27th Annual Gemstone Honors Program Thesis Conference

Friday, April 10, 2026
University of Maryland, College Park

GEMSTONE
HONORS COLLEGE
UNIVERSITY OF MARYLAND

Thesis Conference Schedule

Time	Team	Room	Link
8:00 a.m.	VIRAL	MTH0303	https://go.umd.edu/VIRAL
9:00 a.m.	FET:US	MTH0305	https://go.umd.edu/FET_US
10:15 a.m.	COLOR	MTH0407	https://go.umd.edu/COLORThesisDefense
12:00 p.m.	AID	MTH0401	https://go.umd.edu/Gemstone_Team_AID
	COAST	MTH0303	https://go.umd.edu/COAST
1:00 p.m.	OARS	MTH0105	https://go.umd.edu/OARS
2:00 p.m.	TAIP	MTH0401	https://go.umd.edu/TAIPThesisDefense
3:00 p.m.	TOXINS	MTH0303	https://go.umd.edu/TOXINS
	TORUS	MTH0411	https://go.umd.edu/TORUS
	CYB3RL4NG	MTH0403	https://go.umd.edu/CYB3RL4NG
4:00pm	NEM(O^2)	MTH0401	https://go.umd.edu/NEMO

5:00pm	SAINT	MTH0403	https://go.umd.edu/SAINT
	SEND	MTH0303	https://go.umd.edu/SEND

VIRAL: Using Precision Therapies to Protect the Developing Brain from Viral Infection and Injury

Research Team

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Ademide Adeyemo, Psychology
Aubrey Alexander, Biology, Psychology
Hannah Camacho, Bioengineering
Zofiya Dyba, Chemistry
Caroline Hobson, Biochemistry
Haider Hussain, Bioengineering
Erin Li, Neuroscience, Chemistry
Soumya Maturi, Biochemistry
Arnav Patel, Information Science
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Ashley Pocasangre, Psychology
Janet Ruan, Biology

Faculty Mentor

Dr. Youssef A. Kousa, Neonatal Neurologist, *Children's National Hospital*
Dr. Erin H. Tran, Senior Lecturer, *Department of Cell Biology and Molecular Genetics, UMD*

Librarian

Ms. Nedelina Tchangalova, Public Health, Hearing and Speech Librarian, *University Libraries, UMD*

Discussants

Dr. Natthawan Chaimongkol, Scientist, *Children's National Hospital*
Dr. Chunbo Shao, Scientist, *Children's National Hospital*
Dr. Yanjin Zhang, Associate Professor, *Department of Veterinary Medicine, UMD*
Dr. Hannah Zierden, Assistant Professor, *Department of Chemical & Biomolecular Engineering, UMD*

Research Description

Background: Prenatal viral infections can cause severe damage to the developing brain. Among the most threatening prenatal pathogens, Zika virus can cause microcephaly, congenital contractures, seizures, and fetal demise. Currently, there is no prenatal standard of care or treatment for Zika infection. Whole exome sequencing of severely affected patients identified mTOR (regulator of autophagy) and HEXB (a lysosomal enzyme) as modifiers of injury, suggesting potential therapeutic targets. Objective: In this work, we repurposed and test three drugs that manipulate the autolysosomal pathway in unique ways; chloroquine, a lysosomal inhibitor; metformin, which induces AMPK signaling; and trehalose, a lysosomal flux activator. Methods: Here, we infected immunocompetent and virally susceptible (hSTAT2KI/KI) mice at a time point analogous to the late first trimester in humans. Survival and weight progression were tracked for mice evaluated after birth, and mice underwent testing for gross motor milestones and advanced behavioral outcomes. Here, we studied the efficacy, safety, and optimal doses of the drugs in treating prenatal viral infections. Results: Preliminary data show that metformin increases postnatal survival by day 21. At the doses under investigation, chloroquine appears safe but, along with trehalose, does not improve survival. In future work, we will optimize dosing and further evaluate safety

for all treatments. This work may also be translatable for other prenatally transmitted viruses, such as cytomegalovirus and oropouche.

Acknowledgements

We sincerely thank our mentors, Dr. Youssef Kousa and Dr. Erin Tran, for their incredible mentorship, along with Dr. David Lovell, Dr. Allison Lansverk, and the Gemstone faculty for their guidance. We are grateful to Eunbin Park for her continued dedication to our project, and to Dr. Chunbo Shao, Dr. Natthawan Chaimongkol, Dr. Yanjin Zhang, Dr. Hannah Zierden, and Nedelina Tchangalova for their mentorship and support.

