Photo taken preCOVID-19

UNIVERSITY OF TEXAS ARLINGTON

OFFICE OF UNDERGRADUATE RESEARCH

# FALL 2020 UGRAP & UROP SHOWCASE

## OF UNDERGRADUATE SCHOLARS

UNIVERSITY OF TEXAS ARLINGTON
OFFICE OF UNDERGRADUATE RESEARCH

# FALL 2020 UGRAP & UROP PARTICIPANTS

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Thien Peter Nguyen
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Sherri Pham
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Richard Schargel
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**Title:** Carbon Structure Formation of Silicon Oxycarbide Ceramics
**Student Name:** Eman Alasadi
**Student Major(s):** Chemistry and Physics
**Faculty/Research Mentor**: Peter Kroll, Ph.D.

Polymer-derived silicon oxycarbide (SiCO) ceramics exhibit several outstanding properties and are considered for applications as functional ceramics in additive manufacturing and for energy storage. A key feature of SiCO materials is the so-called “free” carbon content, which are carbonaceous segregations embedded within an amorphous glass matrix. Properties of the material depend on the amount of carbon in the material as well as its actual distribution or morphology: how carbon atoms are connected with each other and in which way they are embedded within the surrounding glass matrix. In this study, we use molecular dynamic simulations with an empirical potential (Tersoff-type) to explore formation of carbon structures in SiCO. Our simulations mimic pyrolysis of the polymeric precursors and annealing of the amorphous ceramic at high temperatures. We model different annealing procedures, apply different heating and cooling rates, and realize structures comprising distinctly different carbon morphologies. We find that isolated carbon atoms of a molecular precursor are initially well dispersed throughout the material. Upon annealing they combine to larger, but finite segregations, which resemble poly-aromatic hydrocarbons or fragments of single-layered graphene. These layered carbon segregations act like walls and effectively separate the surrounding amorphous matrix, essentially confining it in small domains. Continuity and sizes of these domains are related to the amount of free carbon and to the composition of the material. Above a certain temperature annealing yields formation of tubular carbon structures, which – ultimately – convert into large graphitic segregations.

**Title:** Transcriptional Regulation of LD-transpeptidases in the Nosocomial Pathogen, Acinetobacter baumannii
**Student Name:** Hannah Bovermann
**Student Major(s):** Microbiology
**Faculty/Research Mentor**: Joseph Boll, Ph.D.

Carbapenem resistant *Acinetobacter baumannii* is classified as a high-level threat to public health by the Center for Disease Control (CDC). Polymyxin E (colistin) is prescribed as a last-line therapy to combat carbapenem resistant *A. baumannii*. However, colistin resistance has also begun to emerge. *A. baumannii* can inactivate lipooligosaccharide (LOS) biosynthesis to develop colistin resistance, but the underlying molecular mechanisms are not understood. We previously found that two LD-transpeptidases (Ldts),LdtJ and LdtK activities are essential for *A. baumannii* survival without LOS, but the mechanisms that regulate Ldts in *A. baumannii* are not known. Here, we constructed *ldtJ* and *ldtK*transcriptional reporters to measure gene expression, which will allow us to better understand how these genes stabilize the LOS deficient cell wall.

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**Title:** Evaluating Behavioral Reactions to Online Hate Speech
**Student Name:** Will Chen
**Student Major(s):** Mathematics
**Faculty/Research Mentor**: Shirin Nilizadeh, Ph.D.

People often utilize social media websites as a tool for expressing their personal opinions. However, the popularity of these websites attracts nefarious individuals who promote and propagate hate speech based on race, religion, age, gender, sexual orientation, national origin, and disabilities. Due to such cyberbullying and online harassment attacks, there is an increasing prevalence of anxiety and depression among the social media users nowadays. Therefore, it is crucial to be able to detect such online hate speech and analyze how hate targets react to such attacks. Our main goal is to analyze a large sample of conversations on Twitter which are randomly distributed and detect the ones which frequently attract toxic replies. We capture the reactions of the tweet authors of these conversations to find if they exhibit certain behaviors such as responding to the hate instigators or deleting the original tweets. Future steps will include identifying vulnerable tweet authors in real time and providing interventions when they receive hateful replies.

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**Title:** A Multi-Variate Recurrent Neural Network Combining Stock Prices and Google Headlines
**Student Name:** Jose Cortes
**Student Major(s):** Mathematics
**Faculty/Research Mentor**: Li Wang, Ph.D.

