CAREERS

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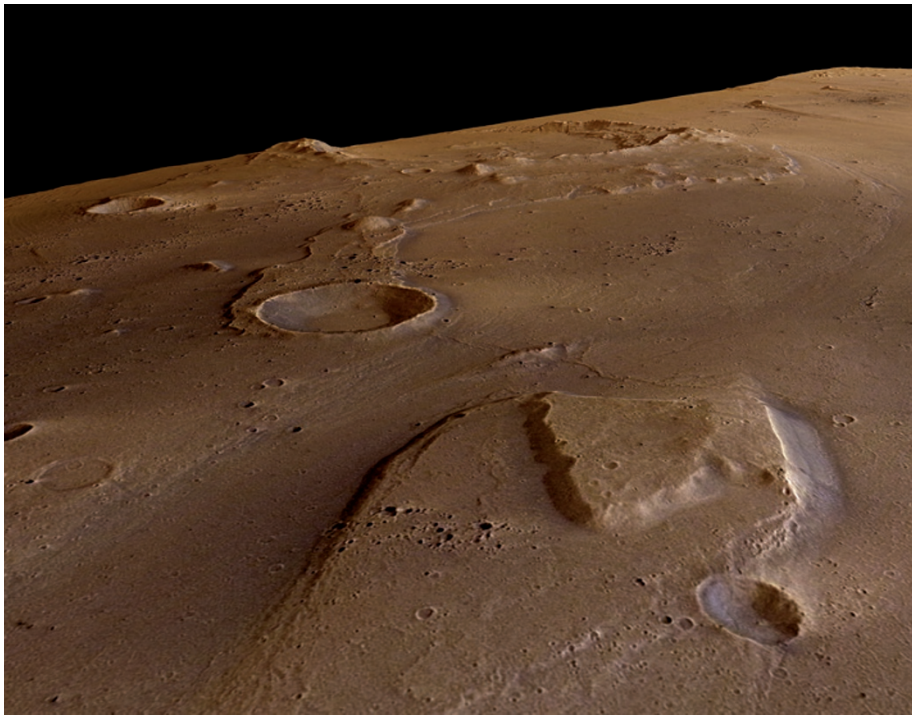


Images from the surface of Mars: analysing these may form part of an astrobiologist's role.

ASTROBIOLOGY

Alien encounters

Establishing a career in astrobiology is not always easy. But keeping one's options open can lead to work in this niche field.

BY NAOMI LUBICK

Michael Callahan knows that he has a great job every time a meteorite sample arrives at the laboratory from NASA's meteorite archive in Houston, Texas. "There's no cooler feeling than working with a meteorite in the lab," he says.

Callahan, an analytical chemist at the Astrobiology Analytical Laboratory at NASA's Goddard Space Flight Center in Greenbelt, Maryland, is one of a growing number of researchers around the world working in astrobiology — the exploration of how and where life might have emerged in the Universe.

The breadth of astrobiology can be daunting. Because the field focuses on questions about the origins of life, it incorporates aspects of astronomy and physics as well as chemistry, geology, oceanography, microbiology and bioinformatics. As a result, there are many different routes to a career in astrobiology; Callahan, for example, started out as an analytical chemist in industry. Exobiology — the study of the possibility of life on other planets — thrived with origins-of-life research in the 1950s and '60s, and really took off with the space exploration programmes in the 1960s and '70s. Later, when the astrobiology label took hold, some people questioned the field's seriousness, notes Zita Martins, an astrobiologist at Imperial College London. Many different types of researchers now contribute to the field; geomicrobiologists look for extremophiles — organisms that live in extreme environments such as deep caves or hot springs; astronomers search for chemical signs of metabolism on other planets; and biologists investigate how life on Earth first appeared.

