Topical Workshops, Symposiums, and Conferences (TWSC)
Abstracts of Selected Proposals for the Astrobiology Program
(NNH24ZDA002N)

Below are the abstracts of proposals selected for TWSC funding for the Astrobiology Program. Principal Investigator (PI) name, institution, and proposal title are also included. Twenty-one proposals were received by the Astrobiology Program in response to this opportunity. Proposals were selected for funding in June 2024, February 2025, and on June 13, 2025.

Britney Schmidt/Cornell University
Astrobiology Graduate Conference 2024 (AbGradCon)

The Astrobiology Graduate Conference (AbGradCon) is run by graduate students for graduate student peers and postdoctoral fellows who study all topics encompassed in the field of astrobiology. A central goal of AbGradCon 2024 is to foster a welcoming environment where early career scientists can share research and collaborate with peers while building long-term professional relationships. This year's conference will encourage applications from underrepresented fields in astrobiology, such as engineering and instrument design, exoplanets and deep space, and origins of planets and stars. AbGradCon 2024 will mark the 21st year of the conference, which has been instrumental in shaping the field via providing a space for talks, poster sessions, keynote addresses, and group activities pertaining to astrobiology. The requested budget will fund 100 attendees for the 2024 event. Additionally, collaborations with Canadian universities have been established to increase international presence and assist in securing funding for these attendees. Hosted by Cornell University, the proposed location for AbGradCon 2024 is Ithaca, NY. The organizing committee is composed of three lead organizers from Cornell University, Georgia Institute of Technology, and The University of Kansas. Co-organizers from Cornell University as well as nearby Canadian universities, York University and The University of Western Ontario, round-out the organizing committee. Cornell has a rich history of astrobiology, producing prominent scientists such as Carl Sagan, Frank Drake, and Steve Squyres. The 2024 conference is centered on looking ahead to the next generation's contributions to astrobiology and planetary science while acknowledging the groundwork laid by Cornell's astrobiology legacy. This is exemplified in a quote by Sir Isaac Newton, "Standing on the Shoulders of Giants", which has been chosen as the 2024 conference theme.

The conference will be held June 10-14, 2024 in Cornell's Klarman Hall Auditorium. The talks and keynote addresses will take place in the 330-seat auditorium. The poster sessions will be held in the large atrium outside of the auditorium. The conference will begin on the evening of June 10th with an opening banquet and keynote address, followed by three days of talks and poster sessions. A second keynote address will be held on June 12th. The last day of the conference is reserved for an optional field trip where participants can engage in a fossil hunting activity around Ithaca prior to their departure.

Before the conference, a Proposal Writing Retreat (PWR) will take place June 7-10, 2024, and is open to 16 students. The proposed location for the PWR is Old Forge, NY. Known to locals as "Adirondack Basecamp", Old Forge is a ~2.5 hour drive from Ithaca. This beautiful, secluded location will allow PWR participants to escape everyday distractions and focus on producing a mock-NASA proposal. The selected lodging has multiple living rooms and porches that will provide ample room for all-hands meetings and breakout groups. Swimming, hiking, canoeing, and other outdoor activities are available for participants to enjoy during writing breaks.

Through AbGradCon 2024, we hope to increase exposure to the astrobiology community while highlighting the importance of peer collaboration. AbGradCon 2024 has been thoughtfully designed to be the catalyst for lasting professional relationships, new ideas, and inspiration that will motivate the next generation of astrobiologists.

Britney Schmidt/Cornell University
The International Summer School in Astrobiology 2024 -- 2028

The Josep Comas i Sola International Summer School in Astrobiology is an annual event that is jointly supported by the US (through the NASA Astrobiology Program) and Europe (through ESA and the Centro de Astrobiologia). The School is for graduate students in astrobiology from all over the world, and is held each year in Santander, in northern Spain, at the summer campus of the Universidad Internacional Menendez Pelayo. Each year the school explores a central theme in astrobiology which is addressed through lectures from international experts, group discussions, student projects, and an excursion to a nearby site of astrobiological interest.

