It is challenging to find ways for people to engage in the library and the resources. This project is part of a larger project that is focused on how art and artist engagement within the library will enhance the social, cultural, and academic atmosphere. This part of the project specifically looks at how performances in the library and how having an artist in residence will be beneficial to the library, the campus population, and the community as a whole. It also examines how student artists can further their education and gain real world experience while participating in these programs.

METHODS: We used library and online sources to gather information from books, articles, and websites about the variety of ways the arts are incorporated into cultural institutions. After a review of these ideas, we focused on artist-in-residence programs, as well as closely related site-specific work, and performances for a literature review. To find out more information about artist residencies, we conducted interviews through email and over the phone with both artists and institutions involved in such programs. We also did an evaluation of Atkins Library through a S.W.O.T. analysis to better understand the best way to incorporate the arts in this particular library. We interviewed library faculty and staff to complete the S.W.O.T.

RESULTS: The research showed multiple ways that academic and public libraries engage the arts: events, artist residencies, exhibitions of library collections and artwork, commissions for artwork, and partnerships with various art institutions. Our interest in art-in-residence programs and performances grew out of a desire to involve student artists as well as personal interest. The literature showed that artist residencies can bring the arts into the library in an interactive and engaging way. They are a way to show the process of art creation as well as the finished products, giving students a deeper understanding of creative processes. Furthermore, this sort of programming makes the library the cultural center of campus and raises the visibility and prestige of the university as a whole.

CONCLUSIONS: Artist residencies are an ideal way for Atkins Library to incorporate the arts into the space. This type of arts-based cultural program will increase traffic, increase patrons' understanding of the arts, and allow student artists to gain real world experience. The library, already a place where students from many disciplines gather, is uniquely situated to host this program. The next steps are to write a proposal, secure funding, and implement the programs in the library.

BITURE REU PROGRAM

Effective treatment of Malignant Ovarian Cancer Cells by Means of Nanoparticle Coated Aptamers

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Currently, anti-cancer chemotherapeutic agents often lead to adverse side-effects and toxicity; thus dosage is limited. New clinical tools for early detection and targeted treatment of ovarian cancer can significantly help reduce mortality. Single stranded DNA aptamers can identify unique tumor biomarkers and aid in early detection for diagnoses due to their binding specificity to tumor biomarkers with high affinity and high specificity. The conjugation of aptamers to polymeric nanoparticles is promising for effective cancer treatment. Polymeric nanoparticle developments have allowed anti-cancer drugs to be embedded within protective shells for controlled drug delivery with reduced toxicity. This project is to determine the ability of several single stranded DNA aptamers to bind and internalize into ovarian tumor cells but not to normal cells. Currently I am determining the binding kinetics of several aptamers to CAOV3 (ovarian cancer) cells vs HOSE 6-3 (nonmalignant ovarian cells) through flow cytometry (FACS). I am also assessing the size and consistency of nanoparticles through scanning electron microscopy (SEM). Finally I am assessing the ability of aptamer coated nanoparticles to hone to in vivo tumors using a mouse xenograft model. The projected goal of this project is to conjugate nanoparticles to aptamers to specifically target ovarian cancer cells to deliver higher and more effective dosages

Interactive Effects of Ocean acidification and Copper on Metabolism of Marine Bivalves

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BACKGROUND: Clams and oysters are filter feeders that can be used as indicator of ecosystem health in estuaries. Heavy metals such as copper (Cu) are common contaminants in estuaries and are toxic in high concentrations. Cu toxicity strongly depends on bioavailability of the metal to the organism, and the free ionic form of Cu (Cu^{2+}) is the most bioavailable form. Ocean acidification (OA) driven by the anthropogenic release of CO_2 in the atmosphere decreases seawater pH and carbonate levels, and these changes in seawater chemistry increase solubility of Cu and bioavailability of Cu^{2+} potentially increasing its toxicity. We studied the interactive effects of elevated CO_2 such as expected during OA and Cu on metabolism of estuarine bivalves (clams *M. mercenaria* and oysters *C. virginica*) using a ratio of activities of two key metabolic enzymes (pyruvate kinase, PK and phosphoenolpyruvate carboxykinase, PEPCK) as a sensitive biomarker of metabolic stress. These enzymes compete for a common substrate (phosphoenolpyruvate) directing it to aerobic (PK) or anaerobic (PEPCK) pathways, so that a decrease in the ratio of PK/PEPCK activities is indicative of a greater dependence on anaerobiosis and thus of energetic stress.

METHODS: Clams and oyster were exposed to 28 days of copper and 395 ppm, 800 ppm, and 2000 ppm of carbon dioxide concentration. Digestive tissues were collected and homogenized in 1:5 buffer solution. The activity of PK and PEPCK were measured using photo spectrometer at 450 nm wavelength. The ratio of PK to PEPCK activity is use as an index of relative aerobic capacity and two way ANOVA was used for statistical analysis.

RESULTS: In clams, PK and PEPCK showed a trend of increasing activity with copper exposure and increasing CO_2 concentration but this trend was not statistically significant ($P > 0.05$). In oysters, exposure to Cu at elevated CO_2 levels (2000 ppm) led to a significant increase in PK activity ($P < 0.05$), while the activity of PEPCK and the PK/PEPCK ratio did not change. Cu exposure alone or in combination with moderately elevated CO_2 levels (800 ppm) had no effect on PK and PEPCK activities or their ratio in oysters.

CONCLUSIONS: Energy metabolism of clams and oysters is robust to the environmentally relevant Cu concentrations and CO_2 levels such as expected during the OA. This may reflect adaptations to life in estuaries which experience high fluctuation of Cu concentrations, CO_2 levels and pH depending on freshwater discharge and metabolic CO_2 production by resident organisms. The estuarine mollusks can effectively protect themselves against Cu toxicity because of diverse metal binding molecules (metallothioneins and glutathione) and antioxidant enzyme. Our data indicate that the predicted OA conditions for the next century will not significantly increase metabolic toxicity of Cu to estuarine bivalves.