FET:US: The Effects Of DiNP Exposure On FLRT2 Expression In Human Umbilical Vein And Endothelial Cells

Research Team

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Maya Mulligan, Agricultural Science and Technology: Environmental Horticulture
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Faculty Mentor

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Discussants

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Dr. Irina Burd, Professor and Chair, *Obstetrics, Department of Gynecology and Reproductive Sciences*, *University of Maryland School of Medicine*
Dr. Emilia Przygrodzka, Assistant Professor, *Department of Animal and Avian Sciences, UMD*
Dr. Halli S. Weiner, Assistant Clinical Professor, *First-Year Innovation and Research Experience Program, UMD*

Research Description

Di-isononyl phthalate (DiNP) is one of the most widely used phthalates, or plasticizers, used in various consumer products. Although it was initially developed to replace more toxic phthalates due to its comparatively less harmful primary and secondary metabolites, it is still associated with adverse health outcomes. In this project, we focused on investigating the effects of DiNP exposure on placental and fetal development, by specifically looking at the expression of Fibronectin Leucine-Rich Transmembrane Protein 2 (FLRT2). It plays a vital role in angiogenesis in the placental labyrinth, a critical structure for nutrient transfer between the fetus and mother. A series of initial titration experiments were performed to determine a range of relevant doses of DiNP to ensure cell viability. Then gene expression of FLRT2 in human umbilical vein and endothelial cells (HUVEC)-2 were measured DiNP post-exposure via reverse transcription quantitative polymerase chain reaction (RT-qPCR). Results indicate that DiNP exposure does in fact have an effect on FLRT2 expression in human umbilical vein and endothelial cells (HUVEC-2). Together, these findings warrant further investigation to determine downstream biological consequences and strategies to protect maternal and fetal health.

Acknowledgements

We would like to thank our mentor, Dr. Andrew Schiffmacher, for his ongoing support and guidance throughout our GEMS experience. We are grateful to the Gemstone Honors Program—Dr. David Lovell, Dr. Allison Lansverk, Ms. Brianna Lucas, and Ms. Leslie Lizama—for the opportunity to engage in comprehensive and interdisciplinary research. We are thankful for the donation of HUVECs from the Moore lab, specifically Dr. Erika Moore. We thank Dr. Rachel Gammons for her feedback as our team librarian. We acknowledge funding support from generous donors at LaunchUMD and from the Animal Science department. Finally, we would like to thank our discussants for taking the time to review our thesis and provide essential feedback, along with the team members' family and friends for their endless support.

COLOR: Mitigating Color Blindness: A Physiologically Based Multi-staged Approach

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Discussants

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Ms. Jiarui Li, Post-Doctoral Associate, *Fischell Department of Bioengineering, UMD*
Dr. Raymundo Rodriguez Lopez, Post-Doctoral Research Associate, *Department of Physiology and Biophysics, University of Illinois Chicago*
Mr. Ian Miller, Worker, *Light Machinery*
Dr. Ichiro Takeuchi, Professor and Chair, *Department of Materials Science and Engineering, UMD*

Research Description

Color vision deficiency, also known as colorblindness, is a widespread challenge for nearly 5% of the world's population. This condition has significant detrimental impacts on an individual's safety, education, career, and ability to perform tasks that rely on color discrimination. Current technologies aimed at addressing color vision deficiency (CVD) are neither effective nor affordable. They can cost several hundred dollars, are not personalized, and rely on filters with low light transmission, making them impractical for daily use. This research explored the process of creating accurate, personalized, and economically viable CVD mitigation solutions, as well as developing quantitative testing techniques. These objectives were carried out through three approaches: selective wavelength thin-film filtering, CVD simulation, and selective wavelength manipulation through additive application of light within a virtual space. Team COLOR successfully modeled a thin-film filter design aimed at addressing red-green CVD color confusion, while maintaining high light transmission. Finally, Team COLOR outlined an alternative exploratory approach for mitigating CVD in augmented reality environments using an adaptation of the designed simulation.

