we propose a project for an REU that is part of a submitted NIH R01 grant that will enhance the nation’s Public Health by analyzing the effect of individual and collective behavior (both physical and informational) on airborne infections. the ability to accurately model disease spread is limited by assumptions of homogeneity and a lack of realistic human behavioral dynamics. Models that incorporate demographic and geospatial differentiation, as well as emergent behaviors, will play a crucial role in enabling prevention and mitigation. These models can also lead to the adaptive design of more effective health interventions.

Project: Identification of network structures affecting resilience to the spread of behaviors and disease in a massive social network.

Challenge: Using massive synthetic networks consisting of approximately 300 million individuals across the United States generated from the Los Alamos National Laboratory’s EpiSimS, the student will identify network structures affecting robustness to the spread of behaviors and disease. These networks include individual contact patterns with demographic and spatial differentiation information. The REU will perform rigorous quantitative analyses of these networks at different scales to identify structural elements – the degree of homophily, clustering, etc – affecting robustness to behaviors and disease based on demographic, socioeconomic, and/or geographic factors.

This project presents a unique challenge and learning opportunity for an undergraduate. The networks under study are massive (between 1 million and 25 million nodes), and will require novel methods for manipulation and analysis. We will work closely with an REU on loading and manipulating these large networks. Then we will them on determining network structures relevant to disease transmission by running epidemic simulations across various observed network structures.