ASTROBIOLOGY

FINDING EXTRATERRESTRIAL LIFE

BY STEVE POINTING

People have always been intrigued by the idea of life on other planets. But how would we feel if something were discovered? And what would it mean for us? Some people imagine scenes straight out of a science-fiction movie: invasion by a cruel species hell-bent on domination. Others are more optimistic. They picture cute aliens like E.T., who just want to be friends.

Given all the speculation, what are the facts? What are the chances of discovering extraterrestrial life? What would this life be, and where's it likely to be found? The people who work to answer these questions are called astrobiologists. Surprisingly, they don't spend all their time peering through telescopes. Many study the life that's right here on Earth.

COUNTLESS WORLDS: AN OLD IDEA

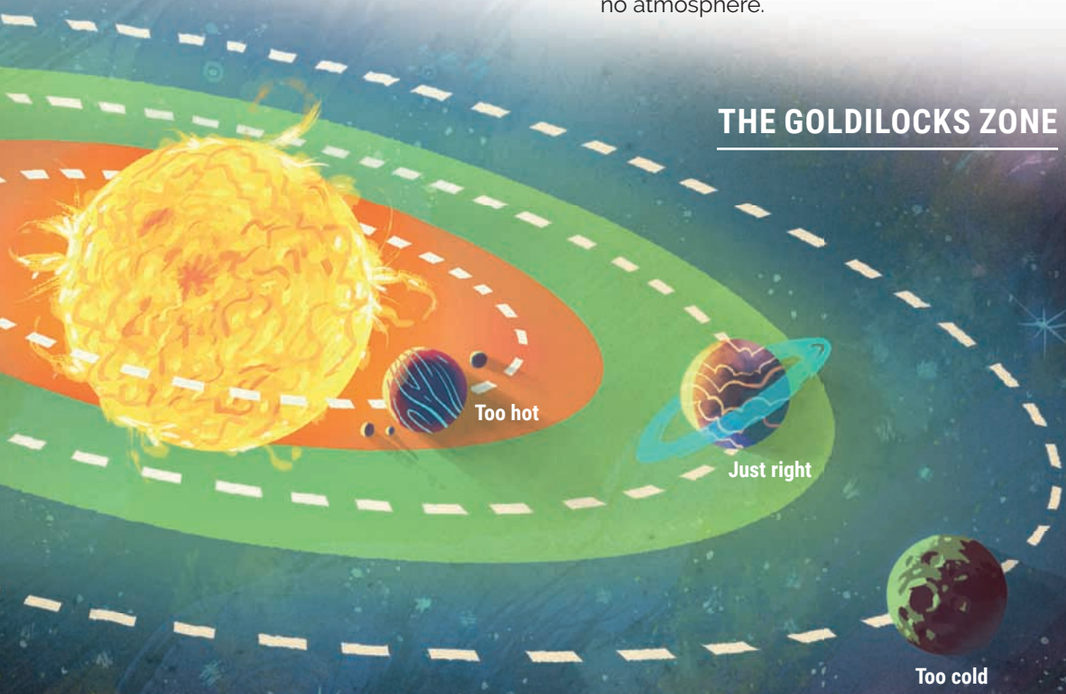
In thirteenth-century China, the philosopher Teng Mu wrote: "How unreasonable it would be to suppose that, besides the heaven and earth, which we can see, there are no other heavens and no other earths." Three hundred years later, an Italian friar, Giordano Bruno, echoed the same idea. "The countless worlds in the universe are no worse and no less inhabited than our earth," he wrote. Unfortunately for Bruno, the church didn't agree, and he was burnt at the stake for heresy!

Things have changed a lot since then. Now the Catholic church even has its own astronomers. Recently, one of them, Brother Guy Consolmagno, said he'd be "delighted" if alien life were discovered. He'd even be happy to baptise an alien, but only if they asked!

LIFE SUPPORT

A main idea of astrobiology borrows its name from the story of Goldilocks. You'll remember how it goes: Goldilocks rejects the bowls of porridge that are too hot or too cold, finally eating the one that's "just right". Astrobiologists believe that for a planet to support life, it needs to be in a "Goldilocks zone". This means orbiting a star at the perfect distance: not so hot that all water boils away as vapour, not so cold that all water is frozen as ice. A planet must have water to be habitable. This is why scientists also use the term "habitable zone".

