

## Astrobiology Initiative

Astrobiology is a deeply interdisciplinary field, requiring an understanding of life and the environments that support it, including atmospheric, planetary, and stellar processes. It seeks to understand how life originates and evolves, what it might look like on other worlds, and how we might recognize its existence from a far. To this end the field combines, biology, chemistry, geology, atmospheric science, oceanography, planetary sciences, and astrophysics, yielding collaborative opportunities that span across our department and college. EAPS already has a core group working on astrobiology research, with expertise in the evolution of the early Earth, planetary habitability, exoplanet biosignatures, and atmospheric physics.

To develop our astrobiology program into a world-class entity, we need to grow in several areas:

**Deep time sedimentary geochemistry.** This person would use geochemical proxies to reconstruct the co-evolution of Earth and environment through time, which is central to understanding habitability. Research interests might include earths oxygenation, exploring the environmental context of the Ediacaran fauna, characterizing environmental change during mass extinctions, and/or examining the causes and consequences of snowball earth glaciations. This type of work can also inform biosignatures that we might look for to distinguish sterile vs. inhabited environments beyond Earth.

**Exoplanetary atmospheric chemistry.** This person would use models and/or experiments to characterize atmospheric chemistries under a variety of stellar, planetary, and biospheric scenarios. Research interests might include using photochemical models or experiments to explore the fate of biogenic gases ('biosignatures') in exoplanet atmospheres, investigating the production of prebiotic molecules under various stellar/planetary scenarios, and/or translating atmospheric observations of exoplanets to surface conditions.

**Exoplanet spectroscopy.** This person would use observations and/or simulated observations to characterize exoplanet habitability and biosignatures. Their research might involve observing exoplanets with ground- or space-based telescopes and looking for spectral indicators of habitability or life. They might also perform simulated observations to inform design choices or observing strategies with future telescopes. Someone who will work with JWST and/or the upcoming large IR/O/UV telescope recently recommended by the Astro2020 decadal survey would be a particularly attractive opportunity for EAPS.

**Program Growth.** Growth in astrobiology research will greatly benefit from an Astrobiology Research Center (ARC), which will engage and support astrobiologists across campus and work to expand the involvement of faculty and students from several departments in the College of Science. Activities would include organizing inter-departmental seminars, journal clubs, and raising seed funding for astrobiology projects. For undergraduates, we will develop a large-enrollment introductory astrobiology service class and create an astrobiology minor within EAPS that could attract undergraduate students from a number of disciplines.