The Role of APE1 in DNA Damage Response to Oxidative Stress

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BACKGROUND: Cells are continuously being exposed to various insults that can damage the genome of an organism. The most frequently occurring DNA damage is reactive oxygen species (ROS)-induced oxidative stress which can lead to the prevention of DNA replication and transcription. However, a built-in response to the oxidative damage takes place called the Base Excision Repair (BER) pathway that includes crucial enzymes called AP Endonucleases. One of these enzymes, known as AP Endonuclease 1 (APE1), is a DNA damage repair enzyme that is known to make a nick in the phosphodiester backbone of DNA. The project is to determine the mechanism behind APE1 and understand its response to oxidative stress. So far it has been determined that APE1 is involved early in the BER pathway, but whether it plays a role in the DNA Damage Response (DDR) pathway remains a mystery. The findings of this ongoing project will help to better understand neuropathological disorders and cancer, and lead to new opportunities for possible cures.

METHODS: Our major hypothesis in this project is that APE1 plays a previously uncharacterized, but essential role in the DDR pathway activation. To achieve this, we utilize the cell-free extracts derived from eggs of *Xenopus laevis* (African Clawed Frog), allowing for the study of in vivo biochemistry without the need for cell cultures. Biochemical and molecular approaches including site-directed mutagenesis and immunoblotting analysis are used to test our hypothesis.

RESULTS AND CONCLUSIONS: Our results demonstrated that hydrogen peroxide-induced Chk1 phosphorylation was compromised in APE1-depleted egg extracts, indicating APE1 is important for the DDR activation. Protein-protein interaction assays demonstrated that APE1 associated with several critical DDR proteins. Further investigations are under way to understand the mechanism behind APE1 and elucidate its role in both the DDR and BER pathways. Understanding the molecular mechanism of APE1's distinct role in the DDR pathway will lead to new methods to use APE1 as a chemopreventive target in cancer therapy.

Transgenic Soybeans Provide a Platform to Develop an Oral Therapeutic for Myasthenia Gravis

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BACKGROUND: Myasthenia gravis is an autoimmune disease that typically results in the formation of antibodies against the acetylcholine receptor. Muscle weakness and fatigue are among the symptoms experienced by patients as these autoantibodies interfere with transmission of signals at the neuromuscular junction. Unfortunately, there is no effective antigen-specific therapy to limit the progressive development of these autoantibodies against the acetylcholine receptor. We propose an oral treatment for this disease composed of a soy formulation made from transgenic seeds expressing a fusion protein containing the acetylcholine receptor plus the type 3 reovirus sigma 1 protein (AChR-sigma). The ability of the viral protein to target epithelial cells of gut Peyer's patches, and deliver the autoantigen in a tolerizing context, is being investigated as a proof of concept for oral therapy in autoimmune diseases. Prior to pre-clinical and clinical trials, a careful characterization of this fusion protein and oral formulation is required.

METHODS: Due to the unique nature of the soybean-derived AChR-sigma fusion protein, it was first necessary to develop specific enzyme-linked immunosorbent assays (ELISA), Western blot analyses, and cell binding assays. Antibody pairs were defined for capture ELISAs. Detection antibodies were also screened for their usefulness in Western blot analyses and for confocal microscopy of AChR-sigma binding to epithelial cells.

RESULTS: ELISA analyses demonstrated the presence of both AChR and sigma 1 protein immune reactivity in seed extracts from selected transgenic soybean lines. Western blot analyses demonstrated the appropriate molecular weight for AChR-sigma, as well as the ability of this fusion protein to form the expected trimeric complexes. Finally, confocal microscopy was used to demonstrate the functionality of AChR-sigma trimers for binding to epithelial cells. Seeds from those lines which expressed the highest levels of AChR-sigma trimers were selected for further propagation.

CONCLUSIONS: Developing oral tolerance therapies which successfully limit the development and/or progression of autoimmune diseases has been a challenging task. While oral autoantigens can be consumed by patients, they often do not provide any significant therapeutic benefit. We and others have proposed that targeting of the autoantigen to specialized epithelial cells in the gut will be required for efficacy in the induction of oral tolerance. To this end, we have expressed the fusion protein, AChR-sigma, in transgenic soybean seeds in an attempt to target the acetylcholine receptor autoantigen to gut epithelial cells for tolerance induction. In the studies described here, we have characterized this fusion protein as a functional trimer of the acetylcholine receptor and the reovirus sigma 1 protein.

Design and Modeling of a Biomimetic Imaging Polarimeter

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BACKGROUND: The polarization of light carries important information that is typically underutilized in modern imaging systems. Polarization imaging is already being utilized by organisms in nature, such as the mantis shrimp. Biomimicry of such creatures allows for the down scaling of optical systems, and thus improvement of accessibility and broadened applications. Our biomimetic imaging polarimeter is a 2x2 lens array with each sub-lens made selective for a different polarization through incorporation of sub-wavelength scale conductive gratings. Example applications for polarization imaging include discerning manmade objects amongst a natural background, mechanical stress testing with photoelasticity, and enhanced detection of cancerous tumors.

METHODS: We use rigorous solutions to Maxwell's equations to quantify structural parameters of the polarization gratings and to simulate system imaging for mid-infrared light. The computational methods include Rigorous Coupled Wave Analysis/Fourier Modal Methods for the polarization grating and the Spectrum of Plane Waves Operator for light propagation and imaging. The optical models were used to compare and optimize subwavelength grating and polarimeter architectures.

RESULTS: A maximum transmission efficiency of 92.6% and a polarization contrast of 3.5×10^{13} was achieved for mid-IR TM polarized light incident on a germanium substrate with an aluminum grating with a 53% fill factor, 400nm period, and 990nm thickness. However, modeling of more realistic fabrication parameters (50% fill factor, 400nm period, and 100nm aluminum thickness) yielded a transmission efficiency of 60% and polarization contrast of 160.4. Incorporation of a 25nm relief structure into the surface of the germanium with the realistic grating increases polarization contrast to 2,379 while still maintaining 60% transmission. Grating transmission efficiency exhibited less than 3% variation across an 18° angle of incidence range. Imaging simulations indicate that increased polarization contrast increases system image quality.

CONCLUSIONS: Rigorous modeling indicates that the integration of nanoscale gratings onto a lens array is a potential architecture for a biomimetic polarimeter, with the performance dependent on fabrication capabilities. These models provided the design basis for fabrication of a realistic planar polarization grating. Experimental fabrication of the designed grating is currently underway.

Transforming Growth Factor beta and Collagen Expression in Breast Cancer

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BACKGROUND: The transforming growth factor beta (TGF β) signaling pathway is a key player in cell and tissue functions, and its deregulation has been associated with tumor development. In normal tissues, TGF β promotes cell differentiation. In contrast, in carcinomas, TGF β stimulates multiple pro-tumorigenic behaviors cells such as cell invasion and also promotes stroma cells secretions leading to microenvironment modifications supportive of cancer progression. Significantly, increases in matrix protein deposition especially of collagen within the primary tumor mass is an independent poor prognosis parameter in breast cancer. Here, we tested the hypothesis that treatments with TGF β or altering TGF β expression are associated with significant changes in collagen expression.

