Online Proceedings

SESSION 1O

UNEXPECTED REBELLIONS: REFRAMING THE NORM

Session Moderator: Michelle Liu, English
MGH 288
12:15 PM to 2:15 PM

* Note: Titles in order of presentation.

A Story of Feminine Sacrifice: the Music, Text and Biographical Connections in Amy Beach's Concert Aria *Jephthah's Daughter*
Clarissa Aaron, Senior, Music Composition, Seattle Pacific University
Mentor: Cherie Hughes, Music, Seattle Pacific University
Mentor: Christine Chaney, English and Honors, Seattle Pacific University

Jephthah's Daughter (Op. 53), a concert aria for soprano and orchestra written by Amy Beach (1867-1944) in 1903, has long suffered neglect due to the fate of its manuscript and the fate of Beach's work in general. This investigation seeks to probe how Beach engaged the Biblical subject matter and mid-1800s French text in her setting. I discuss this engagement through stylistic comparison with the musical traits of her other work, translation comparison between the literal meanings of the original poem and Beach's English rendition, and contextualization of Beach's setting within the history of how this story has been interpreted. The aria fits within Beach's dramatic Romantic style and deliberate molding of text, and tells a story with notable connections to her life and work. Because of the extent to which Beach's life story aligns with that of Jephthah's daughter, Beach's own statements on music as autobiography, and her choice to engage this story in such depth, I argue that this aria may express lament for Beach's own suppression as a female composer in Victorian society. This reading provides further support to a narrative of Beach's life which examines the negative impact of her patriarchal context.

POSTER SESSION 2

Balcony, Easel 96
1:00 PM to 2:30 PM

The Influence of Polymer Defects on the Micro-structures of Semiconducting Polymer Thin Films
Anton Benjamin Resing, Senior, Materials Science & Engineering
Mary Gates Scholar
Mentor: Christine Luscombe, Materials Science & Engineering
Mentor: Wesley Tatum, MSE

Solar energy has unmatched potential as the energy source of the future and semiconducting polymers offer a unique set of properties that can address many of the current barriers that hold solar technology back. Little work has been done investigating bulk film microstructure formation, but the ability to control and engineer defects opens the door to new applications that employ tunable energy levels and adjustable open circuit voltage and short circuit density. Semiconducting polymers are exciting because they have untapped potential for improvements in efficiency, they offer a cheap, energy efficient alternative to silicon, and can be easily mass produced via roll-to-roll printing. Solution processing via roll-to-roll printing is transformative as it allows for low energy, high throughput manufacturing of flexible devices. This research focuses on generalizing structure-property relationships for semiconducting polymers and investigating the locations and causes of crystalline defects. The goal is to extrapolate measurements made at a nanometer scale on self-assembled poly(3-hexylthiophene) (P3HT) nanowires to larger production of bulk films. Current understanding of polymer crystallization is built on two competing models, both of which were developed for non-conjugated, therefore non-semiconducting polymers. The Luscombe group has previously demonstrated that the crystalline defects, such as unfavorable monomer arrangement (regioregularity), bulky end groups, the range of polymer lengths (dispersity) and the specific polymer length (degree of polymerization (DP)) do not affect nanowire width, meaning defects are not excluded to the perimeter of the nanowires. This research isolates the variable of polymer length and controls other defects. Using X-ray diffraction and differential scanning calorimetry, nanowires synthesized from polymer lengths ranging 50 to 150 DP have been tested for melting temperature, level of crystallinity and dimensions to determine where the defects reside. Once this is understood, we can confirm which model for conjugated polymer defects is correct.

POSTER SESSION 2

Commons West, Easel 15

1:00 PM to 2:30 PM

Mental Health and Coping Strategies: A Comparison of Young Adult 4-Year Students and Current Non-Students

Rose Lyles Riebli, Senior, Psychology
Mentor: Christine Lee, Psychiatry and Behavioral Sciences
Mentor: Devon Abdallah, Psychiatry and Behavioral Sciences

Roughly 20% of young adults in the United States experience some sort of mental health disorder. The majority of this research has focused on young adults in general or 4-year college students, however less is known about the mental health and coping strategies of young adults not currently attending school. The purpose of this study was to compare mental health, the use of alcohol and/or other substances as a coping mechanism for stress, and alcohol and marijuana use among young adults who attend 4-year colleges and those not attending school. A subsample (N=552; 56% female, 59.5% White, M age=20.58, SD=1.7) of young adults using baseline data from a larger longitudinal study on health behaviors was used for the current analyses. The subsample included 355 students currently attending 4-year college and 197 young adults not attending school (highest education status of these individuals included less than a high school diploma (1.5%), high school diploma (19.3%), some college (15.2%), 2-year degree (10.1%), 4-year college degree (52.8%), and graduate degree (1%). Findings indicated that young adults not in school reported significantly higher rates of depression, anxiety, and perceived stress in the past month than students in 4-year colleges. Similarly, findings indicated that non-students reported being high from marijuana for more hours, higher rates of alcohol use and coping with stress through alcohol and/or substance use in the past month than 4-year college students. Further research is needed, which focuses on young adults who are not currently attending 4-year colleges as they may face different life stressors and cope differently than 4-year college students.