Acknowledgements

First and foremost, we want to thank our mentor, Dr. Giuliano Scarcelli, for his unwavering guidance and encouragement throughout our time in the Gemstone Honors program. We could not have asked for a kinder or more supportive mentor. We would also like to thank the University of Maryland Nanocenter for their support with our filter fabrication. Furthermore, we would like to thank our panel discussants, Dr. Andrew Bower, Dr. Ichiro Takeuchi, and Mr. Raymundo Lopez for their time and consideration. A special thanks to our discussants, Dr. Ian Miller and Dr. Jiarui Li, for their guidance on our thin film filter development. Finally, we would like to thank our librarians, Ms. Leah DiCiesare, Ms. Pamela McClanahan, and the Gemstone staff.

AID: Advancing Equity in AI-based Skin Cancer Diagnosis

Research Team
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Faculty Mentor
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Librarian
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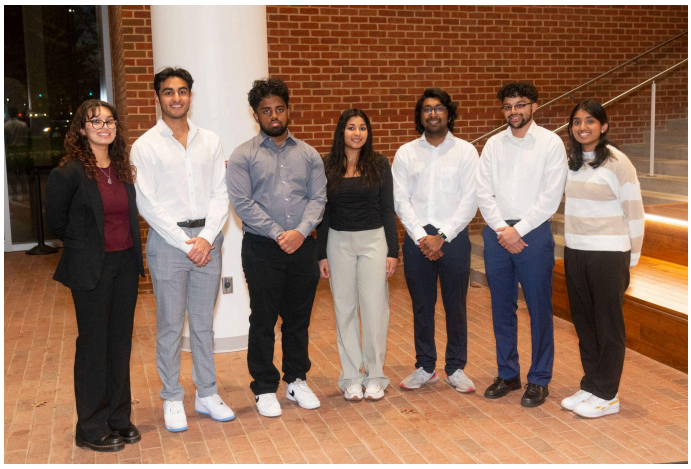

Discussants
Dr. Ashok Agarwala, Professor, *Department of Computer Science, UMD*
Dr. Can Firtina, Assistant Professor, *Department of Computer Science, UMD*
Dr. Ang Li, Assistant Professor, *Department of Electrical and Computer Engineering, UMD*
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Research Description
This project addresses disparities in skin cancer detection models, which often underperform on patients with darker skin tones, contributing to inequities in healthcare diagnosis. Standard ResNet-based models, even when fine-tuned on publicly available dermatology datasets, show clear gaps in performance across skin-tone subgroups. To improve representation and generalization, we applied targeted preprocessing techniques and balanced sampling strategies to enhance representation of minority skin tones. Building on these approaches, we incorporated self-supervised learning using the DINO training process on unlabeled dermatology images to learn more domain-aligned feature representations. We experimented with partial fine-tuning, domain-specific pretraining, and group-aware evaluation metrics to enhance fairness and reduce performance disparities under domain shift. Overall, our work demonstrates the importance of equitable training practices, advanced representation learning, and careful dataset curation in developing reliable, generalizable, and fair AI-driven skin cancer diagnostic models.

Acknowledgements
We would like to express our sincere gratitude to our team mentor, Dr. Heng Huang, and our PhD student mentor, Reza Shirkavand, for their unwavering support and invaluable guidance throughout the entire research process. We also extend our thanks to our discussants - Dr. Ashok Agarwala, Dr. Abhinav Shrivastava, Dr. Ang Li, Dr. Can Firtina, and Dr. Runzhou Tao for generously sharing their time and expertise. Finally, we would like to thank the Gemstone staff - Dr. Lovell, Dr. Lansverk, and our librarian - Mr. Drew Barker for their continued support and assistance.

COAST: Management of Tidal Turbine Biofouling through Protective Biofilms

Research Team

Anthony Boboc, Physics, Nuclear Engineering Minor
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Neha Narayan, Physics, Geophysics
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Discussants

Dr. Darla Goeres, Research Professor of Regulatory Science, *Center for Biofilm Engineering, Montana State University*
Dr. Erick Johnson, Associate Professor, *Department of Mechanical and Industrial Engineering, Montana State University*
Mr. Fraser Johnson, Director of Operations and Assets, *MeyGen*
Dr. Johan Larsson, Professor, *Department of Mechanical Engineering, UMD*
Dr. Mario Tamburri, Professor, *University of Maryland Center for Environmental Science, UMD*