METHODS: In vitro, the murine mammary tumor series (4T1, 4T07, and 67NR) was assessed following incubation with TGF β . In addition, in vivo primary tumor samples collected following treatment with the angiotensin II inhibitor losartan were also assessed. The presence of collagen was determined using Sirius red staining and the concentration derived from standard curves. Alternatively, total protein and collagenous proteins were measured using fast green and Sirius red staining and the ratio derived. Difference between treatment groups were assessed by ANOVA and post-hoc tests with *a priori* significance level set at $p < 0.05$.

RESULTS: First, coating increasing concentrations of collagen I was associated with linear increase in Sirius red stain as measured by OD at 540nm. Second, the incubation of 4T1, and 67NR cells with TGF β was associated with significant changes in collagen expression ($p < 0.05$). Additionally, in vivo primary tumor samples had variable expression of the collagenous protein to non-collagenous protein ratio mimicking the tumor growth in vivo. Finally, when assessed in tumor from animals treated with losartan, the concentrations of collagen present were lower ($p < 0.05$).

CONCLUSIONS: Collagen expression can be detected by Sirius red staining both in vitro and in in vivo tumor samples. Furthermore, TGF β promoted collagen expression by the murine mammary cell with a normal-like phenotype 67NR. In contrast, in 4T1 aggressive tumor cells, the incubation with TGF β was associated with decrease in collagen expression. Interestingly, the expression ratio of collagenous protein over non-collagenous proteins mimicked tumor growth in vivo highlighting the importance of the ECM in breast cancer progression. Finally, the indirect alteration of TGF β expression through treatment with losartan also led to decrease in collagen present in the primary tumor mass. Taken together these data support a role for collagen with the matrix and breast cancer progression.

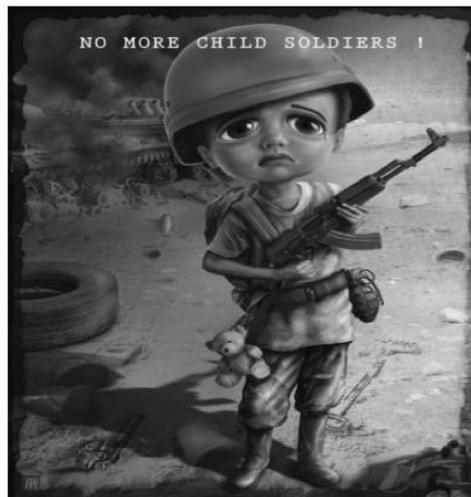
War Games: Analyzing Portrayals of Child Soldiers in Popular Culture

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UNICEF defines a child soldier as “any person under 18 years of age who is part of any kind of regular or irregular armed force in any capacity”(Wessells 7). This research explores child soldiers as they are depicted in contemporary popular culture with a focus on some of the texts and films that have been among the most successful. This research specifically examines *Ender’s Game*, *Harry Potter*, *The Walking Dead* and *The Hunger Games*, which filter the child soldier experience through the allure of magic, fantasy, and dystopia. This project contrasts these renowned texts intended for young audiences with more realistic depictions, such as those found within the critically-acclaimed films *Johnny Mad Dog* and *War Witch*, which are not intended for young audiences and do not provide the escape and entertainment that comes with the fantasy lens. This research highlights the ways in which these representations coincide and differ as well as the implications of these similarities and differences. This project also discusses the potential impact of this popular media in terms of influencing attitudes and perceptions about child soldiers and their experiences as well as how the prevalence and popularity of this media facilitates further discussion within the child soldier discourse. This project also aims to demonstrate that although popular representations of child soldiers intended for young audiences may not align entirely with the actual child soldier experience; they do prompt legitimate consideration of ongoing human rights violations by providing significant insights and a framework for considering child soldiers and the complexity of their experiences.



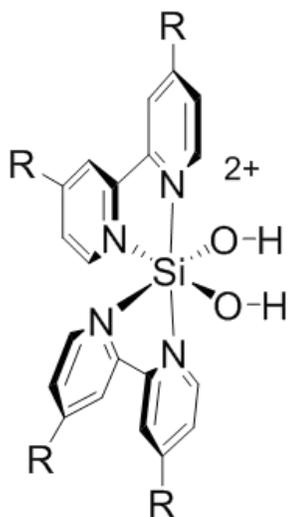
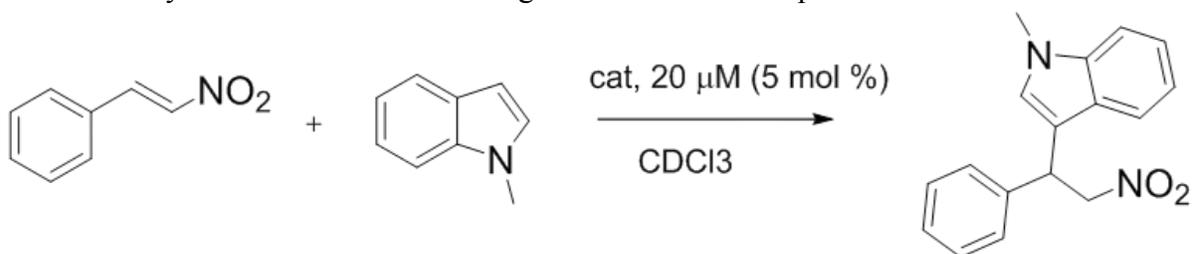
Majewski, Tad. “No More Child Soldiers.”