This proposal requests support for the next four years of the program, from 2024 through 2027. The proposal will support travel for the US participants, two NASA-sponsored instructors, and the US lead organizer.

This proposed event will help develop the careers of twenty students per year and invest in the future of astrobiology through instruction and helping make connections between US students and international participants.

Katherine Freeman/Pennsylvania State University
International Geobiology Course and Symposium (IGC 2024)

The International Geobiology Course will be hosted by Penn State for the second time in Summer 2024. The course has inspired generations of young researchers by introducing them to the field of geobiology via a collaborative, multidisciplinary, and engaging training opportunity. The Penn State team has continued this tradition of high-level of educational outcomes, while reinvigorating the

course with new personnel, and new scientific opportunities.

The five-week course will start in mid-June with two weeks of field studies based in the scientifically rich and varied terrain surrounding the Geological Observatory of Coldigioco in central Italy. Moving to the US at the start of July, participants will spend the next three weeks engaged in project-based learning and research training activities on the Penn State campus. There will also be one additional field trip to sample a meromictic lake with phototrophic bacteria and thrombolite deposits (Fayetteville Green Lake, NY). The course will feature a core team of instructors from Penn State, directed by Kate Freeman and Jenn Macalady with support of PSU staff members and augmented by expert guest instructors. The course features visiting speakers in a day-long symposium, who will bring a variety of perspectives and scientific expertise on hydrogen-fueled microbial ecologies.

We request support specifically to help with travel costs for guest speakers with expertise relevant to astrobiology and planetary exploration, particularly but not exclusively during the day-long symposium. In addition, funds are requested to support professional staff who manage travel, communication, and all other logistics related to the symposium and visiting speakers and guest instructors. Overall, requested funds will strengthen connections to NASA-relevant science and scientists by bringing together students with scientific leaders and by providing funds to support staff who are essential to our success.

Recruitment of participants has sought to maximize diversity of scientific experiences. Our statement of values and code of conduct aim to foster a) respect for every member of the community, b) responsible behavior in field and lab environments, and c) the highest level of scientific integrity. Contingency plans are in place for moving the course entirely to the US in the event of health or safety disruptions.

As for past iterations of the course, we take the broadest possible view of the field of geobiology, which is the fundamental discipline addressing interactions between life and Earth materials (atmospheres, oceans, rocks). These interactions have shaped Earth and its life in astounding ways, and geobiology provides the scientific foundation for understanding their co-evolutionary trajectories. It is also the foundation for understanding living and non-living planets encountered with exploration of the solar system and beyond. The PSU team will endeavor to identify and train young scientists who will become the intellectual leaders of this rapidly evolving and highly interdisciplinary field with high relevance to NASA's exobiology, astrobiology, and planetary sciences goals and missions.

Ofer Cohen/University of Massachusetts, Lowell
Community Building via Supporting the NExSS Co-Leads

The Nexus for Exoplanet System Science (NExSS) is one of the research coordination networks (RCNs) overseen by the NASA Astrobiology Program. It was created to bring together teams that are associated with four divisions of NASA's Science Mission Directorate: the Astrophysics Division (APD), the Planetary Science Division (PSD), the Heliophysics Division (HPD), and the Earth Science Division (ESD). This proposal aims to support of the new NExSS co-lead team to properly conduct

the work the community and NASA require. The work of a NExSS co-Lead is complex and time-consuming.

Michael Way/NASA Goddard Space Flight Center
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Brook Nunn/University of Washington, Seattle
Designing Life Detection Missions: Training Through Simulated Data and Interpretation

In September 2023, 35 early career astrobiologists were tasked with designing missions to detect life on a Mars-like planet. Phase 1 of this workshop, held at NASA Goddard, involved introducing the participants and forming seven mission design teams. By the end of the week, each team had developed a mission plan, including instrumentation choices, justifications, and Science Traceability Matrices (STMs). Phase 2 will further develop these mission concepts, focusing on practical implementation, advanced data analysis, and public communication strategies. Two missions have been selected for the final simulation phase, which involves generating data for analysis. This data will be given to Mission Team #1 and Mission Team #2 for collaborative data analysis and interpretation. Before the final debate, collaborative discussions will end, and each mission team will be divided into Team Life Detection and Team False Positive, resulting in four teams. This proposal outlines the necessary steps to execute Phase 2 of the mission simulation including data generation. The aim is to provide these early career scientists and technologists with the skills and interdisciplinary experience needed to lead future life detection missions beyond Earth.