Research Description

Emissions resulting from fossil fuel consumption have driven anthropogenic global climate change, leading to an increased need for carbon-neutral, renewable energy sources. Among these sources, tidal power offers a powerful and consistent means of energy generation. However, previous studies have indicated that the longevity and maintenance demands of tidal turbines reduce their efficiency within the energy mix. Biofouling, the unwanted growth of micro- and macroorganisms on submerged surfaces, is one factor that contributes to this obstacle. This process occurs over time as organisms such as algae, clams, and barnacles inhabit the stationary surfaces of turbines, forming rough colonies that increase maintenance difficulty and ultimately reduce the time a turbine spends generating energy. Tidal turbine cleaning, repair of broken parts, and deployment/extraction are supplemental costs that inhibit the viability of tidal energy as a widely implemented solution. We investigate the ability of a biofilm to serve as a natural coating that prevents excess growth on tidal turbines, primarily focusing on the biofilm's regenerative properties and resistance to external growth. Utilizing computational fluid dynamics (CFD) simulations of an original biofilm model under applicable tidal conditions, in tandem with wet lab work intentionally combining bacteria that are then spun in biofilm reactors, our research aims to develop a functional biofilm that promotes beneficial growth. Ideally, this biofilm will manage

macroorganism growth, is self-repairing under varying shear forces, allows for adequate heat transfer, and adheres sufficiently to the turbine surface in hopes of increasing the long-term efficacy of tidal turbines.

Acknowledgements

We would like to thank Dr. Deb Niemeier for funding our trip to Scotland and Mr. Fraser Johnson for hosting Team COAST at MeyGen to learn more about tidal turbines. This experience has proven to be invaluable to our research focus. We would also like to acknowledge Harrison Offenberg, one of our former teammates, for his contributions to our project. Finally, we sincerely thank our mentor, Dr. Kjellerup, and Dr. Lovell and Dr. Lansverk from Gemstone for their support throughout our time in the program.

OARS: Developing Unmanned Surface Vessels

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Discussants

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Mr. Tim O'Connor, Director of Advanced Technology, *BlackSea Technologies*
Mr. Joseph Schwartz, Division Director for Navy Tech Improvements, *NAVSEA 05T2, Naval Sea Systems Command (NAVSEA)*

Research Description

Current maritime search and rescue operations rely heavily on manned crews. Organization and dispatching of personnel causes a major delay in locating and reaching individuals in distress. We considered the feasibility of applying autonomous systems to these circumstances in order to allow for quicker deployment. We aimed to develop and test a novel means of quickly identifying and locating people in distress at sea. We chose to address this issue by developing an unmanned surface vessel (USV) with a machine vision system to locate people in distress. Our vision system contained an optical camera and a thermal camera and used a machine learning model developed and trained by the team to identify people. These were mounted on a commercially available hull for aquatic robotics to provide a testbed. To test the vision system, we used a variety of images of people in water to determine the system's efficacy. We repeated this process with open-source vision systems to gauge the progress of training our vision system. To test the USV and the navigation system, we placed and operated the USV in a variety of bodies of water. We integrated the vision system on the USV and tested the range, efficiency and accuracy of identifying individuals.

Acknowledgements

We would like to thank Dr. David Lovell, Dr. Allison Lansverk, Dr. Michael Otte, Leslie Lizama, Brianna Lucas, Jannelle Dang, Nevenka Zdravkovska, and the Gemstone Honors Program for supporting this research. We would also like to thank Dr. David Akin for letting us use the Space Systems Lab and its Neutral Buoyancy Research Facility for testing. We would like to thank our discussants as well.

TAIP: Exploring the Impact of AI on Educators and Syllabus Policies

Research Team

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Ms. Anika Alam, Assistant Director, *Center for Educational Data Science and Innovation, UMD*
Mr. Michael Leon Chrzan, Data Scientist, *Center for Educational Data Science and Innovation, UMD*
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Mr. Luis Morales-Navarro, Research Fellow and PhD Candidate, *Learning Sciences and Technologies, University of Pennsylvania*