Exploring Catalysis with Bis-bipyridylsilicon(IV) diols

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Silicon diols have shown the possibility to be used as dual hydrogen bond donor catalysts. These compounds have many advantages such as, cost effectiveness, low toxicity, stability against hydrolytic decomposition of water, and abundancy. The hexacoordinate diol catalysts used in this study were synthesized from the combination of SiI_4 (1.0 g) with an appropriate bipyridine ligand (app. 1.4 g). Chloroform was then added and the sample was placed in an oil bath at $75\text{ }^\circ\text{C}$ for twenty four hours. Once the compound was synthesized it was washed with chloroform and ether, filtered, and dried overnight. A Nuclear Magnetic Resonance (NMR) spectrometer was used to determine the identity and purity of the catalyst. Once the pure catalyst was obtained, the ability of it to catalyze the addition of nitrostyrene with N-methylindole was measured using an NMR kinetics experiment.



catalysts: R = H, t-Bu, Nonyl

Lightning in the Southeast USA

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Lightning is a major component of severe weather. The average annual lightning strike count within the United States between 1986 and 2012 was around 31.5 million strikes. There are two types of lightning, cloud-to-cloud (CC) lightning meaning it occurs within the cloud and cloud-to-ground (CG) lightning. CG lightning can lower negative or positive charge from the cloud. The data used for research is collected and archived by the National Lightning Detection Network also known as the NLDN. The NLDN focuses on CG lightning. This CG data archive and research is significant because although CG lightning only makes up about 20% of all lightning it still interacts with human activity and can impact our lives.

Beginning in 1986 the NLDN began strategically placing lightning count detection sensors in various parts of the country. Since first deployment sensor use has spread across most of the country. Through the years until present day the sensors were revamped and upgraded to become more accurate and more sensors were placed in new areas with each passing year. As a result of this some of the data from the earlier years throughout the sensors development create discontinuities in the data that must be considered when looking at the data archives. Looking at the first five years of sensor deployment it is evident that there are major differences between count data then versus today. For example, in 1986 the annual lightning count for the United States was roughly one sixth of today's total. This is largely a result of changes in the sensors themselves.

To study the trends in lightning, we took an average of total annual strike counts and then calculated the difference between the average and a specific annual total to find anomalies. To standardize our results for comparison and to decipher better between what was considered the norm, we divided the anomalies by the standard deviation for the annual average – this is called the standardized anomaly. We then found the standardized anomalies for other severe weather phenomena such as hail, wind, precipitation, and tornados in order to look for relatable patterns between severe weather and lightning counts. This is important because it would be expected for severe weather and lightning counts to have a strong correlation. If there are major spikes or differences between the two and they do not follow each other as expected it leads us to question as to whether it is actually a significant lightning activity anomaly or could it be attributed to sensor variability over the years. Preliminary analysis suggests that correlations at the regional scale between lightning and severe weather differ. In the South East, precipitation and lightning count activity seem to follow each other closely, while in the United States as a whole they were not well correlated with each other. For example, in 2003 there is a major spike in lightning activity and we can compare that to other regions at the same time period and begin to diagnose if this is a regional or national trend.

Fabrication of (Au/Polyelectrolyte)_n/CdSe films for enhancement of QD emission

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Quantum dots (QDs) are semiconductor nanocrystals that exhibit size tunable optical properties. It has been shown that excitons, resulting from excited state electrons in the QDs, can interact with the surface plasmons, or oscillating free electrons, found in metal nanoparticles; however, the dependence of this plasmon-exciton interaction on multiple gold layers and the interlayer distance is not well understood. The goal of this project is to control the surface plasmon resonance (SPR) in gold nanoparticles, and to maximize the plasmon-exciton coupling in order to enhance the QD emission by varying the distance between multiple layers of gold. This is accomplished by adding polyelectrolyte spacer layers, or charged polymers, between gold nanoparticle layers to vary the distance, and finding the maximum distance at which fluorescence is optimized. Spin-assisted layer-by-layer assembly is primarily used for the addition of layers onto the films, which will be characterized using atomic force microscopy, and will be further studied using UV-Vis spectrophotometry and steady-state fluorescence spectroscopy. So far it has been observed that the addition of polyelectrolyte spacer layers on top of a monolayer of gold results in an increase in absorbance as well as a red shift in the SPR. Once a second monolayer of gold is added, there is expected to be a broadening as well as a redshift in the SPR peak. The addition of multiple layers of gold in the films allows for new coupling interactions between the QDs and gold nanoparticles; this has the potential to enhance QD absorption and emission rates, which could be seen as useful for future applications such as light-emitting diodes, electronic devices, and biosensors.

**Dance Reconstruction for the American Modern Dance Choreographer,
Paul Taylor**

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The twentieth century was a turning point in the American dance world. With a focus on artistic expression and a contrast to classical ballet, a new art form emerged that paralleled the social changes of its time, creating what we know today as modern dance. Most of the pioneers of this genre deceased; therefore, there is a profound importance to preserve their legacies. Upholding the history of artistic works is just as essential to the contribution of the field as merely focusing on contemporary and new ideas. This research will concentrate on Paul Taylor, one of the few living choreographers from the modern period. Taylor focuses on abstractionism and avant-garde aesthetics, while he blends subtle aspects of ballet with the naturalness of everyday movement and pedestrian gestures. The objective of this research is to collect and assemble evidence to reconstruct Taylor's lost choreographic 1962 work entitled *Tracer*. *Tracer* was last performed in 1964 and little to no record of the dance exists today. Data was gathered through archives at the New York Public Library for the Performing Arts, including pictures, newspaper clipping articles, reviews, and original programs. Data was also gathered through extensive Internet inquiries and searches of the artists involved in the collaboration of *Tracer*, including composer James Tenney and costume/ set designer Robert Rauschenberg. Interviews were conducted with past company members who remembered the dance performance. Meetings took place with dance archivists at the Juilliard School of Performing Arts, American Dance Festival, and Paul Taylor's American Dance Company. Results determined significant historical evidence to be considered for the practical implication of creating a performance-ready work for Paul Taylor's American Modern Dance second company, Taylor II. Results identified the original cast of dancers from 1962, details of the set and costumes, concepts on the musical score, a performance history, and an original notation of the work in the choreographer's personal journal that will support the reconstruction of dance, music, costumes, and sets for the recreation. The research provides an insight for the process and product of a reconstructed dance work, as the field of dance reconstruction has relatively few contributors. Once the reconstructed work is performance ready, Paul Taylor's American Dance Company and the second company will come to The University of North Carolina at Charlotte to work with the dance department, allowing students to gain educational and professional development from highly established icons in their field of study by engaging in master-classes, observing the reconstruction process, rehearsing the found evidence into dance phrases, and speaking with dance professionals. The research, in a greater involvement, will influence the dance world, scholars, companies, and the public alike, to develop a new initiative on preserving the masterworks of seminal twentieth century American choreographers that had a revolutionary impact on the art of dance.

