Casey is a microbial ecologist and postdoctoral researcher at the Lawrence Livermore National Laboratory. He is interested in learning the molecular mechanisms that drive Earth's key bio-elemental cycles, using a combination of observations, experiments and models. Over his early career, Casey has contributed to Microbial Oceanography through methods development, combining flow cytometry with isotope tracers to quantify metabolic rates in the natural environment, resulting in new insights about marine phytoplankton ecology and biogeochemistry. He has logged more than 400 days at sea and has broad experience with molecular and microbiology techniques as well as analytical chemistry. He later pursued interests in numerical modeling and systems biology, developing new mechanistic models of cell metabolism and physiology that link the cellular scale to the ecosystem scale. His most recent work explores how artificial intelligence techniques like physics-informed neural networks and reinforcement learning can be integrated with genome-scale constraint-based models to more faithfully mimic how microbes sense and respond to their environment and to one another. This is a promising area where conventional optimization approaches fail, and that can generate testable hypotheses both in the laboratory and in the field.