Research Description

In this study, we examined the growth of AI primarily in higher education, supplemented by middle school teachers' perspectives. Over the past few years, AI has become increasingly common in the classroom and has sparked conversation about its harms and benefits. By surveying middle school teachers and their opinions on AI in the classroom, and analyzing syllabi from the University of Maryland spanning Fall 2022 to Fall 2025 to examine the change of AI policy, we explored educators' perceptions of AI and their willingness to adopt it in the classroom. Our survey results show that educators still aren't sure of the potential use cases of AI in the classroom, but are encouraged by the possibility of reducing the workload. Our syllabi analysis shows a clear trend towards allowing the usage of AI in the classroom, especially by students training to be future educators. Across our dataset, a requirement to cite AI usage was the most popular restriction on AI usage, indicating educators are increasingly willing to allow AI as long as its use is transparent. Adoption is not consistent across disciplines, with the humanities and education representing the highest observed adoption, and business and engineering representing the least adoption. Future work should survey more instructors across more disciplines to get a more widespread opinion on AI in the classroom. Additionally, we suggest future

analysis of syllabi as a method of measuring instructors' perceptions of education policy, and recommend that universities organize their syllabus collection to accommodate research of this kind as the field of education continues to change at a rapid pace.

Acknowledgements

Firstly, we would like to thank our team mentors, Dr. Lucas Butler and Dr. Jing Liu, for their steadfast support of our work. Despite unexpected challenges, they continued to provide assistance and advice that helped us to focus our efforts and adapt as necessary. Without their help, our project would not be where it is today. We would also like to thank all the Gemstone staff; in particular, Dr. Lovell, Dr. Lansverk, Ms. Lizama, and Ms. Lucas. Their tireless efforts and assistance through all four years of Gemstone allowed us to get valuable experience in undergraduate research. Furthermore, we would like to thank Ms. Amber Pierdinock-Weed for her feedback on our thesis. Lastly, we would like to thank our thesis discussants, Dr. Morales-Navarro, Dr. Daumé, Ms. Alam, and Mr. Chrzan for providing their valuable time and insights for our project.

TOXINS: Evaluating Potential Effects of Thymus vulgaris on Antiretroviral-Induced Oxidative Stress

Research Team

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Margaret Kato, General Biology, Computer Science
Hannah LaPadula, Biochemistry, Chemical Engineering
Tami Mumuney, Chemistry, Spanish Professional Contexts
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Discussants

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Dr. Typhanye Dyer, Associate Professor, *Department of Epidemiology and Biostatistics, UMD*
Dr. Lindsay Festa, Research Assistant Professor, *Children's Hospital of Philadelphia*
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Dr. Lishan Su, Professor, *Department of Pharmacology*; Director, *Division of Virology, Pathogenesis and Cancer, Institute of Human Virology, University of Maryland School of Medicine*

Research Description

The use of antiretroviral therapy (ART) for managing human immunodeficiency virus (HIV) is effective in suppressing viral replication, but also associated with adverse side effects linked to oxidative stress. This study investigated the potential of Thymus vulgaris (garden thyme), an antioxidant-rich herb, to

mitigate these effects. The antioxidant ability of thyme was quantified using Oxygen Radical Absorbance Capacity (ORAC) and Total Phenolic Content (TPC) assays. Cell viability under varying concentrations of thyme was measured using the CellTiter Glo assay to determine an optimal treatment concentration. Dual treatment of thyme with tenofovir disoproxil fumarate, a commonly-prescribed ART, was conducted to assess thyme's ability to mitigate ART-induced cytotoxicity. The results provide insight into the mechanisms of ART-induced oxidative stress and suggest an accessible means to improve drug adherence and patient outcomes, particularly in populations disproportionately affected by HIV. Beyond ART toxicity, this study suggests potential applications for mitigating oxidative stress in related therapeutic contexts.

Acknowledgements

We would like to sincerely thank our mentor, Dr. Yanjin Zhang, for his valuable guidance and direction throughout our project. We would also like to extend a special thank you to members of the Zhang lab, Peixi Chang and Bhargava Teja Sallapalli, for all their support in the execution of our experimental work. We would also like to thank Matthew Cain, our librarian. We are also deeply grateful to Dr. David Lovell, Dr. Allison Lansverk, and the remainder of the Gemstone staff for all of their assistance over the course of the program and for providing us with the opportunity to produce research with a meaningful impact. Finally, we would like to recognize our late team member, Joe John, and express our utmost gratitude for all of his contributions to the development of our thesis proposal and initial research process.