Mass is another essential factor if a planet is to have life. The greater the mass of a planet, the more gravity it will have, and gravity allows a planet to hold on to its atmosphere. Having an atmosphere is important because it contains life-giving gases, such as oxygen. A planet with low mass will have low gravity. This means essential gases will escape into space, leaving the planet with little or no breathable atmosphere. Although not a planet, our moon is a good example of this. Because it has low mass, our moon has much less gravity than Earth and virtually no atmosphere.

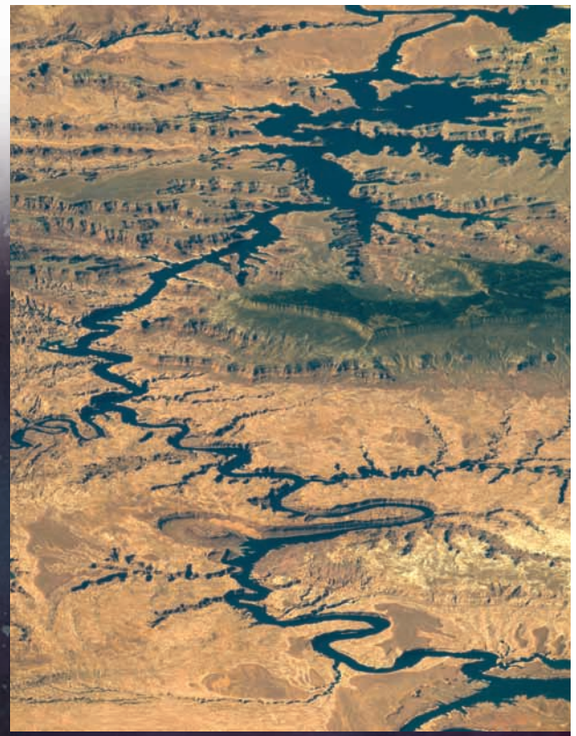


mass: the quantity of matter (something you can touch) that a body contains

LIFE ON MARS?

As far as we know, Earth is the only planet in our solar system that supports life. Earth is slap bang in the middle of the habitable zone for our star, the sun. We have plenty of water. But astrobiologists now think that our nearest planetary neighbour, Mars, was once in the same habitable zone. (This is possible because the sun's heat and brightness change over time, which means the habitable zone changes, too.) Some scientists even believe that the red planet is still just within the zone.

Satellite imagery and evidence in Martian rock prove that liquid water was once abundant on Mars. Unfortunately, the red planet's surface has since become an extremely cold, dry place. Liquid water has little chance of existing. Added to this is the problem that Mars has little atmosphere. Nevertheless, many scientists believe that primitive life may still cling on, and support for this idea comes from close to home – Antarctica.



Water on Earth: the Colorado River (as seen from space)

Water on Mars?: Scientists wonder if water once ran in these gullies.

MARS ON EARTH

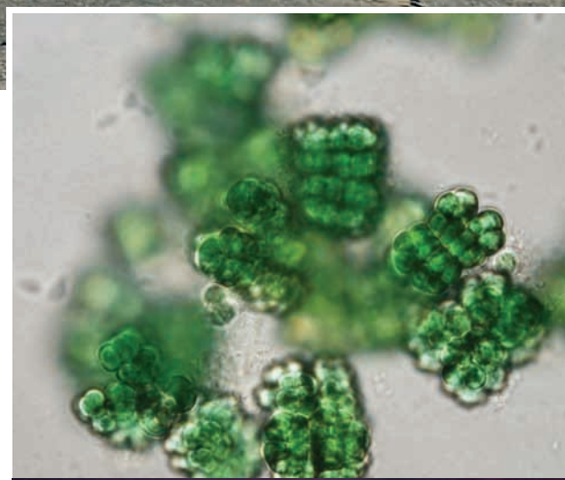
One of Antarctica's many striking features is the McMurdo Dry Valley region, the coldest, driest place on Earth. (Unlike the rest of Antarctica, there is no snow or ice.) This makes the region very similar to Mars.

Scanning the valley landscape for the first time, you'd be forgiven for thinking it's completely lifeless. There are no trees, no birds, no sign of any animals except for a few mummified seals that have accidentally wandered inland and met a grisly end. Look beneath the surface, however, and the Dry Valleys come alive. Here, you'll find **microbes**. You might even find a few hardy invertebrates that feed on them. Like a green blanket of life, this layer of microbes extends across the region – but it's hidden for a good reason. Rock and soil provide protection from the sun's UV radiation, scouring winds, and extremes of temperature.