Combined Effects of Cadmium Pollution and Hypercapnia on the Activity of the Two Enzymes, Pyruvate Kinase and Phosphoenolpyruvate Carboxykinase, in the Mollusc *Mercenaria mercenaria*

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BACKGROUND: Anthropogenic increase in atmospheric carbon dioxide (CO₂) levels leads to an increase in ocean temperature and a decrease in seawater pH. These changes lead to increased solubility of metal contaminants in seawater potentially affecting metal toxicity to marine organisms. The additive effects of both hypercapnia and metal pollution are predicted to exhibit measurable effects on the activity of two enzymes at the branch-point between anaerobic and aerobic metabolism of phosphoenolpyruvate (PEP) in the clam, *Mercenaria mercenaria*. Higher phosphoenolpyruvate carboxykinase (PEPCK) activity indicates increased anaerobic metabolism in the organism, a condition that serves as an indicator of metabolic stress. The goal of this experiment is to ascertain whether cadmium pollution under hypercapnic conditions exacerbates metabolic stress in *M. mercenaria*.

METHODS: To measure the activity of pyruvate kinase (PK) and phosphoenolpyruvate carboxykinase, we employed a spectrophotometric analysis to calculate the rate of NADH consumption in both the PK and PEPCK assays. As a coupling enzyme for PK or PEPCK assays, we used lactate dehydrogenase and L-malate dehydrogenase, respectively, and protein concentration was also taken into account using a Bradford assay. The ratio of PK to PEPCK activity will determine whether cadmium and hypercapnia act as additive metabolic stressors. Statistical analysis will be performed using two-way ANOVA with CO₂ levels and Cd concentration as fixed factors. Factor effects will be considered statistically significant if P<0.05.

RESULTS: All of the data for PK and PEPCK activity as well as protein concentration has been collected and is currently being statistically analyzed. The results of this experiment can be applied to existing climate change models to help predict the effects of ocean acidification and metal pollution on marine organisms.

Identifying Species Differences in the Antibacterial Target Undecaprenyl Pyrophosphate Synthase with a Novel Fluorescent Substrate Analogue

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BACKGROUND: Undecaprenyl pyrophosphate synthase (UppS) is an essential enzyme present bacteria that catalyzes the synthesis of C55 bactoprenyl diphosphate (BPP) *in vivo* via eight consecutive condensation reactions of isopentenyl diphosphate (IPP) and farnesyl diphosphate (FPP). BPP is critical to the biosynthesis of peptidoglycan, capsular polysaccharides, O-antigens, and teichoic acids. Capsular polysaccharides, in particular, contribute to the virulence and pathogenicity of certain species of bacteria. Thus, UppS has been identified as an antibacterial target. Typical antibacterials are broad range and may wreak havoc on symbiotic human microbiota. If UppS of pathogenic strains can be specifically targeted, the wide array of adverse side effects due to non-specific antibiotics may be reduced.

METHODS: UppS genes from 15 bacterial species were transformed into *Escherichia coli* expression cell lines and expressed using IPTG. Enzymes were isolated and purified using affinity chromatography. A fluorescent probe, 2-cyanoanilogeranyl diphosphate (2CNA-GPP), was used to track UppS activity. Products of overnight reactions with UppS, 2CNA-GPP, and IPP were analyzed with reverse phase high performance liquid chromatography (RP-HPLC). Reactions were also monitored in real-time with 96-well fluorescence plate reader assays. Furthermore, reactions with UppS from *E. coli* were quenched at time points and compared with an overnight reaction to analyze the consumption of the fluorescent substrate and the production of polyisoprenoids. The effects of a *Staphylococcus* UppS inhibitor, were also assessed between several bacterial species with plate reader assays.

RESULTS: All 15 UppS enzymes from different species were isolated and detected with an anti-His western blot. Fourteen of the 15 proteins were functional and products were analyzed via RP-HPLC. Under the current reaction conditions, UppS enzymes synthesize products between 6Z and 10Z isoprenoids. Time point reactions with *E. coli* UppS revealed that nearly all substrate consumption occurs within 60 min of initiation. In addition, the relative rates of UppS reactions decreased in the presence of the *Staphylococcus* UppS inhibitor.

CONCLUSIONS: All UppS enzymes appear to utilize the 2CNA-GPP analogue as a substrate with the exception of *Mycobacterium tuberculosis* UppS. Data collected from the *E. coli* UppS time point reactions exposes the possibility of defining kinetic parameters of UppS enzymes with fluorescent plate reader assays. Inhibition assays revealed differences in the effects of the UppS inhibitor between species. The differences in inhibition in connection with protein sequence variations may lead to novel UppS inhibitors that target specific bacteria.

Periostin and Transforming Growth Factor beta Induced Expression in Breast Cancer

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BACKGROUND: Composition and density of the extracellular matrix (ECM) plays preeminent roles in disease progression. In particular, in breast cancer, mammary density is an independent parameter associated with ECM alterations of cancer progression. Beside collagens, ECM proteins include periostin (POSTN) and transforming growth factor beta induced (TGFBI) and both are regulated in part by transforming growth factor beta (TGF β). Interestingly, POSTN has been associated with aggressiveness of multiple carcinomas. Here, we investigated the hypothesis that POSTN promote breast cancer progression.

METHODS: Expression of POSTN and TGFBI by mammary cell series (67NR, 4T07, 4T1) and human cell series (MCF10A, MCF7, MDA-MB-231) was investigated using ELISA following incubation with or without TGF β . Furthermore, the growth and phenotype of MDA-MB-231 cells, especially the expression of E-cadherin and CD133, were determined using Hoechst staining and flow cytometry, respectively. Differences associated with cells, treatments were assessed by ANOVA and post-hoc test with an *a priori* significance level set at $p < 0.05$.

RESULTS: Cells expressed significantly different baseline concentrations of POSTN whereas TGFBI concentrations were much higher and similar between cells. Both the expressions of POSTN and TGFBI were increased following incubation with TGF β . In the murine mammary tumor series, the expression of POSTN was cell dependent. The expression of E-cadherin in MDA-MB-231 cells tended to be lower following incubation with TGF β .

CONCLUSION: Taken together, these observations support the increase in the POSTN and TGFBI expression following TGF β incubation in breast cancer. Furthermore, POSTN may promote tumor cell alterations associated with tumor progression.