Jordy Bouwman/University of Colorado, Boulder
AbGradCon 2025

The Astrobiology Graduate Conference (AbGradCon), which is organized by graduate students for their peers and postdoctoral fellows, focuses on a wide range of topics within the field of astrobiology. A primary goal of AbGradCon 2025 is to foster a collaborative environment where

early-career scientists can share their research, develop long-term professional relationships, and collaborate with fellow scientists. This year's conference will actively encourage participation from underrepresented areas in astrobiology, such as engineering and instrument design, exoplanets and deep space, planetary stewardship, and the origin of planets and stars.

The proposed location for AbGradCon 2025 is Boulder, Colorado, hosted by the University of Colorado Boulder and the Laboratory for Atmospheric and Space Physics. 2025 will mark the 22nd year of the conference, which has played a pivotal role in training future astrobiologists by providing a platform for presentations, poster sessions, keynote addresses, and group activities centered around astrobiology.

The theme for this year, "Dark Skies, Bright Futures", aligns with both the spirit of AbGradCon 2025 and Colorado's Dark Skies Month, celebrated each June. Taking place from June 2 to 6, 2025, Colorado's efforts to preserve the natural night sky will enable the immersion of participants in astrobiology activities both during and outside of the conference. In a field as vast and challenging as astrobiology, the uncertainties of the future are symbolized by "dark skies" but with that challenge comes the promise of innovation and growth -- "bright futures". This theme underscores the value of the conference as a springboard for early-career scientists, offering them exposure to cutting-edge research, networking opportunities, and invaluable insights into career paths spanning academia, industry, and government.

Attendance at AbGradCon events has seen considerable growth. In 2015, the conference hosted 55 participants, increasing to about 80 attendees in 2017. Both the 2018 and 2019 conferences accommodated around 95 attendees each, with a notable rise in international participation. In the past two years, the conference has attracted approximately 100 attendees, with up to 23% coming from non-U.S. institutions. We are expecting to see similar numbers in 2025. AbGradCon 2025 will host approximately 100 early career scientists, defined as graduate students and postdoctoral fellows within two years of completing their PhD. Participants based in the U.S. will receive full funding to attend, and the organizing committee will work with international partners to secure additional funding for international attendees who might otherwise be unable to participate.

Prior to the conference, the Proposal Writing Retreat (PWR) will take place from May 29 to June 1, 2025. This retreat, open to 16 participants, is scheduled to be held at the Mountain Research Station (MRS) in Nederland, Colorado. This retreat is aimed at late-stage PhDs and students who have proposal writing experience to sharpen their proposal writing skills as they move into their next career stage. Prior PWRs hosted around 15 participants, broken down into smaller groups to write mock NASA ROSES-style proposals.

Altogether, AbGradCon 2025 aims to increase exposure to the astrobiology community, highlight the importance of peer collaboration, and provide training to future astrobiologists. We will continue the efforts of past AbGradCon events to design the conference as a catalyst for lasting professional relationships, new ideas, and inspiration for the next generation of astrobiologists.

Nancy Ryan Gray/Gordon Research Conferences, Inc.
2024 Organic Geochemistry Gordon Research Conference and Seminar

The 2024 Organic Geochemistry Gordon Research Seminar and Conference (GRS/GRC) is seeking funding to support students and postdoctoral speakers, particularly those involved in NASA-focused research. The conference will take place at the Holderness School in New Hampshire from July 27th to August 2nd, 2024. This year's program features sessions aligned with NASA's Astrobiology Strategy, including "Organic Matter in the Solar System" with speakers Heather Graham (NASA), Fabian Klenner (UW), and Angel Mojarro (NASA). Other sessions will address microbial biosignatures, the thermodynamic limits of microbial methanogenesis, and organic matter cycling within Earth's carbon cycle.