Developments on prediction models are often focused on efficiently and effectively processing a single set of data. Multi-Variate Recurrent Neural Networks take a lateral approach, combining data not traditionally used parallel with traditional data. To understand, develop and improve this

technique, we must explore cases where i t could be applied. The current application combines stock prices and headlines.

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**Title:** Phthalates in Children's Dental Products
**Student Name:** Chris Jimenez
**Student Major(s):** Geology
**Faculty/Research Mentor**: Un-Jung Kim, Ph.D.

This study aims to investigate the occurrence, release and associated exposure of plasticizer in consumer products that are meant for small children and infants. Phthalates are a class of chemicals that are added to products in order to make them both more durable and flexible. These chemicals are endocrine disruptors have been linked to respiratory illness in children and have been shown to overall increase the rate of various adverse effects in animal model based toxicological studies. The purpose of our research project is to test for phthalates and the replacement chemical compounds in children's products such as teething toys, baby orajel, toothbrushes, and pacifiers that would potentially deliver these chemicals to the user via the oral route and include health problems in the young population. To achieve the goal, in lab condition controlled leaching from selected dental/oral product to artificial saliva will be performed and the observed compositional occurrence pattern and level of target compounds from the samples will be quantified as estimated daily intake in a targeted young population through a statistical analysis.

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**Title:** Analyzing FASB's Proposed Statement of Financial Accounting Concepts
**Student Name:** Pranav Kadam
**Student Major(s):** Accounting and Finance
**Faculty/Research Mentor**: Ramgopal Venkataraman, Ph.D.

The Financial Accounting Standard Board (FASB) is a privately funded and organized entity that sets standards used by businesses in the United States to prepare financial statements. These financial statements that are used by the investors to make informed investment decisions about the firm. These documents are updated by the FASB when necessary due to either changing market conditions or new technologies or financial instruments. The first step in the process is for the FASB to put it on its agenda followed by an exposure draft that outlines their current thinking on the issue. There is a comment period, during which preparers, users, accounting firms and academics provide feedback on the exposure draft. The FASB then meets and considers all these issues and issues a final document which sets the authoritative standard. Due to the changing nature of economic assets, liabilities and equity, the FASB revisited the basic concepts with an exposure document of financial accounting concepts that was issued on July 16, 2020. My research focuses on this exposure draft.

**Title:** Electro Spun Nano Fiber Dimension Manipulation
**Student Name:** Monalisa Karim
**Student Major(s):** Aerospace Engineering
**Faculty/Research Mentor**: Rassel Raihan, Ph.D.

Nano fiber mats are widely being used in number of fields because of their attractive properties such as: high porosity, high surface to volume ratio, piezoelectric properties, conductivity and magnetic shielding. Porous nano mats are utilized for ultrafiltration while the piezoelectric properties of nano mat can act as a sensor when infused in CF or GF composite laminate. Among different procedures to produce nano mats, electro spinning is the most common. In the process of fabricating nano mats, a number of parameters affect the electrospinning process: voltage, solution concentration, solution viscosity, air flow, temperature, humidity, needle tip to mandrel distance etc. Our goal is to determine how these parameters affect different fiber properties such as diameter, porosity, tensile strength and dielectric properties.

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**Title:** Development of Motor Skills and Coordination
**Student Name:** Irissa Le
**Student Major(s):** Biology
**Faculty/Research Mentor**: Priscila Tamplain, Ph.D.

In this study, we reached out to parents of children with DCD in the US, documenting their experiences and recording any data that would have corresponding implications. DCD, on average, affects 5-6% of children in grade school. Many of these children have difficulties adapting in a public school setting. They often feel ostracized and have difficulties fitting in with fellow classmates. Often times, parents of these children expressed concern of the limited number of resources available. In conducting this research, we quickly realized that it was indeed a concern and prompted us to strive to provide better support for these children with this disorder.

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**Title:** Blunted Hyperemic Response to Mental Stress in Young, Non-Hispanic Black Men is not Impacted by Acute Dietary Nitrate Supplementation
**Student Name:** Peter Nguyen
**Student Major(s):** Exercise-Science Kinesiology
**Faculty/Research Mentor**: R. Matthew Brothers, Ph.D.

