2021 Postdoc Research Symposium
5-Minute Research Narratives: Abstract Book

1. **Dr. Alexa Rodriguez, History of Education. "Crafting Dominicanidad: Education and the 1916 US Occupation of the Dominican Republic"**

My research examines the 1916 US occupation of the Dominican Republic to analyze how US and Dominican stakeholders used public schools to disseminate their notions of Dominican citizenship. Drawing on correspondence and memos from the Department of Public Instruction in the Dominican Republic and US military government, as well as periodicals and newspapers from both countries, I examine how US officials, education administrators, and guardians engaged in these efforts. Although the US military government used schools to exert state control, Dominicans individually and collectively redirected these state institutions to serve their needs and to negotiate their relationship to the state. Schools were central to how both Americans and Dominicans of all classes articulated, circulated, and practiced ideas about membership to and within the Dominican nation. This research provides two critical interventions. First, this work decenters the US in histories of American imperialism, showing that local actors were active participants in US efforts and vital to shaping their own visions of citizenship through public schools. Second, this dissertationgives prominence to Dominican subjects and voices by studying their statements and actions in response to US efforts.

2. **Dr. Ali Khalilimeybodi, Cardiac systems biology. "Systems analysis of cardiomyopathy signaling."**

Heart muscle cells grow and change their structure during life. In some individuals, inherited gene mutations in heart muscle cells lead to abnormal heart growth, known as familial cardiomyopathy. These changes often interfere with the heart's function to pump blood, adversely affecting the patient's life quality and could even lead to heart failure and death. In this project, I study the mechanism connectinggene mutations to heart growth by developing a systems biology model of heart muscle cells to identifykey regulators. First, I developed and validated a cardiac signaling network model of familial cardiomyopathy linking gene mutations to changes in heart cells' shape. Then, I will combine it with aheart's metabolic pathways model to consider the role of both altered heart signaling and metabolism inthis cardiac disease. I will perform multiple analyses on the signaling-metabolism model to identify potential drug targets effectively inhibiting heart abnormal growth and will perform

experiments on heartmuscle cells to validate model predictions. This study combines the powers of computational scienceswith experimental biology to provide a solution for patients with a life-treating disease. I expect this studyto lead to new treatment strategies and potential drugs for patients with familial cardiomyopathy.

3. **Dr. Hamid Nadir, Education "Elementary Teachers' Understanding and Enactment of Systems Thinking."**

This study investigated 41 elementary teachers' understanding and perceptions of integrating systems thinking, an engineering principle, into their instruction prior to a professional development (PD) program. Systems thinking has been identified as an important component of engineering education and is advocated by both the Next Generation Science Standards and Framework for K-12 Science Education. Research suggests limited studies on systems thinking, while those studies generally documented the absence of this skill in K-12. Data sources for the study included the Likert scale questions, open-ended survey items, and teacher pre-interviews. Those were analyzed to assess teachers' understanding of systems and systems thinking, their confidence in integrating this approach into instruction, and the degree to which teachers perceive systems thinking *should* be integrated into their instruction. Preliminary results indicated that the elementary teachers, despite teaching contents like water cycle, climate change, photosynthesis, had a limited understanding of systems and systems thinking. Results also indicated that while teachers endorsed including systems thinking in instruction, they had low confidence in teaching systems thinking. These findings suggest a need for PD that supports elementary teachers in understanding systems thinking and increases their confidence in teaching systems thinking, so they can integrate systems thinking in their instruction.

4. **Dr. Jacob S. Porter, Biocomplexity Institute. "Predicting species of origin from short DNA strands with neural networks."**

Purpose: Viruses affect our drinking water, food supply, and health. DNA from many species may be found in waste water, inside your mouth, in the gut, and in other places in the environment.Distinguishing between viral and non-viral segments of DNA is an important first step in classifying species for analyzing the health of an environment.

Methods: Modern neural networks allow sophisticated classification of DNA sequences, but they require more hardware and time investment. I discuss Plinko, a neural network classifier designed at the Biocomplexity Institute of the University of Virginia, that classifies viruses from non-viruses. It has the potential to classify all living things based on short DNA strands. It uses an unprecedented multi-view architecture for DNA strands and a decision tree of as much as 3000 trained neural networks.

Results: Plinko's virus classification improves on competing neural networks by 5-10%, and it has a megabyte sized hard drive footprint compared to database methods, which have a gigabyte

sized footprints. It performs well on both hard to classify problems and easier problems.
Impact: Plinko is yet to be published, but it has good accuracy. It can scale to classify all living things,which other neural networks are not able to do.