Held biennially, the Organic Geochemistry GRC and GRS are renowned for fostering discussion, collaboration, and innovation in geochemistry and astrobiology. The format encourages interaction between senior and junior scientists, promoting career development and cross-disciplinary research. Funding is requested to cover registration and travel costs for students, postdoctoral researchers, and session leaders, with an emphasis on enhancing accessibility and participation for underrepresented groups. Specific funding priorities include subsidized travel for presenters, registration for speakers and session leaders, and support for 15 additional participants at the undergraduate, graduate, or postdoctoral levels.

Consistently evaluated as "High-Performing," the Organic Geochemistry GRC attracts 125-150 participants globally, fostering a collaborative environment that advances geoscience. The GRS provides early-career scientists with networking and presentation opportunities, creating a welcoming community. This year's GRS will feature a session titled "Interrogating Extreme Environments for Their Astrobiological Potentials." The GRS/GRC conferences are advertised on the Gordon Conferences website, through emails, and via social media, with sponsors acknowledged in conference programs, on websites, and during sessions. Special highlights include a GRC Power Hour focusing on intersectional challenges in STEM, facilitated by Dr. Sheila Jaswal, and an Effective Science Communication Workshop led by Dr. Gabriela Serrato Marks. The requested funding will enhance participation, support early-career scientists, and promote collaboration within organic geochemistry and astrobiology.

Ryan Felton/NASA Ames Research Center
A Workshop on AI Foundation Models for Astrobiology

We propose running a small, focused workshop (15-20 people) to study and analyze the scientific potential and needs for AI Foundation Models (FM) in astrobiology. Foundation Models represent a major shift in AI tool development by building large, general models (e.g. deep learning models) that train on broad data and can then be fine-tuned downstream to many specific tasks with far less time and cost. In simple terms, FMs create their own, complex, internal representation of the data that can then be queried and refined for analysis and applications far more efficiently - analogous to how a dictionary can be used to find word meaning rather than trying to deduce meaning from

raw text. FMs are proving extraordinarily successful (e.g. large language models such as GPT) and may become a key part of many areas of scientific research. This is already happening with efforts to combine protein-folding models (AlphaFold) with protein language models, or with the NASA Earth Science Geospatial Landsat FM. This workshop will bring together astrobiologists, data scientists, and others to discuss and evaluate how FMs may or may not fit into astrobiology. The goals are to a) scope out the options and capabilities for astrobiology FMs (i.e., which topic areas and what data would be relevant), b) to examine and outline what would be needed to produce FMs and what use cases might look like, and c) to create a short-list of potential FMs with a focus on need, timeliness, current technological and data capabilities, expertise within the community, and future innovation. A white paper will be drafted during the workshop and completed shortly after to capture key elements of the discussions and - contingent on the conclusions - to highlight the FM short-list and to bring it to the attention of the astrobiology community, along with a suggested course of actions to bring one or more FMs to fruition.

Karyn Rogers/Rensselaer Polytechnic Institute
Exploring the Abiotic Background for Life Detection: A Joint NfoLD - PCE3 - NOW Workshop

The NfoLD, PCE3, and NOW Research Coordination Networks (RCNs) propose a joint workshop leveraging expertise across disciplinary boundaries to explore how the planetary abiotic background can inform life detection strategies, the landscape of life's origins on Earth and on other putative habitable worlds, as well as forthcoming spacecraft missions. The 3-day hybrid workshop, with in person and virtual attendance, will be held in Spring 2025 in Washington, DC. The workshop will consist of presentations from subject-matter experts, group discussions, and breakout activities designed to engage across career levels and outline community next steps. Workshop attendees will assess the state of knowledge of the 'abiotic background' in the context of Ocean Worlds, identify knowledge gaps and key areas for new research, and engage in the conceptualization of life detection strategies. The workshop will emphasize attendance by experts from the fields of prebiotic chemistry, origin of life, astrochemistry, and other relevant communities. The workshop outcome will be a publication in the journal Astrobiology that synthesizes workshop discussions, findings, and recommendations for life detection mission strategies.