Prevalence of cardiovascular disease (CVD) and the mortality from CVD is greatest in the Non-Hispanic black (BL) population. Mental stress causes an increase in forearm blood flow (FBF) that may stem from nitric oxide (NO) and β-adrenergic mediated mechanisms. Understanding relations between hemodynamics and mental stress is essential to mediate the higher risk for and prevalence of CVD in the BL population. There are 2 phases of experimentation. In phase 1, data was collected in the fasting state and served as baseline measures. In phase 2, data was collected before and 2 hours post consumption of a beverage with high dietary nitrate ($NO_3$: beetroot (BR) or a similar looking and tasting beverage that was low in dietary nitrate supplementation (placebo; PL). The study highlights that young, BL men exhibit a blunted blood flow response to mental stress compared to young, WH men. This observed vascular dysfunction may not improve

through acute $NO_3$ supplementation aimed at augmenting NO bioavailability and subsequent vasodilatory function. Although BL men exhibit elevated prevalence of CVD and hypertension, possibly mediated by vascular dysfunction, these data suggest simple acute treatment with dietary $NO_3$ may not be enough to improve vascular health as assessed by hemodynamic responses to mental stress.

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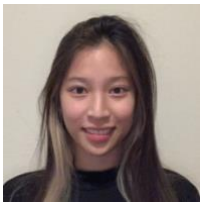

**Title:** Influence of Predators on Social Behavior of Daphnia and their Offspring – Transgenerational Plasticity
**Student Name:** Janice Pham
**Student Major(s):** Biology
**Faculty/Research Mentor**: Matthew Walsh, Ph.D.

Environmental factors can induce behavioral changes in an organism which can then span across multiple generations, also known as transgenerational plasticity (TGP). An understanding of the factors that underly TGP is significant in expanding our knowledge on how evolution can cascade throughout generations as well as its adaptive significance. To do so, the response of Daphnia raised in predator cue and non-predator cue to light was assessed, and it was revealed that after continued exposure to predator cue, the phototactic index of offspring was lower than in parents. Future steps would be to test whether populations that naturally differ in exposure to predators, differ in their response to continued manipulations of predator cues in the lab.

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**Title:** Cutaneous and Muscle Reactive Hyperemia in Young Adults with Major Depressive Disorder
**Student Name:** Sherri Pham
**Student Major(s):** Exercise-Science Kinesiology
**Faculty/Research Mentor**: Jody Greaney, Ph.D.

The reactive hyperemic vasodilatory response to a brief period of tissue ischemia provides an index of microvascular function and is an independent predictor of cardiovascular morbidity and mortality. As such, reactive hyperemia is a non-invasive technique that is commonly utilized to provide an index of vascular health in various patient groups. Major depressive disorder (MDD), a non-traditional risk factor for cardiovascular disease (CVD), has been associated with blunted reactive hyperemia, though this is not a universal finding. Further, to date, the quantification of the reactive hyperemic response in adults with MDD has been limited to the forearm muscle, assessed as Doppler ultrasound derived blood velocity in the brachial artery following a period of suprasystolic cuff occlusion.

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**Title:** EM: Suspicious Audio Classification using Deep Learning
**Student Name:** Subham Pokhrel
**Student Major(s):** Computer Science
**Faculty/Research Mentor**: Shirin Nilizadeh, Ph.D.

The objective of the research is to identify suspicious sounds and pinpointing their location in space through the use of Deep learning and IoT mobile sensing devices. The software should be specialized in suspicious sounds differentiation including those sounds that are obscured by heavy background noise. The Deep Learning classifier would be tested against adversarial

attacks such as audible or hypersonic noise injection. In addition, the software uses an inter-connected network of IoT devices and GPS to triangulate the location of the suspicious sound. This will be done by creating a network of devices to act as listening nodes and combined with GPS Triangulation. Our current step is Sound Recognition and testing of different classifiers against adversarial attacks. The future step would be sound location which would deploy the classifiers to into mobile devices and location triangulation.

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**Title:** Outer Membrane Modifications Mediate Carbapenem Tolerance in Gram-negative Bacteria
**Student Name:** Richard Schargel
**Student Major(s):** Biology and Microbiology
**Faculty/Research Mentor**: Joseph Boll, Ph.D.

Antibiotic tolerance remains a growing, yet understudied, problem in modern health care settings. Tolerant bacteria survive in otherwise lethal antibiotic concentrations. When the antibiotic is removed, tolerant bacteria resume normal growth. Similar to well-studied antibiotic resistance mechanisms, bacterial tolerance contributes to widespread treatment failure. However, the molecular factors that regulate antibiotic tolerance are not well understood. Antibiotic tolerance depends on the strain-to-strain variation as well as the administered antibiotic. Upon exposure to “last-line” carbapenem ß-lactam antibiotics, tolerant gram-negative bacteria form spherical morphotypes devoid of a peptidoglycan cell wall. These morphotypes are commonly known as spheroplasts; furthermore, the molecular mechanisms and factors that mediate antibiotic-induced spheroplasts are mostly unknown. In this study, we examined the role of divalent cations and lipid A modifications on the outer membrane of drug-tolerant bacterial spheroplasts in order to find an explanation for their ability to continue causing infection despite lacking a fundamental cellular component, the peptidoglycan cell wall. Our results showed that most gram-negative organisms are able to incorporate divalent cations to increase survival. Additionally, Lipid A modifications regulated by the *pho* and *arn* operon play a substantial role in mediating survival in antibiotic tolerance conditions.

