

Opportunity Title: Coenzymes and the RNA World

Opportunity Reference Code: 0046-NPP-NOV23-ARC-AstroBio

Organization National Aeronautics and Space Administration (NASA)

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Application Deadline 11/1/2023 6:00:59 PM Eastern Time Zone

Description RNA world theories figure prominently in many scenarios for the origin and early evolution of life. These theories posit that RNA molecules played a much larger role in ancient biology than they do now, acting both as the dominant biocatalysts and as the repository of genetic information. Many features of modern RNA biology are potential examples of molecular fossils from an RNA world, such as the pervasive involvement of nucleotides in coenzymes, the existence of natural aptamers that bind these coenzymes, the existence of natural ribozymes, a biosynthetic pathway in which deoxynucleotides are produced from ribonucleotides, and the central role of ribosomal RNA in protein synthesis in the peptidyl transferase center of the ribosome.

This project uses both a top-down approach that evaluates RNA function in modern biology and a bottom-up approach that examines the capacities of RNA independent of modern biology. These complementary approaches exploit multiple in vitro evolution and RNA isolation techniques coupled with high-throughput sequencing and bioinformatics analysis. The top-down approach will identify and characterize RNAs that directly interface with the small-molecule metabolome and then use this information to extrapolate backwards through evolutionary history to the most primitive forms of life. The bottom-up approach will explore the ability of RNA, RNA-metabolite complexes, and RNA-peptide complexes to carry out functions relevant to the emergence and early evolution of life. Together these complementary approaches will advance understanding of the most primitive organisms, their early evolution, and their eventual transition to modern biochemistry.

Location:

Ames Research Center
Moffet Field, California

Field of Science: Astrobiology

Advisors:

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Applications with citizens from Designated Countries will not be accepted at this time, unless they are Legal Permanent Residents of the United States. A complete list of Designated Countries can be found at: <https://www.nasa.gov/oiir/export-control>.

Eligibility is currently open to:

- U.S. Citizens;



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- U.S. Lawful Permanent Residents (LPR);
- Foreign Nationals eligible for an Exchange Visitor J-1 visa status; and,
- Applicants for LPR, asylees, or refugees in the U.S. at the time of application with 1) a valid EAD card and 2) I-485 or I-589 forms in pending status

**Eligibility
Requirements**

- **Degree:** Doctoral Degree.