Michael Wong/Carnegie Institution of Washington
Workshop on Information, Selection, and Evolution (WISE)

Objectives: The core objective of the Workshop on Information, Selection, and Evolution (WISE) is to assemble some of the world's most thoughtful and influential thinkers from a wide range of backgrounds to listen, learn, and share ideas related to lawful, universal processes by which order arises in the cosmos. WISE, which will take place October 23-25, 2024, at Carnegie Science's beautiful Washington, DC, campus, will bring together ~80 leading thinkers in topics related to the

intertwined topics of evolution, emergence, selection, function, information, energy/entropy, statistical mechanics, and the arrow(s) of time.

Methods: We will convene the Workshop on Information, Selection, and Evolution (WISE) at the Broad Branch Road campus of Carnegie Science, October 23-25, 2024. We will welcome ~80 scholars from a wide range of physical and chemical sciences, systems engineering, social sciences, and philosophy. The workshop will feature a small number of plenary lectures, primarily given by early-career scholars, leaving ample time for breakout groups, poster sessions, collective brainstorming, and spontaneous discussions. In addition to a workshop report, we anticipate the formation of up to a dozen small, multidisciplinary collaborative teams, who will hold a series of smaller meetings/workshops in the 3 years following WISE--events that we anticipate will lead to many new publications. We have already secured an agreement with the editors of the Journal of the Royal Society Interface Focus to publish a special issue inspired by interactions at WISE.

Significance: Our fervent hope is that WISE inspires a new generation of informed, open-minded, and engaged researchers--an international community of scholars who tackle questions related to lawful processes of evolution in creative new ways. Innovative investigations into the roles of information and selection in lawful evolutionary processes has the potential to inform all areas of science, from astrophysics to paleobiology to neuroscience. Topics that WISE will tackle include questions that are directly relevant to the NASA Science Mission Directorate, including but not limited to:

- Is there a lawful process that describes the complexification of abiotic systems, from galaxy formation to stellar nucleosynthesis to mineral evolution?
- What role does information play at the origin of life?
- What classes of evolving systems are there, and is the evolution of physical systems bounded, but the evolution of life open-ended?
- What feedbacks between life and its environment drive increasing complexity?
- What metrics are best for measuring complexity, how can we detect evidence of selection, and do the answers to these questions help us develop agnostic biosignatures for astrobiological inquiry?
- Do laws of information and evolution apply to technological systems, and if so, what predictions do they make for the coevolution of biology and technology on Earth?

Nancy Ryan Gray/Gordon Research Conferences, Inc.
2025 Archaea: Ecology, Metabolism and Molecular Biology Gordon Research Conference and Seminar

The Gordon Research Conferences (GRC) provides an international forum for the presentation and discussion of frontier research in the biological, chemical, and physical sciences, and their related technologies. High-quality and cost-effective meetings organized by GRCs have been recognized as the world's premier scientific conferences, where leading investigators from around the globe discuss their latest work and future challenges in a uniquely informal, interactive format. The 2025

Archaea GRC will bring together internationally renowned speakers, discussion leaders, postdocs and students, who will exchange the latest developments in the fields of metabolism, molecular biology, ecology, and biotechnology of Archaea. The incredibly broad scope of the meeting enables simultaneous advancement of these fields, spawning new collaborations that cut across traditional disciplinary lines. The 2025 meeting will be accompanied by GRS, a series of highly successful and unique meetings in which early career researchers (ECRs) present their work, discuss their unpublished results and build informal networks with their peers that may lead to a lifetime of collaboration and scientific achievement.