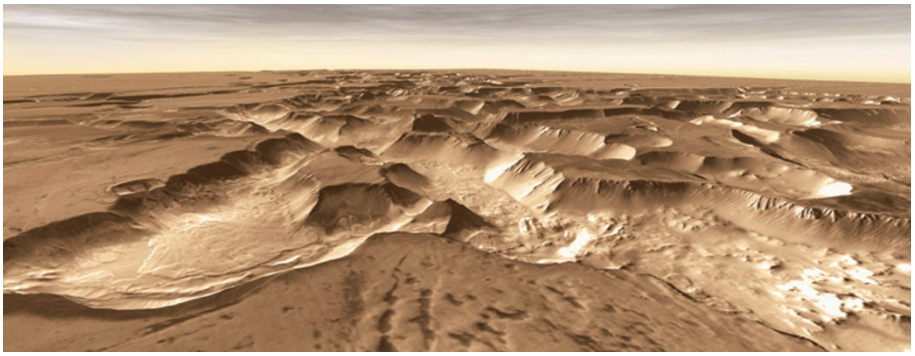
Martins, for example, works in the department of Earth science and engineering, developing techniques for uncovering microbial life and metabolism in extreme settings, using soil samples from the Utah desert as stand-ins for samples from Mars. She collaborates with soil scientists, geochemists, biologists and robotics engineers who specialize in exploration. "That's the beauty of the astrobiology field. It's scientists from different research fields, working together," she says. NASA has an annual conference dedicated to the field, which is taking place this week in Atlanta, Georgia.

JOINT MISSIONS

Support for astrobiology research is spread across many funding streams and disciplines, and finding funding and jobs that are strictly astrobiology-related is difficult, especially given recent budget woes. NASA and the European Space Agency (ESA) support the largest number of astrobiology-related positions, whether they are in Earth-science observation or engineering jobs on the next space mission. But NASA is facing budget cuts that have alarmed researchers in the field. For 2012 and 2013, a slight increase in the budget for human space exploration, from US$3.7 billion to a proposed $3.9 billion, was countered by a decrease for the science directorate, including planetary-science research, from $5.1 billion to a proposed $4.9 billion. The agency has withdrawn its component of the ExoMars programme — a joint mission with ESA to send an orbiter and rover to look for methane on the red planet, which is scheduled for 2018. NASA's funding would have created more research positions for biologists and instrumentalists, among others.

Although the US Terrestrial Planet Finder — a mission intended to look for Earth-sized planets in the habitable zones of distant solar systems — has been suspended, astronomers hope that NASA's James Webb Space Telescope, an observational mission with similar planet-finding goals, will continue moving forward.

Despite cuts in some areas, NASA's Earth budget is up slightly from $1.76 billion in 2012 to $1.79 billion in 2013, notes geochemist Mitchell Schulte, a programme officer for the Mars Exploration Programme at NASA headquarters in Washington DC. That means that research done on this planet but with applications off-planet could still be awarded funding, such as hunting for extremophiles and ▶



NASA/JPL-CALTECH/ASU

Noctis Labyrinthus, a region of the red planet captured by NASA's Mars Odyssey orbiter.

their proteins, or remote-sensing research such as LiDAR (a technique for detecting water, or mapping minerals and topography).

The Centre for Astrobiology in Madrid, which was established in 2000 as a partner to the NASA Astrobiology Institute based in Mountain View, California, is an example of an organization that is crucial for strengthening ties between researchers around the world, says astrophysicist Lisa Kaltenegger, who holds dual positions at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts, and the Max Planck Institute for Astronomy in Heidelberg, Germany.

"I look for people who are willing to take this risk. In my experience, that is an extraordinarily hard thing to do."

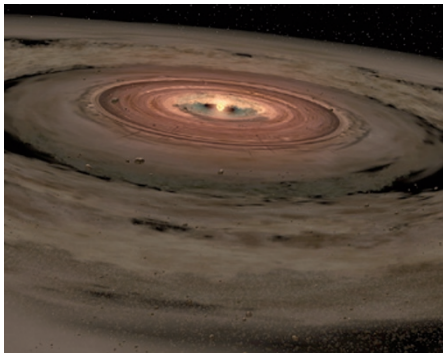
In addition to NASA's partner centre in Spain, other centres have sprung up, including Germany's Institute of Planetary Research in Berlin, which is a cooperative alliance of about 200 scientists across 17 science organizations, with funding from the Helmholtz Alliance based in Bonn, which studies planetary evolution. Gerda Horneck, a former deputy director of the German Aerospace Centre's Institute of Aerospace Medicine in Cologne, says that there are now 25 PhD candidates in the Helmholtz Space Life Sciences Research School, based in various locations in Germany.

