

FORWARD THINKING

A Researcher's Hunt for Extraterrestrial Intelligence

Nathalie Cabrol of the SETI Institute, a nonprofit working with NASA and others, on the new tools helping us discover life in the universe



ILLUSTRATION: MARK WEAVER

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Our first encounter with extraterrestrial life won't be with little green men—it'll likely be with little green microbes, says astrobiologist Nathalie Cabrol. "Microbial life, simple life, is what we're really after in the solar system," she says. "That doesn't mean it's not going to be intelligent in its own way."

Dr. Cabrol is at the forefront of the hunt for life off Earth. She works at the Search for Extraterrestrial Intelligence, or SETI, Institute, a nonprofit based in Mountain View, Calif., where scientists study the origins of life, where it might exist in the universe and how to find it. Recent advances—including the Kepler telescope's discovery of thousands of far-flung exoplanets—have increased the chances of locating extraterrestrial life, if it exists. SETI scientists have worked with the National Aeronautics and Space Administration, the National Science Foundation and universities to develop instruments for probes to Mars, Jupiter, Saturn and Pluto.

Dr. Cabrol has studied the universe for more than 25 years. In 1994, she presented a map of Mars' Gusev crater to NASA, with data indicating it might have been a lake billions of years ago. Based on her findings, NASA chose the crater as the landing site for its rover, Spirit, which touched down in 2004 and found evidence of past water. She has continued her research into Martian

lakes, and has visited volcanoes in the Andes and Chile's Atacama desert to learn more about hunting for living organisms in extreme environments. Dr. Cabrol has been the director of the SETI Institute's Carl Sagan Center for Research, a division focused on astronomy, planetary and climate science, astrobiology and exploration, since 2015.

Dr. Cabrol spoke with The Future of Everything about the new technologies, from artificial intelligence to lasers, that will assist in the search for life in the universe.

We'll Need a More Bespoke Approach to Exploration

We have to change the way we approach exploration. Right now we're doing general medicine. But every single planet and moon we're going to explore is its own planetary experiment. Of course you have the tools of general medicine that are going to always work—the stethoscope, something to look in your ear, a camera. But as you go and explore each of these worlds you have to apply specialty medicine. Right now we have environmental stations on board these rovers [such as NASA's Curiosity rover on Mars], and this is great because this is finally giving us the high-resolution [temperature and atmospheric data] we need to understand the local conditions. But microbial organisms in those environments are going to be there because of micro- to nano-climates. We need to know the climate at the level of a rock, a slope. You have to sit still and you have to do a lot of work in a small area.

AI Will Help Us Interpret Alien Signals

We are looking for signals coming from outer space, but nothing tells us that a human being would be able to recognize patterns [created by alien technology]. This is where AI comes in. It can see the patterns that we might not necessarily recognize, and a lot faster. This has been a great tool to go back to [the SETI Institute's] archive of data and see if we don't already have something that has been acquired in the past that we didn't understand at the time and that might be a sign that there is somebody somewhere that can send messages into space. We can [use] exoplanet research, we can lean on co-evolutionary biology that tells us how biology evolved in extreme environments. Now you can take all of this data and start modeling what is going to happen on those planets, what type of life could evolve. This is very important because it leads to

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New Tools in the Hunt for Life: Lasers...

What I'm hoping is that we will develop new perspectives and new tools that we can search with. There is now laser SETI, which is a project to place specialized cameras around the globe to look for laser flashes from deep space. Laser SETI will observe all of the sky, all of the time, so even relatively rare events can be found. It can discover pulses over a wide range of pulse durations, which may have been overlooked in previous astronomical surveys. But equally exciting is the fact that by exploring new territory, the chances of finding something completely unexpected are not zero.

...and the Study of Light

We're going to start being able to [analyze gases and minerals in the light coming from distant planets] with the next telescopes. Spectroscopy of the atmospheres of distant planets will tell us whether they contain things like water and methane. Once we start to see that some planet has an ocean and the mixture of gases in its atmosphere seems to be in disequilibrium, that's important. Life creates disequilibria. This is what we are looking for.

We'll Have to Change Our Definition of "Life"

Say we find life on Mars tomorrow. That tells us that out of eight planets in the solar system, 25% of them support life. That's a staggering number. That changes our perspective on how inhabited the universe is. The issue is that it's difficult to search for something we don't know. So we start with something we know and have a base of something to search for.

This interview has been condensed and edited.

Forward Thinking is an interview series from The Future of Everything where noteworthy figures from business, culture and technology reveal what lies ahead.

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