TORUS: Development of a Toroidal Propeller for Marine Applications

Research Team

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Dr. Kenneth Kiger, Professor, Keystone Professor, Associate Dean of Undergraduate Programs, *Department of Mechanical Engineering, UMD*
Dr. Ethan Lust, Assistant Professor, *Department of Mechanical and Nuclear Engineering, United States Naval Academy*
Dr. Peter Sunderland, Professor, *Department of Fire Protection Engineering, UMD*

Research Description

Toroidal propellers have demonstrated promise for increased efficiency and reduced cavitation in an aerial environment, particularly in small-scale applications such as unmanned aerial vehicles. However, there is still limited research on their performance in a marine environment. To address this gap, we developed a design methodology for marine toroidal propellers with an Expanded Area Ratio (EAR) equivalent to that of a traditional screw propeller. The toroidal propeller geometry is parametrically varied by blade reference line and blade angle modifications to achieve an efficiency identical to the screw propeller. Using Computational Fluid Dynamics (CFD), the baseline screw propeller and the toroidal propeller geometries were simulated in identical marine environments, which were assembled and verified against experimental data. Performance metrics, including thrust, torque, and efficiency, were compared to assess effective parametric variation. This provides a process for evaluating toroidal propeller applications and contributes to a better understanding of how toroidal propellers behave in marine environments.

Acknowledgements

We would like to thank Ishaan Bhardvaj, Neel Jay, Malcolm Maas, Teja Nallagorla, Jordan Qureshi, Yin Wang, and Daniel Yuan for their assistance and the time they dedicated to supporting our team. We would also like to thank our librarian, Mr. Matthew Cain, for his guidance and support throughout our research process. Finally, we would like to express our appreciation to our mentor, Dr. Johan Larsson, for his mentorship, input, and guidance throughout this project.

CYB3RL4NG: Using Diachronic Static Word Embeddings for Term Toxification on Reddit

Research Team

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Akhilesh Puranam, Computer Science, Business Analytics Minor

Faculty Mentor

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Librarian

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Ms. Liancheng (Krystal) Gong, Ph.D. Student, *College of Information, UMD*
Dr. David Loshin, Associate Research Engineer, *Applied Research Lab for Intelligence and Security, UMD*
Dr. C Anton Rytting, Adjunct Lecturer, *Department of Computer Science*; Associate Research Scientist, *Applied Research Lab for Intelligence and Security, UMD*

Research Description

Toxic discourse on the internet has a powerful influence on its users, and recognizing increasingly negative or derogatory usage of specific terms–such as ‘Karen’ or ‘woke’–can help signal potential “toxification” of an online space. Our research demonstrated that a novel approach building on prior work on diachronic static word embedding analysis can assist in tracking and understanding term toxification on Reddit, a popular online social media platform, by observing how the usages of words with multiple meanings (including a pejorative/negative one) change over time. Although not comprehensive in its approach to observe changes and toxification, our study found that word embeddings can be used to track how words change over time. This study can be expanded by using contextual word embeddings, expanding comparisons to other social media platforms, and implementation on different languages.

Acknowledgements

We would like to express a sincere thank you to the Gemstone Honors Program for providing the opportunity for a four year research project. Specifically, thank you to Dr. Lovell, Dr. Lansverk, Nevenka Zdravkovska, and all Gemstone Honors Program staff and faculty. We would also like to thank our mentor Dr. Erik Nesse for guiding us through this research as our mentor and role model. Thank you to all of our discussants for their invaluable feedback. We would like to thank our friends and family for supporting us as we conducted our research. Without the support of those mentioned above, this research would not have been possible.

NEMO^2: Neutralizing or Eliminating Malignant Oceanic Organisms

Research Team

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William Hao, Mechanical Engineering Major, Robotics and Autonomous Systems Minor
Erin Hopper, Computer Science, Math
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Librarian

