

Project Title: "Inconspicuous partners: unveiling the functional role of uncultivated *Mycoplasmatales* in bivalve health and disease"

1. Abstract

Marine bivalves, including oysters, are cornerstone species in coastal ecosystems and aquaculture, performing essential ecological functions such as water filtration, habitat creation, and supporting biodiversity. However, they face escalating threats from environmental stressors, climate change, and infectious diseases, which significantly compromise their populations and ecological roles. Central to understanding and managing these threats is the microbiome—the diverse community of microorganisms that reside in and on marine bivalves, profoundly influencing their health and resilience.

A dominant yet enigmatic group within these microbiomes is the uncultivated bacterial order *Mycoplasmatales*. Despite their consistent prevalence, the ecological functions and interactions of *Mycoplasmatales* with their bivalve hosts remain largely unknown due to their resistance to traditional cultivation techniques. Our preliminary research has revealed that these bacteria can constitute up to 90% of the microbial community in the mucus of healthy oysters, dramatically decreasing during infection by pathogens such as *Perkinsus marinus*, the causative agent of Dermo disease. This striking dynamic indicates a potentially crucial role for *Mycoplasmatales* in host health, disease resistance, and stress resilience.

This OVPR Seed Grant project aims to uncover the functional roles, ecological significance, and metabolic capabilities of uncultivated *Mycoplasmatales* within bivalve hosts. We will employ cutting-edge genomic sequencing and microscopy techniques to characterize these microbes comprehensively, elucidating their interactions with host physiology and responses to environmental stress and disease. By addressing this significant knowledge gap, our research will provide fundamental insights into microbial ecology, enhance understanding of marine disease dynamics, and inform strategies for sustainable bivalve aquaculture and conservation management.