The Effects of PolyDOTs on the Eastern Oyster, *Crassostrea virginica*

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Polymer dynamic organic theranostic spheres (PolyDOTs) are currently being studied as a potential to be used in photothermal ablation treatment of cancer. If shown to be successful, these PolyDOTs will be mass-produced and it is expected that they, like any other engineered nanoparticle (ENP), will be found in the ambient environment. The specific PolyDOTs used in these studies are P3HT/BSe PolyDOTs and are activated to thermally ablate cancer cells using 808nm of near infrared light. The overall purpose of these studies is to evaluate the potential toxicity of PolyDOTs to estuarine organisms, which would be exposed to natural sunlight as well as the nanoparticles. In order to investigate the potential of even greater toxicity (e.g. potentiation) due to solar exposure, which includes UV radiation, infrared radiation, and longer wavelengths of light, the PolyDOTs were exposed to the sun for 4 hours and effectively “charged”. Once charged, hepatopancreas tissues from the eastern oyster (*Crassostrea virginica*) were exposed to various concentrations of both uncharged and charged PolyDOTs for 24 hours. In addition to the *in vitro* studies, *in vivo* studies were performed by exposing whole oysters to uncharged PolyDOT solutions. Hepatopancreas tissues were collected after a 48-hour exposure period, and the effects of the PolyDOTs on lysosomal destabilization were analyzed using the Neutral Red assay and cell viability was assayed using the MTT assay. The lysosomal toxicity assays with *in vitro* hepatopancreas tissues exposed to uncharged PolyDOT particles showed evidence of toxicity at concentrations greater than 100ppb. However, when exposed to charged PolyDOT particles *in vitro*, there was evidence of toxicity starting at 10ppb, suggesting potentiation. When exposed to PolyDOTS *in vivo*, there were no statistically significant differences between exposure groups. The MTT toxicity assay showed that there were no statistically significant differences between the exposure groups when tissues were exposed to both charged and uncharged PolyDOTS *in vitro* and uncharged PolyDOTs *in vivo*. This commonly used cell viability assay was less sensitive than the sublethal lysosomal destabilization assay. Studies like this one are not only important for understanding the effects of ENPs on oysters, but are also important for understanding the broader ecological impacts of ENPs on other species within the environment.

RAW Macrophages and the Proliferation of 4T1 Mammary Tumor Cells

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BACKGROUND: Breast cancer is the most common diagnosed cancer in women within the United States. Inflammation at the site of a cancerous tumor often recruits the help of immune cells, such as macrophages, and the presence of such immune cells is typically associated with a dimer prognostic for breast cancer patients. Macrophages within the tumor mass can have anti-tumor or pro-tumor characteristics usually in very early and later breast cancer stages, respectively. Our recent investigations surprisingly indicated that when RAW macrophage cells were co-implanted with 4T1 murine tumor cells, the primary tumor burden was reduced.

HYPOTHESIS: Here, we investigated the hypothesis that RAW macrophages through cell-cell contact or signaling slowed 4T1 cell proliferation.

MATERIALS: 4T1 cells (10,000 cells/well in 96-well tissue culture plates) were co-cultured with decreasing concentrations of RAW cells. Additionally, 4T1 cells were also incubated with different concentrations of RAW conditioned media. The proliferation of 4T1 cells was monitored by fluorescence as 4T1 cells constitutively express RFP and Hoechst nuclear vital dye was also used. Differences measured, on at least 3 independent experiments for each condition, were assessed using ANOVA and post-hoc tests with an *a priori* significance level of $p < 0.05$. Overtime proliferations of 4T1 cells were compared through slope analyses.

RESULTS: The addition of high numbers of RAW cells decreased 4T1 tumor proliferation ($p < 0.05$). Furthermore, the addition of RAW cell conditioned media alone (no RAW cells) also led to decreased 4T1 tumor proliferation ($p < 0.05$). The results indicate that the greater the concentration of macrophages or RAW supernatant, the lower the 4T1 proliferation in comparison to tumor cells alone ($p < 0.05$). Overtime, analyses demonstrated that the effects were more pronounced after a 4-5 day incubation.

CONCLUSIONS: In the conditions tested, our *in vitro* observations mimic the growth pattern observed *in vivo*. The observations that both RAW cell and supernatant led to comparable inhibition of 4T1 cell proliferation strongly support a paracrine effect of RAW cells secretions.

A Place to Heal: Intimate Partner Violence Survivors Reflect on Shelter Service Delivery

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BACKGROUND: Research estimates that 1 in 4 women will experience physical violence at the hands of an intimate partner during her lifetime (Tjaden & Thoennes, 2010). There are nearly 1,916 programs and shelters identified nationwide where victims of intimate partner violence (IPV) may receive services (NNEDV, 2014). During time-limited shelter stays, IPV victims have the opportunity to heal and plan for the future in a safe environment. IPV services are philosophically committed to service delivery that helps restore victims' empowerment, as self-determination and agencies are often deeply eroded within abusive relationships. Despite this commitment, shelters may struggle with service delivery models that undermine empowerment through excessive rules and disempowering practices (MOCADSV, 2012). Better understanding IPV victims' challenges within the shelter environment can enhance efforts to strengthen services.

METHODS: IPV shelter residents and service providers were engaged in a series of listening projects, which are similar to focus groups. Four listening projects, 2 with shelter residents (n=15) and 2 with staff (n=30), were convened at a local IPV shelter. A semi-structured interview guide utilized open-ended questions to elicit perceptions about services that might promote or impede empowerment. Listening projects lasted between 45 and 75 minutes, were facilitated by the lead researcher, and were digitally recorded then transcribed by the research team. Shelter residents received a \$10 gift certificate for their participation. Verbatim transcripts were thematically coded independently by all members of the research team. Identified themes were then discussed, revised, and consolidated.

RESULTS: Three thematic challenges associated within the shelter environment emerged: 1) obtaining basic needs, 2) planning for independence, and 3) living communally. All three challenges can serve as opportunities for client empowerment or disempowerment. Current service delivery strengths and challenges were identified.