5. **Dr. Jonna Yarrington, Repair Lab (Democracy Initiative). "What does environmental justice look like for so-called climate change deniers?"**

Tangier Island is one square-mile of land, barely above sea-level in the middle of the Chesapeake Bay. It is one of two remaining bay islands—of scores that were once inhabited. Home to over 1,000 at the beginning of the 20th Century, there are now fewer than 390 full-time residents. Tangiermen are mostly white, middle- and lower-income, fundamentalist Christians, Zionists who fly the flag of Israel, self-described Donald Trump fanatics, and science skeptics. While they understand changes on their island as "erosion," with historical and anthropogenic causes and consequences, most Tangiermen also profess a skeptical creed toward climate change science. This leads us to ask: what does environmental justice look like for so-called climate change deniers? This question has great potential for sociocultural anthropological and historical research in a place like Tangier, which is disappearing before our eyes. But it also has a much wider significance, as much of coastal North America—and other coasts far beyond—is or will be considering sociocultural implications of sea-level rise. The implications I am most interested in revolve around how the state mediates value and what the profession of creed has to do with perceived just desserts.

6. **Dr. Miyoung Chong, Deliberative Media Lab, Media Studies. "Racist Framing through Stigmatized Naming: A Topical and Geo-locational Analysis of #Chinavirus and #Chinesevirus on Twitter"**

During the COVID-19 pandemic, racists remarks accompanied by racist hashtags were disseminated via social media. Particularly, Asian Americans in the U.S. have been suffered from racism and xenophobia, resulting in physical violence and mental harassment in many cases. Despite the major function of the social media as an open-access platform for unedited and free speech for people with a diverse background, the global episodes of the soaring racism and xenophobia occurred in online public arenas reaffirmed that the platforms could be used for a nurturing ground of racism and xenophobia. This study examined the top influencers in the racist hashtag Twitter network and top shared neighboring hashtags with #Chinavirus or #Chinesevirus. We extracted topics from the racist hashtag Twitter network applying the state-of-the-art BERTopic modeling technique and conducted a geo-locational analysis of the participants of the network globally and by U.S. states. Trump was identified as the most influential actor in the #Chinavirus and #Chinesevirus Twitter network. This study

confirmed previous literature that the political elite's public communication strategy to deviate the attention of the public suffered from the new disease and went through hardships under the epidemic crisis.

7. Dr. Mohammad Mazharul Islam, Biomedical Engineering. "Multi-scale model of mucin-driven microbial modulations in infectious diseases"

My research involves exploring the metabolic and phenotypic characteristics of the antibiotic resistant pathogen *Pseudomonas aeruginosa* in the infected mucus layers in various parts of the human body. Specifically, I focus on the microbial interactions with mucin, which is a key component in the mucus layer, and is known to modulate the pathogen's metabolic traits as well as the proliferation and development of biofilms. Understanding the mechanistic mucin-driven modulations of microbial phenotypes is of paramount importance in multiple diseases including cystic fibrosis, a disease characterized by defective clearance of mucus. However, the mechanisms of the specific modulating effects of mucins are poorly understood. To improve our understanding of mucin-driven metabolic phenomena in infectious biofilm, I use a multi-scale agent-based computational framework involving a genome-scale metabolic reconstruction of *Pseudomonas* and a transport model of the microbes and metabolites in the mucus. Using this method, I identify the key modulators of metabolic and transport behavior of some of the clinically isolated phenotypes of *Pseudomonas*. This research will guide us to devise innovative solutions for combating this pathogen by controlling biofilm dispersion, which can then be translated to many other infectious diseases.

8. Dr. Tochukwu Ozulumba, Biomaterials Science, Chemistry. "Building an artificial model of the human lymph node

Replicating the functions of our organs outside the human body can enable researchers to better understand how diseases progress and test new drugs. Furthermore, it addresses ethical concerns surrounding the use of animals in research. Models of organs such as the heart, lungs and kidneys have been replicated by growing cells isolated from those organs in small plastic devices called 'chips'.

Despite the successes with these organs, there is no model currently availablefor the lymph node, a key organ which controls how our bodies respond to vaccines and fight infections. Therefore, my research is focused on building anartificial model of the lymph node. Cells are grown in water-based materials called hydrogels and housed within chips following a pattern that matches the architecture of living lymph nodes. We predict that replicating spatial organization is important for maintaining lymph node function.

We reproducibly developed chips containing cells in hydrogels that remain alivefor 24 hours. Next, we will keep the cells growing for longer and include differentcell types to

test complex functions. If successful, this will be the first spatially organized model of the human lymph node and will guide future models for studying diseases and drug testing.