POSTER SESSION 2

Balcony, Easel 93

1:00 PM to 2:30 PM

Dynamic Imine Bond Exchange for Self Healing in Organic Electronics

Stuart William Smith, Senior, Materials Science & Engineering
Mary Gates Scholar
Mentor: Christine Luscombe, Materials Science & Engineering
Mentor: Jonathan Onorato, Materials Science and Engineering

Organic materials show promise as alternative materials for many modern-day electronics applications, such as transistors, LEDs, and photovoltaics. They hold many advantages over their inorganic counterparts, such as being lighter weight, lower cost, and flexible. Self-healing polymers are a specific form of organic polymer that are particularly promising because of their potential use in flexible devices. Self-healing materials have the capacity to spontaneously reform damaged bonds, thereby returning the material to its original state and recovering its initial properties. Imine bonds are a type of self-healing bond. Imines have a highly dynamic nature, allowing for the reshuffling of bonds required to recover material properties. Much research has been done on the use of imine bonds in self-healing polymers; however, no work has been done utilizing imine bonds for self-healing in semiconducting polymers. To incorporate self-healing behavior into a semiconducting polymer, we have investigated the synthesis of a poly(azomethine), a semiconducting polymer with an imine bond along the backbone. Initially, as a proof-of-concept for the dynamic exchange of bonds in our specific system, we reacted aniline with 2-thiophenealdehyde to form an imine. Then, to determine if bond exchange occurred, the imine produced was reacted with another amine. The reaction showed that a significant amount of imine exchanged, so we moved on to a polymer system. We synthesized 4,4'-dinitrotriphenylamine, which we then reduced to produce a diamine species. This diamine was then polymerized with a dialdehyde species, resulting in a fully conjugated polymer with multiple imine bonds along the backbone. The polymer will be made into thin films for testing. Mechanical properties will be investigated to determine initial film properties. Additionally, transistors will be produced to see if electrical properties can be recovered after the film has been damaged.

POSTER SESSION 2

Commons East, Easel 53

1:00 PM to 2:30 PM

A Graph Theoretical Analysis of Pediatric Sports Concussion using Diffusion Tensor Imaging

Samantha H Sun, Senior, Bioengineering
CoMotion Mary Gates Innovation Scholar
Mentor: Christine Mac Donald, Neurological Surgery

Every year there are at least one million new cases of sport-related concussion in children younger than 18 in the United States. Current diagnostic screening tools, such as CT and MRI, are insensitive to the subtle microstructural changes that occur following concussion, and in pediatric concussion, there is additional complexity of the still-developing brain and how concussion affects its long-term development. While these patients' radiographic images often appear normal, they report an array of post-injury symptoms, which questions the true extent of brain injury after concussion. The aim of this research project is to utilize advanced neuroimaging and analysis tools, diffusion tensor imaging (DTI) and graph theory, to explore short-term and longitudinal changes in the brain following pediatric sports concussion and to obtain a more reliable and sensitive method to diagnose pediatric concussion. Children aged 10 – 14 with unresolved symptoms from a sports-related concussion and age-matched controls were included in this study. Each participant underwent MRI scans and clinical assessments 4-6 weeks post-injury and 6 months after the initial visit . We used DTI, which has been shown to be sensitive to microstructural changes related to concussion in adults. In addition, we analyzed the DTI data using graph theory, which is a mathematical tool that models information as a network. We investigated differences in network properties between concussed and non-concussed children and used random generated networks as a control. We confirmed that the network properties of children were distinct from random networks. We also observed a 9% reduction in global clustering and 16% increase in local connectivity in the concussed patients, suggesting overall network disconnect and stronger, but more segmented, local network groups. These preliminary results encourage further exploration of the methods employed and display clinical relevance in distinguishing between concussed and non-concussed youth.

POSTER SESSION 2

Balcony, Easel 94

1:00 PM to 2:30 PM

Improving Characterization Methods for Ultrasonic Transducer Materials

Corey Roszell Johnson, Senior, Mat Sci & Engr: Nanosci & Moleculr Engr
Mentor: Christine Luscombe, Materials Science & Engineering
Mentor: Stephen Davis, Transducers

Ultrasonic transducers are key components in the probes of ultrasound devices used for medical imaging. The probe consists of 4 different materials; a piezoelectric element, backing material, an acoustic matching layer and an acoustic lens. The properties of these materials will directly impact the performance of the transducer and the quality of the images produced, making them a high priority for future development. Currently, researchers at Siemens Healthineers are looking to develop new materials for our ultrasound probes to help increase device performance and make better ultrasound devices. This senior capstone project looks to develop the Acoustical Properties Measurement System (APMS), a characterization testing system, to aid in the production of the new transducer materials. Development of new MATLAB and LabView code has been carried out to provide a smoother operating experience and enhanced design simulation. Data storage has been revised to provide a single location for users to access all collected data and a new naming system has been implemented for easier sample tracking. A standard operating procedure has also been established to help aid new users in operation of the system and a new method for measuring high attenuation materials has been developed. These improvements to the APMS system will further benefit the research and development of Siemens Healthineers ultrasound devices, providing customers and their patients with provide accurate diagnoses and help them to make the best decisions for their care.