Relevance to NASA Astrobiology Mission: The domain Archaea represents a vast diversity of microorganisms that play major roles in biogeochemical cycles, biotechnology, and industry. Many archaeal species are extremophiles that thrive in the driest deserts, acidic hot springs, volcanos, deep sea hydrothermal vents, and saturated salt lakes. Many archaea are extremely resistant to radiation. These environments are similar to those found on Mars and other extra-terrestrial bodies that might support life. Researchers who study archaeal extremophiles seek to uncover the molecular mechanisms that support life at the extremes, extremophilic enzymes, metabolic pathways, and regulatory mechanisms. With this knowledge, the search for life on extraplanetary bodies can be designed with even more focus. Recent phylogenomic indicates that eukaryotes arose from the domain of life Archaea, the Asgard lineage specifically. Understanding the deep evolutionary roots of the tree of life and underlying mechanisms that gave rise to modern-day eukaryotes must therefore include explorations of archaeal phylogeny, metabolism, cell and molecular biology. Such knowledge is key to understanding how life might have evolved on Earth and possibly on other extraterrestrial bodies. Archaeal genomes are rich in unique CRISPR-Cas systems and other enzymes and metabolic pathways suitable for multiple biotechnology applications, including genome editing, biofuel production and bioremediation. Adaptations to life in extreme environments, origin of eukaryotes and cellular complexity and application of archaeal enzymes for biotechnology will be the focus of 2025 meeting.

Nancy Ryan Gray/Gordon Research Conferences, Inc.
2025 Applied and Environmental Microbiology Gordon Research Conference and Seminar

Established in 1950, the Applied and Environmental Microbiology (AEM) Gordon Research Conference (GRC) is one of the longest running of the Gordon Conferences. The success and resilience of the AEM GRC is due to the profound influence that microbes have on planet Earth, developing and sustaining our environment from the Hadean era to the present. Despite profound technological advancements in our ability to census key microbial groups and to discover their metabolic potential, we often lack the ability to predict and control microbial community dynamics to benefit the human condition. AEM characterizes the in situ functioning of microorganisms and has wide ranging impacts from understanding the evolution and adaptation of life on Earth to the development of a predictive understanding of microbiome-environment interactions that underlie the habitability of planets. This meeting brings together scientists from a wide range of disciplines to discuss the fundamentals of AEM and promote cross-fertilization of ideas, collaboration, and the

identification of new approaches to understand the origin and evolution of life as well as for the sustainable control of microbial dynamics for environmental interventions to keep Earth habitable.

The 2025 AEM GRC will be held July 13-18 at Mount Holyoke College (USA) and will be preceded by a Gordon Research Seminar (GRS) which is organized by and for ECRs to allow for peer-to-peer connections to be made prior to the main meeting. The 2025 AEM GRC/GRC aims to (1) explore how scales influence microbial applications across natural, industrial, and clinical environments and within a One Health framework; (2) build a wide-ranging AEM community; (3) foster career development; and (4) catalyze collaborations between disciplines with historically limited interactions, e.g., environmental and human microbiome researchers. Microorganisms have a profound influence on Earth by shaping the geosphere, driving evolution, sustaining the environment, influencing ecosystem and human health, and catalyzing reactions that solve anthropogenic issues and push the bioeconomy. These influences cross temporal and spatial scales and the AEM field uses fundamental knowledge of scales to advance unique solutions that address critical global challenges. Solutions have been developed at laboratory to field site scales and at gene to organismal levels. The critical barrier to solving global scale problems is translating small scale solutions to global understanding of urgent issues ranging from contaminants to pandemics to climate change. The program reflects exciting new developments in the field and will ensure that talks, poster pitches and presentations at the AEM GRC will be innovative, world leading. The meeting will promote exchange of the latest ideas and techniques in the broad AEM field, generating new ideas and cross-field collaborations while enhancing and promoting the careers of the next generation of scientists in this dynamic and exciting field.

Nancy Ryan Gray/Gordon Research Conferences, Inc.
2025 Molecular Mechanisms in Evolution GRC

This TWSC proposal requests funds to support registration fees for eight speakers at the 2025 Gordon Research Conference (GRC) on Molecular Mechanisms in Evolution: Evolutionary Innovation Across Scales and Time. This GRC is a premier international scientific conference that attracts 200 participants who study evolution in viruses, bacteria, yeast, plants and animals using both theoretical and experimental approaches. The GRC will be held June 22-27, 2025 at Stonehill College, Easton, MA. The co-Chairs of the conference are Dr. Shelley Copley (Professor of Molecular, Cellular and Developmental Biology, University of Colorado Boulder) and Dr. Dan Jarosz (Associate Professor of Chemical and Systems Biology and of Developmental Biology, Stanford University).