So what's the connection with Mars, aside from the harsh environment? The answer is sandstone. In Antarctica, some microbes live in sandstone, and sandstone is also present on Mars. This is why many astrobiologists believe we'll find similar microbial life on the red planet – and soon we'll be able to search for it. The next generation of Martian rovers will be able to drill beneath the planet's surface, looking for signs of life.

The McMurdo Dry Valley region in Antarctica

Finding microbes on Mars would be a major breakthrough. It would prove that life is elsewhere in our solar system, and the odds of finding it would become more favourable. Already there's growing evidence that life-sustaining water may exist outside the traditional habitable zone. Several of Jupiter's and Saturn's moons have a surface of super-cold ice. It's possible that the massive gravitational force of the two planets, or even volcanic activity on the moons themselves, may one day create enough heat to cause some of this ice to melt. And who knows how things might go after that? Recently NASA announced plans to send a robotic spacecraft to Europa, one of Jupiter's moons, to find out more.



Microbes

microbes: microscopic organisms, such as bacteria, viruses, or fungi

LIFE AMONG THE STARS

Some would say that the opportunities for life to exist in the universe are endless. Next time you look up at the night sky, consider this: almost all the stars you see are other suns. Many have their own orbiting planets, and some of these will be in their own Goldilocks zone. Thanks to telescopes such as NASA's Kepler, we can see that even our own small corner of the galaxy contains thousands of other planets. The numbers are staggering. It's been estimated that there are more planets in our galaxy, the Milky Way, than there are grains of sand on Earth! The chance that even one of these planets has the right conditions to support some kind of life is very high. It could be simple microbes like those in Antarctica, or it could be something very different.

So what about those aliens of our dreams – or nightmares? Scientists at the SETI (Search for Extraterrestrial Intelligence) Institute have spent many years scanning the galaxy for radio waves in the hope of finding an alien broadcast. They have yet to make contact, but this doesn't mean intelligent life isn't out there. SETI has scanned only a tiny part of the Milky Way, and we know that our galaxy is just one in a vast universe.

INTELLIGENT LIFE?

