CHEMISTRY & BIOCHEMISTRY DEPARTMENT STUDENT SEMINAR

Investigating the role of Radical S-Adenosyl-L-Methionine Enzymes from Methanogenic Archaea

by Saiman Adhikari, ’26 BMB

11:30 a.m. **April 16, 2026** **Darrah Auditorium**

McCreary Hall Room 101

Abstract:

Radical S-adenosyl-L-methionine (SAM) enzymes are one of the largest known superfamilies of enzymes, with over 700,000 unique sequences that catalyze over 100 distinct reactions. These enzymes bind SAM and a [4Fe-4S] cluster to catalyze a wide variety of reactions, resulting in biological products such as cofactors, antibiotics, repaired DNA, and modified RNA and peptides. Archaea are the second largest group after bacteria to have radical SAM enzymes. Methanogenic archaea, also known as methanogens, are strict anaerobic microbes that produce methane as a metabolic byproduct, producing around ~ 70 % of the atmospheric methane annually. Even though methane plays a significant role in global warming and is the most abundant non-CO_2 greenhouse gas in the atmosphere, it has also been described as a potential source of renewable energy. Methanogens have been shown to have a large reliance on [Fe-S] binding proteins, and they encode for a large number of predicted radical SAM enzymes. Around half of these putative radical SAM enzymes have not been established to have a specific function, and understanding their mechanisms could uncover novel chemical transformations, natural products and biosynthetic pathways.

We are working to biochemically characterize the predicted radical SAM enzymes from methanogens. We express the recombinant radical SAM protein in *Escherichia. Coli,* our protein expression host, and purify the enzyme using affinity chromatography. The purified radical SAM enzyme is then reconstituted with iron and sulphur for complete cluster incorporation followed by iron quantification using Atomic Absorption spectroscopy. We are also establishing protocols to streamline the screening, reconstituting and purification process. Ultimately, we aim to characterize and validate the radical SAM enzymatic activity via High Performance Liquid Chromatography (HPLC)-based Enzymatic Assay.

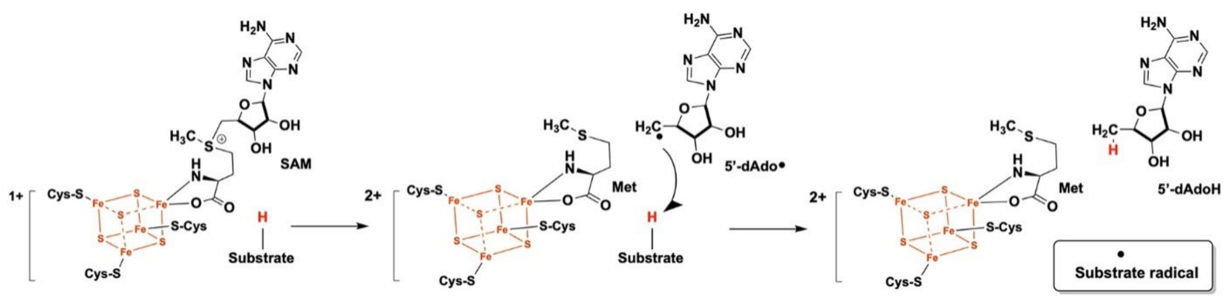

Figure: Common steps in canonical radical SAM enzyme catalysis. [1]

(1) Boswinkle, K.; McKinney, J.; Allen, K. D. Highlighting the Unique Roles of Radical *S* -Adenosylmethionine Enzymes in Methanogenic Archaea. *J. Bacteriol.* **2022**, *204* (8), e00197-22. https://doi.org/10.1128/jb.00197-22.

CHEMISTRY & BIOCHEMISTRY DEPARTMENT STUDENT SEMINAR

A Stabilizer-Free Non-Polar Dispersion for the Deacidification of Contemporary Art on Paper

by Paula da Silva, '27 Chemistry/Studio Art

11:30 a.m. **April 16, 2026** **Darrah Auditorium**
McCreary Hall Room 101

Abstract:
The use of paper started to change in the middle of 20th century, moving from a simple support for studies or sketches to being the heart of autonomous works, at times torn, burnt, folded, perforated, twisted or creased; as is the case for Simon Schubert, Kiki Smith or Stefano Arienti artworks. However, due to the acidity presented within these substrates, i.e., the paper making process and aging, the preservation of these cellulose-based works are threatened. The depolymerization of cellulose catalyzed by acidic compounds leads to a decrease in the mechanical properties of the artworks. Many strategies to stop the acid-catalyzed degradation of cellulosic substrates have been developed; unfortunately, few of them can be safely used on contemporary artworks, drawings or archival materials This paper proposes a new method for the pH control of paper, potentially compatible with most ballpoint pen drawings and manuscripts, and safely usable on folded or creased paper. A deacidifying dispersion of calcium hydroxide in cyclohexane has been prepared starting from alkaline nanoparticles obtained via a solvothermal reaction. The efficacy of this method was tested on acidic paper mockups featuring ballpoint pen ink (Bic Cristal Blue). The protective action arising from the applied treatment was evaluated upon artificial aging, measuring cellulose viscosimetric polymerization degree (DPv), cellulose pyrolysis temperature, samples pH, and colorimetric coordinates. The interesting results obtained on mockups led to the application of this new formulation on a series of perforated, burnt, and creased drawings from a private collection.

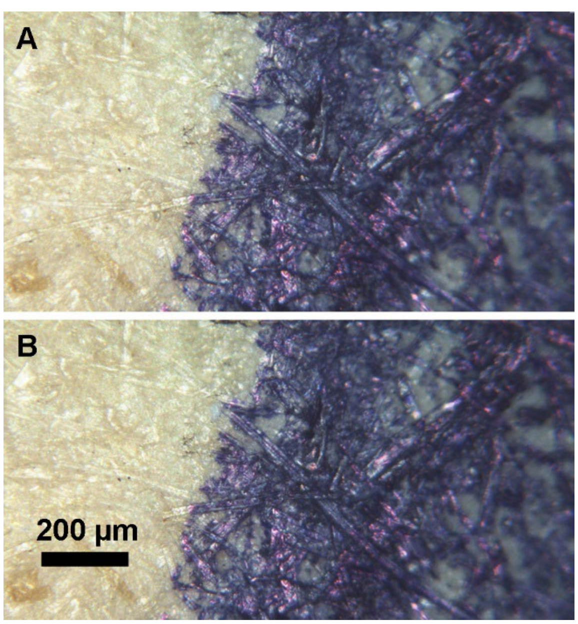

Figure 1 Optical microscopy pictures taken before (A) and after (B) the application of calcium hydroxide nanoparticles in cyclohexane on acidic paper featuring Bic Cristal blue ink. No difference due to the application can be seen.

Figure 2 Recto and verso of Arienti's drawing number 53 belonging to the artwork Picasso. RTI diffuse gain photographs.