The conference program includes a wide range of speakers and discussion leaders from institutions and organizations worldwide, concentrating on the latest developments in the field. Nine scientific sessions in the mornings and evenings will cover a range of topics from de novo gene evolution to evolution of eukaryotes to evolution in a changing world. Afternoons will include four poster sessions.

This community is dedicated to fostering the careers of early-career scientists. The GRC will be preceded by a Gordon Research Symposium organized by and for graduate students and post-docs. Early career scientists will present posters at well-attended poster sessions and 15 will be selected to give short talks. The relatively small size of the GRC facilitates interactions between participants at all career stages. Extensive interactions between early-career scientists and senior scientists occur throughout the conference during poster sessions and coffee breaks, over meals in the dining hall and at the bar following the evening session.

The Molecular Mechanisms in Evolution GRC is highly relevant to the goals of the NASA Astrobiology program, which supports "the study of the origin, evolution, distribution, and future of life in the universe." The molecular evolution community is deeply engaged in experimental and theoretical investigations of the evolution of life on Earth. A better understanding of how life evolves in the context of the varied environments on earth, ranging from deep sea hydrothermal vents to the dry valleys of Antarctica to the human gut, provides critical context for thinking about how life might emerge and develop under different environmental conditions in other worlds

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Nancy Ryan Gray/Gordon Research Conferences, Inc.
2025 Chemistry and Physics of Liquids GRC

The Chemistry and Physics GRC (short for liquid GRC/GRS) has been a long-running conference since 1957. The adjunct liquid GRS was introduced in 2015 to provide professionals (graduate students and post-docs) with comparable experience levels a platform to share their pre-published research, exchange cutting-edge ideas, and build collaborative relationships with early-career peers. The liquid GRC and GRS have a 67-year-long rich history as of 2023, held biannually in Holderness School, NH. We expect attendance of > 130 scientists based on the 2023 Chemistry and Physics of Liquids GRC. Furthermore, we anticipate > 40 early career trainees (graduate students and post-doctoral fellows) to attend the GRS portion of the conference. The GRC will be comprised of invited speakers and discussion leads. The GRS is focused on providing a venue for early career trainees to meet and both establish collaborations with each other and to interact with established scientists in the field. Two keynote established speakers and four panelists representing a broad array of experiences from academia, National Laboratories, and Industry will be present at the GRS.

An outcome of the conference will be to frame the future research direction (experiment, theory, and simulation) and to continue the growth of a modern, vibrant, and diverse scientific community focused on elucidating the physics and chemistry of liquids.

The 2025 Chemistry and Physics of Liquids GRS/GRS will be germane to astrobiology program under the planetary division in NASA. According to the Decadal Strategy for Planetary Science and Astrobiology 2023--2032, elucidating fundamental phenomena in liquids is crucial to understanding the origin of life on the early Earth and the search for life elsewhere. Water under a variety of conditions is essential for modern organism functionalities and was likely heavily involved throughout evolution. Thus, understanding fundamental processes in water play a huge role in

comprehending the origin of life and searching for life elsewhere. To this end, our 2025 chemistry and physics of liquids technical program will include topics ranging from non-equilibrium phenomena, fast and slow processes in liquids, in addition to liquid droplets and complex colloidal liquids comprising bio condensates. highlighted from ROSES 2024 Exobiology (C.5, Planetary Sciences) and Soft Matter/Complex Fluid (E.3, Biological and Physical Sciences). Outside of astrobiology, interfaces of liquids (water-air interfaces, water-mineral interfaces) are very important in weathering assessment, oceanology, as well as climate changes. Overall, the liquid GRC/GRS topics are relevant to the research goals of NASA's Strategic Plan 2022 -- Strategic Objective 1 and Origins, Worlds, and Life: A Decadal Strategy for Planetary Science and Astrobiology 2023-2032 - Questions 9 and 11.