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**Title:** Micro foundations and Transnational Anti-racist Protests
**Student Name:** Anshu Shrestha
**Student Major(s):** Political Science
**Faculty/Research Mentor**: Brent Sasley, Ph.D.

The world has seen a rise in populist, kleptocratic, right-wing ideologies, especially after the 2010s. Is the sudden rise of illiberal politics in states worldwide a coincidence or are there factors that can tie them together? As of now, there is no factual correlation and causation despite these states interacting in the international arena and sharing many similarities. On the other hand, transnational protests are also not a new phenomenon in the world but the rise in anti-racist protests is unprecedented. After George Floyd's death in Minneapolis, the USA on May 25, 2020, thousands of protests were recorded on six continents. It is difficult to pinpoint what exactly it was about Floyd’s death that resonated with so many people as the reasons differ according to the economic, socio-political, and historical context of the states. Additionally, how will international states perceive the United States as a superpower in the future when there is so much civil

unrest? We attempt to find an accurate purpose for these protests and analyze what it means for the world view of the United States.

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**Title:** Innovative Sensors for Subsurface Emissions (ISSE)
**Student Name:** Nathaniel Steadman
**Student Major(s):** Civil Engineering
**Faculty/Research Mentor**: Kathleen M. Smits, Ph.D.

Most methane studies conducted in research use an array of aboveground sensors which are readily available on the market today, leaving little understanding for the belowground migration of methane from natural gas pipelines. Even these aboveground sensors are lacking though as they are primarily used to detect gas, not determine the concentration of the gas. The same issues are prominent in the existing belowground sensors. The sensors that were reviewed under this research are a new innovative approach to belowground methane sensors which allows for continuous, real time data to be collected which also promotes safer testing environments for researchers. These sensors use thermal conductivity to determine the concentration of methane gas in the subsurface at a specific point. One of the main issues with these innovative sensors is they have not been widely tested by researchers or industry professionals. The goal of this research was to determine their performance and proper set up.

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**Title:** Classified Object Localization in SLAM and Loop Closure through Reinforcement Learning
**Student Name:** Rhitu Thapa
**Student Major(s):** Software Engineering
**Faculty/Research Mentor**: Nicholas Gans, Ph.D.

In computational geometry and robotics, SLAM (Simultaneous Localization and Mapping) is the computational problem of constructing or updating a map of an unknown environment while simultaneously keeping track of an agent's location within it. SLAM is the key driver behind unmanned vehicles, drones. This technology scans and learns about the environment and allows us to augment it with useful and value adding digital content. Maps generated by many visual Simultaneous Localization and Mapping (SLAM) algorithms consist of geometric primitives such as points, lines, or planes. Using this technique, the motion of the object is identified by using the motion of the image. Using the Linux Machine, the path of the robot was recorded, and later trajectory was created using ORB SLAM for the loop closure. The approach was tested on several public data sets and own data sets for the promising result. Future steps will include testing our algorithm on three data sets in lab environment using tag markers to demonstrate the accuracy of classified object Localization process.

**Title:** Chemotherapy Medication Effects Focused on Rodents and Humans
**Student Name:** Katia Vazquez
**Student Major(s):** Psychology
**Faculty/Research Mentor**: Perry Fuchs, Ph.D.

Chemotherapy medication is an intervention used in the treatment of cancer. Not all patients who develop cancer have the same treatment plan, but each medical intervention is based on the malignancy. Chemotherapy medication has been known to cause “chemobrain” (Panoz-Brown, et al., 2017). Chemobrain is medically termed as chemotherapy-induced cognitive impairment (CICI) and is a concern for those who use chemotherapy. Rodents have helped to further evaluate the effects of chemotherapy such as cognitive deficits and memory encoding/retrieval. There have been significant findings in cognitive impairment in humans with the use of chemotherapy medications, but for rodents the studies vary. In the ongoing study a deeper understanding of the effect chemobrain has on decision-making and short-term memory is still being researched. Chemotherapy medication can also have an effect on how encoding and retrieving memory is executed. The hypothesis focuses on main effects in decision making and short-term memory loss due to chemotherapy medication specifically on how it can have an effect on encoding and retrieval processing.


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