For fledgling scientists in the field, the economic climate means that success can hinge on finding multiple funding sources. Julie Huber, a microbial oceanographer at the Marine Biological Laboratory in Woods Hole, Massachusetts, whose research focuses on life at deep hydrothermal vents, says she applies for grants from NASA and the US National Science Foundation for oceanography programmes and occasionally from the US National Institutes of Health for microbiology research. She also applies to private foundations such as the Gordon and Betty Moore Foundation in California and the Alfred P. Sloan Foundation in New York. Huber says she considers herself lucky to have secured funding, given the budget woes of government agencies and the state of the foundations' endowments. "It used to be you had to write one or two grants to support yourself for five years," she says. "Now it's four, five, six grants every year, with no growth in the pool of money."

Other initiatives have helped to augment support for the field. The CAREX project from the European Union's Seventh Framework programme for research, which coordinated the study of life in extreme environments, wrapped up this year after spending €1.4 million (US$1.8 million). Its data on desert life, specifically microbial diversity and aspects of life in extreme environments, could help to inform surveys for life on Mars, although it is not labelled as astrobiology. The next round of European funding, Horizon 2020, will include support especially for astrobiology and space exploration, says Horneck. How much support is still under discussion. Up to this point, various projects across partnered universities and institutes have received about €2 million over three years from the European Union for cooperative astrobiology research, the CAREX funding being one example.

SPACE SCHOOL

Few PhD programmes award astrobiology degrees; students typically earn their degree in a field such as analytical chemistry or microbiology but focus on astrobiology for their thesis. For example, the University of Washington in Seattle confers a certificate in astrobiology for graduate-level research, but graduate students retain their home-department affiliation for their doctorate. Graduates with this certificate have gone on to work as astrobiologists or in related fields at NASA or other institutes.



NASA/JPL-CALTECH/T. PYLE (SSC)

Astrobiologists hope to continue to study stars such as 51 Ophiuchi (artist's rendition pictured).

In 2005, Stockholm University launched an astrobiology graduate school for an initial five years to gauge interest in the field, a sort of interdisciplinary curriculum experiment. The university considered it a success, and departments including astronomy and geology have transferred their experience into the newly created astrobiology centre.

Sandra Siljeström's career exemplifies the potential myriad roles an astrobiologist can have. A graduate from the Stockholm programme who trained as a geochemist, Siljeström is now a research scientist at the government-run SP Technical Research Institute of Sweden in Borås, where she works on projects for the Swedish space board, developing methods to examine small amounts of organic compounds using time-of-flight spectroscopy. She is also helping to develop the Mars Organic Molecule Analyser, an instrument to be carried on the ExoMars rover. Her position also includes contract work for industry, examining organic compounds in rocks and other materials.

MORE BODIES

Horneck advises undergraduates and master's students to ground themselves in one of the many applicable sciences before moving on to astrobiology-related research. She says getting a solid grounding in their field before pursuing astrobiology is important.

However, Malcolm Walter, director of the Australian Centre for Astrobiology at the University of New South Wales, advises students to start taking astrobiology courses at the undergraduate level if they are available. "The skills are generic and can be applied to many career paths. Being interdisciplinary, thinking in an interdisciplinary fashion leads to many career opportunities," he says. "I look for people who are willing to take this risk. In my experience, that's an extraordinarily hard thing to do."

Walter says two of his PhD students recently ended up working for NASA — one as a classical geologist at the Jet Propulsion Laboratory in Pasadena, California, and the other as a mineral spectroscopist, mapping mineralogy on the surface of Mars. Other students have gone on to work for biotechnology firms or the booming Australian mining industry.

Horneck worries that talented graduates will leave the field because few jobs exist outside NASA, ESA and academia, and even there, positions are limited. Many projects are suited to PhD theses, but not to full-time jobs. Not enough opportunities exist for bright doctorates to continue their research. "This is something that needs attention," she says. Even so, student interest portends good things for the field. "Ten years ago, there were no courses. Now it's a field very much taken up by students," Horneck says. Despite the challenges, she foresees a burgeoning field, with more discoveries on the horizon. ■

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