We seek support from NASA's Topical Workshops, Symposiums, and Conferences (TWSC-24) in Space and Earth Sciences and Technology for the speakers, discussion leaders, and panelists who are attending the 2025 Liquids GRC/GRS. This funding will provide partial registration fee support for participants, including, but not limited to graduate students, postdocs, and early career faculty and research scientists.

Steven Desch/Arizona State University
Under the Atmospheric Hood: How geochemical cycles affect exoplanet biosignatures

We request funds to support attendance of 50 scientists at a Workshop to be held October 13-15, 2025, at Arizona State University, "Under the Atmospheric Hood: Geochemical Cycles and Biosignatures". The goals of the workshop are: 1) discuss the meaning of an atmospheric biosignature, that it is a production rate inferred from an abundance measurement, that exceeds all known abiotic rates of production; and 2) build community consensus on what variations in key elements X lead an otherwise-Earthlike exoplanet to be non-Earthlike in terms of habitability or our ability to detect life on it. Here X denotes elements important to gross make-up of a planet (Fe, Mg, Si, Al, Ca, Na, redox state), affect its geophysical evolution (U, Th, 40K), or comprise its volatile envelope and bioessential elements (C, N, H2O, S, P, Cl). The findings of this workshop will be submitted for publication by February 2026. The findings will strongly affect target selection for observations by JWST and HWO and are strongly relevant to the goals of the NExSS, NOW and NfoLD Research Coordination Networks. We will also administer pre- and post-workshop surveys to assess the impact of the Workshop on interdisciplinarity, and these results will be submitted for publication also by February 2026. Improving cross-disciplinary communication to search for life on exoplanets aligns strongly with the goals of Astrobiology and the TWSC program.

Hilairy Hartnett/Arizona State University
Arizona Astrobiology Symposium

The Arizona Astrobiology Symposium is an annual statewide research symposium organized and hosted by students at Arizona State University. Research presented at past symposia intersected the fields of physics, chemistry, biology, and engineering, all with implications for understanding

life in our universe. These symposia began virtually during the COVID-19 pandemic but have since blossomed into an interactive, hybrid format where students and faculty engage from community colleges and universities across Arizona. This year, we are aiming to expand our symposium to the broader southwestern United States to establish a strong network among the astrobiology community.

Shannon MacKenzie/Johns Hopkins University
Planetary science research community activities to advance astrobiology in support of Research Coordination Network for Ocean Worlds (NOW)

As part of NASA's new programmatic infrastructure in support of the Astrobiology program, the Network for Ocean Worlds, (NOW) was initialized August 2019. The overarching goal of NOW is advancing comparative studies to characterize Earth and other ocean worlds (Figure 1) across their interiors, oceans, and cryospheres, investigate their habitability, search for biosignatures, and understand life in relevant ocean world analogues and beyond. This goal will be achieved by communication and collaboration across a virtual network of scientists that are supported by NASAs Planetary Sciences and Earth Sciences Divisions (PSD and ESD) to conduct diverse research ranging from outer solar system ocean worlds to the oceans and cryosphere of Earth, with implications for astrobiology. NOW will be led by an interdisciplinary team to foster intellectual development across these fields of inquiry and advance technical concepts for assessment of habitability and biosignature detection in remotely sensed and in situ studies.

This research coordination network enhances collaboration and communication across disciplines and institutions at the national, and hopefully will extend to international, levels to advance ocean worlds astrobiology research. NOW will meet TWSC program goals in that it will (i) increase the efficiency of investigators through advanced scientific/technical training, (ii) increase the efficiency of investigators through the open exchange of ideas, and (iii) expose investigators to new subject areas. Through these synergistic programmatic efforts, NOW will foster creative insights that will feed forward to the development of new Ocean Worlds and Earth observational missions.

NOW will advance the goals and objectives of NASA's PSD and ESD by addressing the potential for life elsewhere and studying planet Earth from space to advance scientific understanding of life in remote (ocean, cryosphere) environments and to meet societal needs.