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Discussants

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Research Description

Lionfish, specifically Pterois Volitans and Pterois Miles, are a predatory Indo-Pacific fish that has been introduced to the Caribbean. As it spreads along the East Coast of the United States, invasive lionfish are causing significant damage to marine ecosystems due to a lack of natural predators and insufficient management techniques. Through species distribution modeling (SDM), we investigated how climate change and landward migration of the gulf stream will affect the northward range expansion of lionfish along the East Coast. We also analyzed aquatic invasive species management policies from state governments across this region, including lionfish-specific policies. We identified sea temperature and salinity as the primary predictors of lionfish presence. SDM results show that by 2100, lionfish are likely to maintain a perennial population off the eastern coast of the United States and continue to spread northward, though they are unlikely to establish permanence in the Chesapeake Bay. These predictions, affirming that climate change will expand the lionfish range, create a timeline that motivates policy initiatives to control lionfish and mitigate damages they will cause in mid-Atlantic waters. Our policy results show commonalities among state policies such as the illegality of releasing invasive species and focus on population or management control and conservation of native species. We discuss implications

for state preparedness for managing aquatic invasive species, including lionfish. Our results expand understanding of invasive species distributions and policy in the face of climate change and support informed policy decisions for future aquatic invasions.

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SAINT: Fabrication, Characterization, and Cytotoxicity Assessment of Catanionic Surfactant Vesicles for Nanotherapeutic Applications

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Research Description

Conventional chemotherapeutics lack spatial and cellular specificity, often resulting in off-target toxicity and limited therapeutic indices. Nanoparticle-based delivery systems offer a strategy to improve drug stability and tumor selectivity. However, lipid-based platforms remain limited by manufacturing complexity, instability, and heterogeneous size distributions. In contrast, catanionic surfactant vesicles formed through the aqueous mixing of oppositely charged surfactants present a modular and cost-effective alternative capable of functionalization. Here, we investigate anionic-dominant vesicles composed of sodium dodecylbenzenesulfonate (SDBS) and cetyltrimethylammonium tosylate (CTAT) as a tunable drug delivery platform. Vesicles were synthesized using both manual mixing and an optimized coaxial microfluidic flow-focusing system to evaluate reproducibility and size control. Surface modification was achieved using polyethylene glycol (PEG2000), folate, and PEG2000-folate conjugates to assess steric stabilization and receptor-targeting potential. Dynamic light scattering confirmed vesicle formation and enabled comparison of size distributions between fabrication methods, and toxicological evaluation in cancer cell lines assessed the effects of surface functionalization on cellular responses. Anionic vesicles demonstrated measurable cytotoxicity consistent with membrane-associated interactions, whereas PEGylation reduced nonspecific toxicity. Folate functionalization did not significantly increase cytotoxicity under the conditions tested, suggesting that receptor-mediated uptake may not directly translate to enhanced cell killing in the presence of folate in media. Ongoing studies in folate-free conditions are aimed at further evaluating receptor-dependent effects. Collectively, the current findings establish catanionic surfactant vesicles as structurally tunable

nanocarriers, and retain stability across temperatures and mixing methods.

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SEND: Evaluating the Impact of Socioeconomic Factors on Parent-Reported Timing and Quality of Autism Diagnosis: A Mixed-Method Study

Research Team

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Research Description

An early autism spectrum disorder (ASD) diagnosis can promote positive outcomes and significantly improve the effectiveness of interventions and support for autistic individuals. However, there are documented disparities in the prevalence of early ASD diagnosis across demographic groups. Children in higher income families, white children, and children assigned male at birth are more likely to receive an official diagnosis of ASD. In order to develop a comprehensive understanding of the specific barriers and facilitators parents and caregivers face when seeking a diagnosis for their child, the current study utilized a mixed-method design. Participants completed an initial survey about their experiences and interviewees were then selected from participants who expressed interest in further involvement. These participants engaged in a semi-structured interview, elaborating on the process of obtaining an ASD diagnosis for their child. With a total of 35 valid survey responses, we conducted ANOVA testing and a series of descriptive and inferential statistical tests. With a total of 17 interviews, we utilized a double validation coding approach to analyze the qualitative data. Findings of this analysis suggested a

significant relationship between socioeconomic factors and ASD diagnosis quality and timing. Future research can validate these findings and help inform policies and strategies to reduce specific obstacles to diagnosis, making the process more accessible to families across diverse backgrounds.

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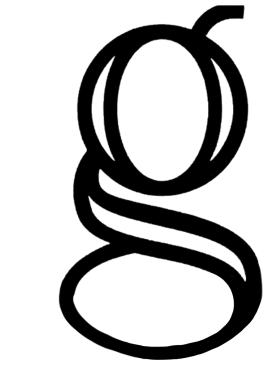

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