CONCLUSIONS: Findings support recent IPV literature claims that service delivery quality strongly influences client outcomes. Enhanced staff training, improved processes, and additional resources may be necessary to address clients' basic needs, plans for independence, and communal living situation

Usability and Analysis of Business Databases

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Usability is defined as “a quality attribute that assesses how easy user interfaces are to use.”³ A user interface is only useful when utility and usability are considered as important aspects of the interface’s development process. An interface has good usability if it provides ease of use, efficiency, effectiveness, engagement, and error tolerance. If an interface lacks these qualities, users tend to give up. In academics, conducting research and being able to utilize the data gathered is an extremely important aspect of a student’s academic success. In this project, two business databases undergo testing and analysis in order to uncover more about their usability. Both the Business Source Premier and ABI/Inform Complete databases allow students to search for various sources of information regarding business and related subjects. To analyze the usability of these databases, task based analysis was used in order to collect quantitative and qualitative data about the student’s user experiences. Task-based analysis requires a set number of participants to answer a few questions, complete a list of predefined tasks, and finish with some follow up questions regarding their involvement in the study. After the usability testing is complete, the collected data is analyzed in depth for further evaluation. The data is important as it provides empirical evidence that allows for an inferred understanding of the usability of the business databases. Recommendations are provided in order to access apparent usability issues that will equip librarians with further details and explanations of the interpretation of the analyzed data. This newly found understanding will assist with the library’s future decisions in regards to the databases. The data will also reveal evident utility issues that can aid librarians in the development of instructional courses and training. The training would allow students to fully utilize all aspects of the database’s provided utilities. This project ensures that students are provided with all the tools necessary to not only take advantage of the library’s databases, but also allows them to thrive in their varying academic environments.

³ Jakob Nielsen, *Usability 101: Introduction to Usability* (Nielsen Norman Group: www.nngroup.com, 2012). <http://www.nngroup.com/articles/usability-101-introduction-to-usability/>

CHARLOTTE RESEARCH SCHOLARS PROGRAM

**Oral History of the Black Experience: through the lenses of Dr. Maya
Angelou**

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The notion of race is primeval. Humanity has given names to their strains since physical difference first began to appear. In the United States, race has been an obsession since the first Europeans sighted so-called “savages” on these shores. They subdued, slaughtered and finally sequestered them out of view. Race in America took on a deeper and more disturbing meaning with the importation of African slaves. The ideals of democracy in America and the values of universal equality as emphasized in the Constitution of the United States of America have been consistently contradicted. The current plight of race relations in America merits some serious questions and dialogue between diverse ethnic groups that reside in the country. Using Dr. Maya Angelou’s poems, this project offers solutions to curb racism in the United States. Indeed, Dr. Maya Angelou’s writings promoted racial equality and the betterment of humanity. The relevance of Dr. Angelou’s mission and poetry addressed the need for change to improve racial harmony and disparities in America. Her work explicitly exemplifies our need to understand the roots of this social problem. Identifying some historical events of the past can be used as a critical factor to reflect and confront the social ills and strange kind of enigma associated with the problem of racism.

**Connections through Technology:
Bridging the Digital Divide for Men in the Supportive Housing Community**

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BACKGROUND: Technology surrounds everyday life, with approximately 280 million Americans utilizing the internet. How we utilize this technology varies, but it can be stated that approximately 61% optimize the internet for eHealth resources. Yet, there are many Americans who do not have access to the internet. A vulnerable population with little to no access are those living in a supportive housing community (SHC). Therefore, we hypothesized that residents who participated in a technology program could decrease their anxiety related to computer courses, increase their social capital, and increase their confidence when evaluating eHealth information.

METHODS: Twelve male residents of SHC agreed to participate in our study. Participants enrolled in a six-week educational technology course called “Connections through Technology” (CTT) and were required to attend a minimum of five out of six one hour sessions. Prior to the start of the program, participants completed a pre-test survey. At the conclusion of the six-week educational intervention course the participants completed a post-test survey.

RESULTS: In our pretest (n=12), the data shows that a fourth of participants felt very anxious when considering participating in a computer course, however, it is also pertinent to show that 50% did not feel anxious at all. When pertaining to questions regarding what, where, and how to acquire health information participants scored an average of 48% in disagreement that they were able to distinguish and locate where and how to find reliable health resources. The results from our post-test indicated that there is a positive trend in the ability to decipher health related data on the internet while decreasing anxiety related to the use of computers, and increasing the ability to connect with others via online applications. The one on one time was the most productive for teaching skills, promoting confidence, and reducing anxiety.

CONCLUSIONS: Qualitative data emerged from testimonials and supports the positive trends suggested from the quantitative data of the study. Statistical analysis indicates there was a 16% increase in participant’s who self-reported as being “not at all anxious when taking a class about the usage of computers.” The participants also reported a 58% increase in the ability to differentiate between low quality and high quality eHealth sources. Social connections were revealed through the CTT Facebook page. Residents attempted connections with prior friends and immersed themselves with social groups with shared interests. The research expands on current knowledge concerning: stigma and anxiety; accessing computers; and participating in social media during the recovery process.

The Neuropeptide Substance P Limits the Production of the Inflammatory Mediator IL-6 by Resident CNS Cells Induced By a Viral Nucleic Acid Motif

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Inflammation is a normal protective innate immune response following tissue-scale cellular damage associated with trauma or infection. However, inflammation can occur in the central nervous system (CNS) and such responses can be detrimental to the host. CNS inflammation is closely associated with various diseases such as Alzheimer's disease, Parkinson's disease, amyotrophic lateral sclerosis, multiple sclerosis, and with bacterial and viral infections. Resident cells of the CNS have been increasingly recognized to play a key role in the initiation of inflammation within the CNS. Such cells include microglia, which resemble and share similar functions to peripheral leukocytes such as macrophages. These cells are capable of detecting and responding to viral and bacterial pathogens via specific receptors known as pattern recognition receptors (PRRs), such as Toll-like receptors (TLRs), that interact with discrete motifs known as pathogen-associated molecular patterns (PAMPs). In addition, microglial responses can be influenced by other mediators present in the CNS, such as the neuropeptide substance P, which interacts with its receptor (termed neurokinin-1 receptors or NK-1R) expressed by this cell type. Previous studies from our laboratory have shown that interactions between substance P and the NK-1R augment the inflammatory responses of microglia to bacterial PAMPs. In the present study, we have investigated whether this neuropeptide can influence the production of inflammatory mediators by a microglial cell line (EOC13.31) induced by a synthetic viral nucleic acid motif to begin to test the hypothesis that substance P similarly augments the responses of microglia to viruses. Our preliminary data suggests that, in contrast to its effects on bacterially induced responses, substance P attenuates microglial IL-6 production elicited by a viral motif as measured by capture ELISA. These studies therefore suggest that, rather than promoting damaging inflammation, substance P interactions with the NK-1R could be protective by limiting such responses following viral infection.