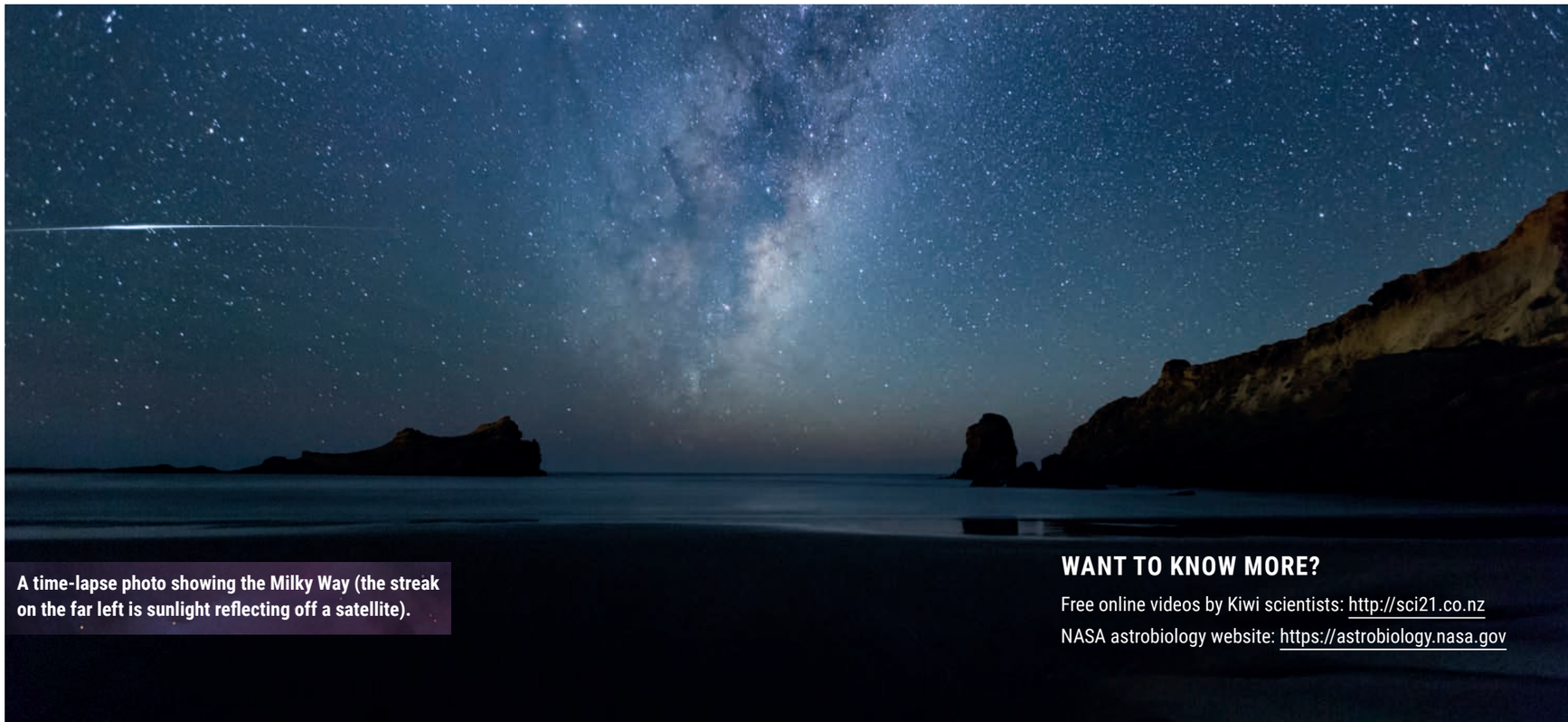
The SETI Institute assumes that one sign of intelligence is the ability to use technology such as radios for communication. The use of technology is a good start, but there's a broader definition of intelligence we need to consider: the ability to reason, empathise, problem-solve, consider complex ideas, and interact socially. Is there a way we can search for these qualities? Are there tell-tale signs? Probably not. But if we find an intelligent alien civilisation, we'll need a way to communicate with it. Communication is a necessary tool for all social interaction, as we know on Earth.

ALONE OR NOT?

Not everyone believes that the universe contains life, especially intelligent life. The famous Italian physicist Enrico Fermi rationalised that intelligent aliens couldn't exist because they'd have made contact by now. His reasoning has become known as Fermi's Paradox. Fermi believed that any intelligent life forms would have been able to colonise space and eventually entire galaxies. So where are they?

Fermi's argument is strengthened by the fact that stars and planets are different ages, and any life in these places would have evolved on a different time frame. Think about it: if you were an alien from a much older planet and had visited Earth four billion years ago, you'd have found nothing. Fermi asserted that the universe has had plenty of time to develop advanced civilisations, and yet we still haven't met anyone. So the obvious conclusion is that we're alone.

Whether you buy into Fermi's thinking or not, the next century will be a fascinating time. Some astrobiologists are predicting "unparalleled" discoveries – and maybe these discoveries will come in your lifetime. Perhaps your generation will be the first to learn the answer to one of the biggest questions of all time.



A time-lapse photo showing the Milky Way (the streak on the far left is sunlight reflecting off a satellite).

WANT TO KNOW MORE?

Free online videos by Kiwi scientists: http://sci21.co.nz
NASA astrobiology website: https://astrobiology.nasa.gov

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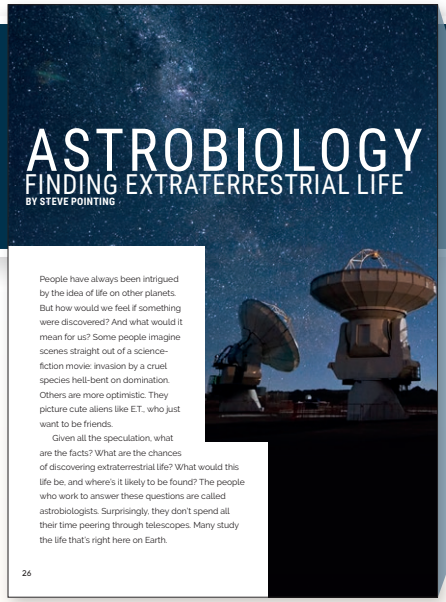
by Steve Pointing



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