POSTER SESSION 2

Balcony, Easel 95

1:00 PM to 2:30 PM

The Synthesis and Characterization of Semiconducting Rubber

Michelle Katz, Senior, Materials Science & Engineering
Mentor: Christine Luscombe, Materials Science & Engineering
Mentor: Viktoria Pakhnyuk, Chemistry

Organic electronics have generated wide interest and excitement because they are relatively inexpensive to produce and are created from abundant resources, unlike their inorganic counterparts. Many organic materials also possess the unique potential of being stretchable in electronic applications including solar cells, OLEDs, and transistors. These materials can be made into wearable electronic devices and have the potential to power other advanced technology. Organic electronics are often made using semiconducting polymers. However, these polymers are semi-crystalline and brittle in solid state. To enhance their stretchability, our approach is to incorporate stretchable rubber into the semiconducting material by chemically linking the two polymers to combine their properties. This research investigates the crosslinking the well-known semiconducting polymer P3HT, poly(3-hexylthiophene), with polybutadiene (PB), a common rubber, to create a stretchable semiconducting material. To make crosslinking possible, we synthesize P3HT that includes a functional bromine to produce P3HBrT, poly(3-(6-bromohexyl)thiophene). Once the P3HBrT is synthesized, it can then be crosslinked with PB at different ratios to optimize for conductivity and stretchability. The crosslinked

P3HBrT/PB can then be made into a thin film transistor and characterized for the desired properties. Ultimately, future research in this area will lead to a new generation of electronic devices with improved material properties.

POSTER SESSION 2

Balcony, Easel 92

1:00 PM to 2:30 PM

Modular Process for Arbitrary Fiber-Based Device Production and a Novel Fiber-Based Organic Photovoltaic Architecture

Zackary Aidan Wolford, Senior, Mat Sci & Engr: Nanosci & Moleculr Engr
Mentor: Christine Luscombe, Materials Science & Engineering

Organic photovoltaic (OPV) cells are an emerging technology with the potential to become a major source of energy in our future. In addition to a lower environmental impact than common silicon-based solar cells, OPV cells are flexible, lightweight, and comparably inexpensive to fabricate. They are also quite customizable via molecular engineering providing the opportunity for much novel architecture. Our research team focuses on innovating a modular processing system for OPV cells in the form of multi-component fibers by continuously coating device layers onto wires. Using a small, user-friendly system allows us to focus on the most important factors that affect the morphology of the resulting OPV fiber. After characterizing the fibers we are able to consider what changes need to be made to the modular system, allowing us to better advise on the design of a larger-scale manufacturing process for organic photovoltaic fibers.

POSTER SESSION 4

Balcony, Easel 89

4:00 PM to 6:00 PM

Recovery of Poliovirus from Primary Sludge

Yarrow Linden, Senior, Environmental Health
Mentor: John Scott Meschke, Environmental & Occupational Health Sciences
Mentor: Christine Fagnant, Environmental & Occupational Health Sciences

In some locations (*e.g.*, refugee camps or rural areas in countries like Haiti), fecal waste systems are not water-based, but resemble a pit latrine, for which current sampling and processing methods were not designed. The fecal waste is collected and held, often under poor infrastructure. The fecal sludge management process is important to consider for environmental surveillance, as this may be the only source for screening. This surveillance is important for the continued eradication of poliovirus (PV). The goal of my research was to develop a method for PV extraction from sludge in pit latrines for use in locations with concentrated fecal waste. Towards this goal, I modified two existing protocols for extraction of various viruses from different solid media and applied them to evaluate virus recovery from primary sludge. The first (M1) was originally designed to recover hepatitis A from oysters, while the second (M2) was originally developed to extract somatic coliphages from sewage sludge. The modified methods were evaluated using primary sludge collected from a wastewater treatment plant in Seattle and spiked with the vaccine strain of poliovirus type 1 (PV1). Virus recovery was assessed by a plaque assay. M1 involved acid adsorption followed by glycine elution, threonine elution, skimmed milk flocculation, vertrel and threonine extractions. For M2, liquid and solid fractions were initially separated by centrifugation. Processing of the solid fraction involved beef extract elution, sonication, skimmed milk flocculation, and vertrel extraction, while the liquid fraction was concentrated using membrane filtration and beef extract elution. The preliminary data indicate that M1 may have a higher recovery, and therefore be the preferred method for use during environmental surveillance of poliovirus. Future work should include additional replicates and optimization of the preferred method.