Dissertation Defense Announcement
To: The George Mason University Community

Candidate: Rocio Prisby
Program: PhD in Biosciences
Date: Friday, November 22, 2024

Time: 1:00 p.m. EST
Location:
In Person, Conference Room 1004
Institute for Advanced Biomedical Research (IABR)
10920 George Mason Cir, Manassas, VA 20109

And Virtual via Zoom
Join Zoom Meeting
https://gmu.zoom.us/j/96376245512?pwd=kaTir120FCUXg4fLJ79t72j1H53bxl.1&from=addon
Meeting ID: 963 7624 5512
Passcode: 766514

Committee Chair: Dr. Alessandra Luchini

Committee members: Dr. Lance Liotta, Dr. Amanda Haymond Still, Dr. Dale Greenwalt

Title: Innovative Biomaterial Strategies For Sample Enrichment And Neuroinflammatory Mechanisms In Lyme Disease

Abstract:
The incidence of Lyme disease (LD), caused by *Borrelia burgdorferi*, has been steadily increasing, particularly in the Northern Hemisphere, making it the most prevalent tick-borne illness in these regions. Accurate diagnosis and treatment of Lyme disease remain challenging, especially when neurological complications, such as neuroborreliosis, arise. Current serological testing methods lack sensitivity and specificity, leading to a considerable rate of misdiagnosis and delayed treatment. This study introduces PolyDyeMesh (PDM) and DyGel Polyamide (DGP), two novel materials developed to enhance the non-invasive detection of LD biomarkers in urine and to be deployed at the point-of-need. Laboratory characterization through spectroscopy and validation by mass spectrometry demonstrated that these materials improve analytical capabilities.
In addition to enhancing analytical methods, we investigated the role of *Borrelia*-derived outer membrane vesicles (OMVs) in the pathogenesis of neuroborreliosis. When incubated with the microglial cell line HMC3, OMVs induced increased expression of IL-6, a pro-inflammatory cytokine involved in microglia activation. OMV proteomic analysis identified several immune response regulation factors, including OspA, supporting their potential roles in disease progression.

By presenting advancements in sample enrichment technologies and exploring an innovative hypothesis on neuroborreliosispathogenesis, this research provides fresh perspectives for improving LD detection and addressing the underlying mechanisms of disease progression. The findings support the future use of the materials in a device for point-of-need sample collection, which could enhance access to diagnostics for underserved populations. Additionally, the possible involvement of OMVs in neuroborreliosis pathogenesis could open avenues for therapeutic intervention.