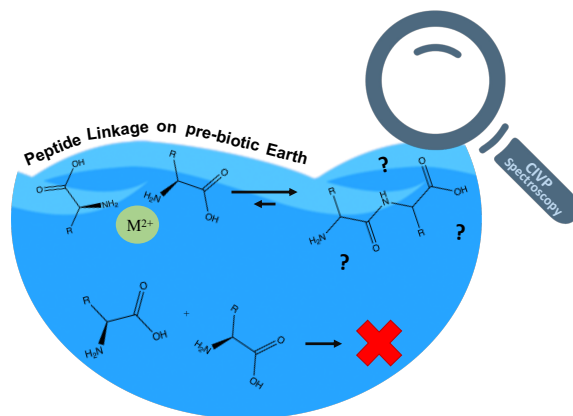


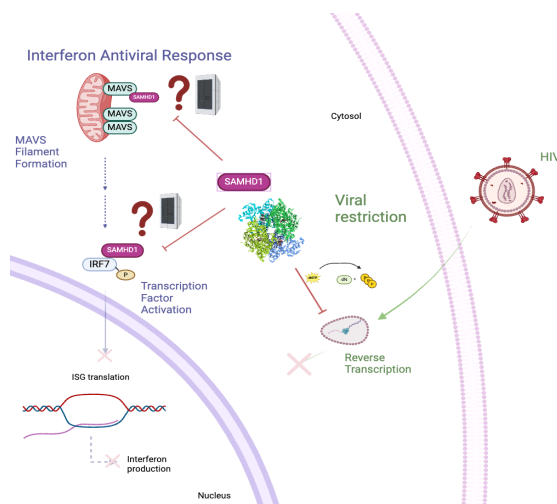
Erica Bocanegra



Utilizing cryogenic ion vibrational spectroscopy to explore divalent metal ion complexation with amino acids and condensation reactions leading to peptide bond formation at the air-water interface

AND

Ricardo Ramírez Padilla



A Structural Elucidation of the Role of SAMHD1 in IFN-1 Signaling in HIV-1 infection

Friday, April 12, 2024 at 12 pm
BASS 305

Coffee and lunch will be provided

Erica Bocanegra is a second-year graduate student in Mark Johnson's lab. Her research involves studying small organic super-acids and reaction mechanisms in water-restricted environments. When not running experiments, she can be found developing software through Python programming and optimizing performance of the IR lasers. Outside of lab, she can very often be found enjoying a hike in East Rock park.

Abstract: Water-restricted environments, such as the air-water interface, provide unique conditions for biologically relevant reactions such as peptide bond formation. While ribosomes efficiently catalyze peptide linkages in the cell, this reaction is not favorable in bulk aqueous solution. This raises the question of how peptides could be generated on prebiotic Earth. One hypothesis invokes the formation of Cu^{2+} complexes with monomeric amino acids at the air-water interface, which then undergo condensation reactions leading to peptide bond formation. Key aspects of this mechanism involve the role of restricted hydration and alignment of the reactants while tethered to the ion. Previous experimental work relied on surface-sensitive infrared spectroscopic characterization of reaction products in macroscopic reactors, which provided only qualitative evidence for the species responsible for the appearance of the amide I band. We are addressing these issues by exploiting recent advances in cryogenic ion vibrational predissociation (CIVP) spectroscopy, which enables isolation of assemblies with exact composition and structural characterization of reactants, intermediates, and products of reactions that are initiated by temperature or photolysis. A particularly interesting finding in this class of systems is the unexpected chemical decomposition of alanine derivatives by Mg^{2+} in the absence of water. We propose that combining these capabilities provides an avenue for properly investigating how water restricted environments enable catalytic acceleration of biologically relevant reactions.

Ricardo Ramírez Padilla is a second-year graduate student in Yong Xiong's Lab.

Ricardo's current research examines a viral restriction factor functions in the cell and its structural mechanism of action. He likes listening to music, playing video games, and bar trivia.

Abstract: The sterile alpha motif and HD domain-containing protein 1 (SAMHD1) is a homotetrameric deoxynucleotide triphosphohydrolase (dNTPase) that regulates the cellular levels of the various dNTPs and participates in HIV-1 viral restriction by downregulating viral reverse transcription (RT). Despite its viral restriction activity, biochemical data suggest that SAMHD1 can bind Interferon Regulatory Factor 7 (IRF7) and Mitochondrial Antiviral Signaling (MAVS) protein to *inhibit* downstream transcription of interferon-stimulated genes (ISGs), key for the antiviral state induction. SAMHD1 seems to have antagonistic roles in HIV infection, where it restricts RT but also downregulates immune signaling, which could explain why a successful HIV infection is known to *not* produce a marked immune response/inflammation. To elucidate SAMHD1's structural interplay between its dNTPase/viral restriction activity and its immune signaling modulation, cryo-electron microscopy will be employed to obtain structural information on SAMHD1 complexes with IRF7 and MAVS and shed light on their interactions.