Synthesis and Electrochemistry of Rh and Ir Pybox Complexes

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Rhodium 2,6-bis[(4S)-4-R-yl-2-oxazolin-yl]pyridine (pybox) complexes have been shown to be effective catalysis for asymmetric hydrosilylation of ketones. It has been postulated that a rhodium(I) pybox complex (generated from a rhodium(III) pybox compound) is the catalytically active species in the hydrosilylation reaction. The Donovan-Merkert group has conducted electrochemistry studies on a rhodium(III) pybox complex (**1**) and confirmed that electrochemical reduction of this compound generates the rhodium(I) pybox complex postulated to be the catalytically active species discussed above. We have been exploring the electrochemistry of **1** further and have also synthesized and are exploring the electrochemistry of an analogous iridium complex. The syntheses of the pybox complexes were conducted using Schlenk techniques. The electrochemistry was studied using cyclic voltammetry and bulk electrolysis. ¹H and ¹³C{¹H} NMR spectroscopy are being used to characterize the compounds. Recent electrochemistry results reveal that electrochemical reduction of **1** in the presences of triphenylphosphine results in a rapid reaction of the reduced rhodium complex with triphenylphosphine. Further studies are being conducted to identify the product(s) of this reaction.

The New York Times Perspective on the Mexican Rebellions During the 1920s

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BACKGROUND: Throughout the chaotic years of the 1920s after the Mexican Rebellion (1910-20), the Sonoran Elite, which was made up of Adolfo de la Huerta, Álvaro Obregón, and Plutarco Elías Calles, stood as influential figures that symbolized Mexico's political, ideological, and militaristic clashes between opposing factions. Alongside the significant individuals of this decade, three important domestic conflicts, the Huerta Revolt (1923-24), the Cristero Rebellion (1926-27), and the Escobar Rebellion (1929), shaped the country's historical path with decisions that would ripple with aftereffects far beyond the immediate outcomes from those engagements. All of these events influenced the foreign interactions between the United States and Mexico during the tense diplomacy of these two countries to the point that the New York Times created a perspective many in that region believed to represent the domestic climate of Mexico.

METHODS: The decision was made to observe and analyze these historical events through the articles and editorials of the journalists found in the New York Times Archive.

RESULTS: During this decade, the American journalists represented an important and influential perspective on the events in Mexico through their reporting, predictions, and opinions. The primary sources gathered a large amount of information which usually followed these three conflicts day-by-day and created a specific outline which did not reflect a domestic perspective but indicated an opinion that positioned foreign interests as paramount.

CONCLUSION: The results analyzed exhibit a change in public opinion over the time span of the three revolts. During the Huerta Revolt, journalists displayed sympathy and understanding towards the Obregón government and the ideologies represented by the Obregónist citizens. Due to the decisions and interactions Obregón had with American journalists at this time, the New York Times found that the rebels offered less leniency for American interests inside Mexico. The daily articles of the Huerta conflict revealed a willingness of the journalists in the New York Times effort to cover as many details as possible. However in both the Cristero Rebellion and the Escobar Rebellion, both the New York Times and the U.S. government gradually desired to have the conflicts end since the prolonging of these conflicts would not benefit America's reputation after the numerous occasions America offered support to Mexico. Alongside this undesired effect, the impact these rebellions had on American interests in Mexico expired any remaining patience of American citizens and prolonged a tense clash of negotiations between the two countries until all foreign subsoil and land property was claimed by Mexico in 1938 under an act that reiterated Article 27 of the 1917 Constitution.

Development of a Universal Cell Loader for Fast and Reliable Construction of Physiological Brain Vessels in 3D

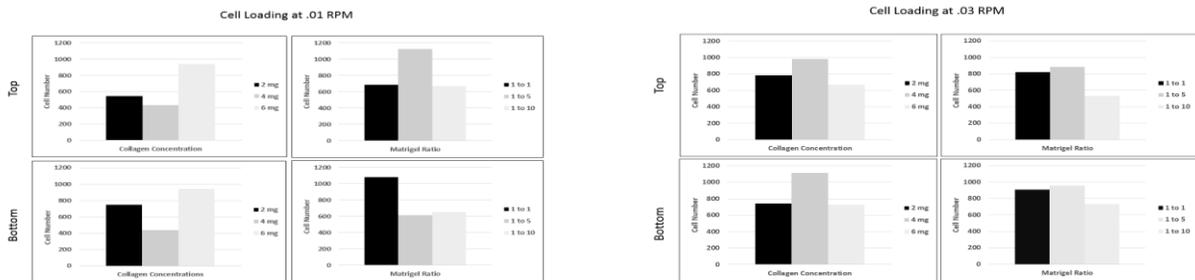
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BACKGROUND: The Blood Brain Barrier (BBB) is a unique signature of brain vessels, which serves as a tight and selective filtering mechanism that carries blood to the brain and spinal cord tissues, blocking the transmission of neurotoxic molecules. To better understand the role of the blood–brain barrier (BBB) we have designed a microfluidic platform that replicated critical mechanical and functional features of the BBB. However, the current in vitro methods provide 2D vessel and the most recent 3D cell loading method takes several hours and showed uneven cell loading to side surfaces. In this project, we are developing a mechanism that can overcome these limitations.

METHODS: We have created the first generation of “1-Axis Universal Cell Loader”. This mechanism is capable of implementing multiple gear ratios that provide varying low magnitudes of RPM ranges. The low RPM ranges are a result of preliminary experiments that suggested that lower RPMs would give adequate time and a stabilized environment for uniform cell affixment to all surfaces. The new mechanism also included a versatile tray that was capable of fitting multiple substrates including multi-well dish, 50ml dish, and glass slide. To control contamination risk and battery lifetime in a high humidity environment, the new mechanism also featured a self-contained weatherproof power delivery system for wireless operation. The mechanism was used in unison with the developed microfluidic BBB model to optimize operational conditions (RPM and ECM concentrations). The channels were coated with ECM and then cell loaded. The BBB device was then rotated on the “1-Axis Universal Cell Loader” for 2 hours. The device was imaged on the second day to verify surface affixment. Tightness was confirmed by GL1 staining.

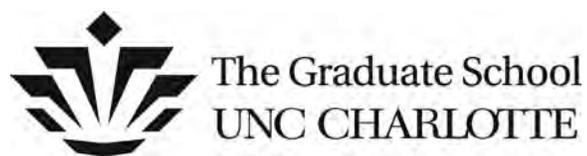
RESULTS:



CONCLUSIONS: The mechanism proved successful in reducing incubation time and uniform cell coating. The matri-gel 1:5 seemed most effective in providing an adequate pallet for cellular affixment.

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