

What are the chances of life on another planet?

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In an infinite universe, most scientists agree, the odds of life existing on a planet besides Earth are pretty high. It is unlikely, however, that familiar life forms will be found on any planet within our solar system.

Life as we know it—everything from single-celled organisms to human beings—consists largely of liquid water. So a planet that harbors life can't be too cold or water will freeze, nor can it be too hot or all the water will evaporate. Planets closer to the sun than Earth are too hot, and those farther away are too cold. The surface of Venus, for example, is hot enough to melt lead, and would vaporize any living thing, while the surface of Mars is frozen solid.

Life as we know it here on Earth also requires a magnetic field and an atmosphere, both of which protect it from the lethal radiation our parent star, the sun, emits. Earth's magnetic field—generated by its rotating iron core—deflects the solar wind, a continuous stream of high-speed, high-energy particles coming out of the sun. (As those particles careen by the edges of Earth's atmosphere, they sometime create the phenomenon we call the Northern Lights.) Without the [magnetic field](#) there, the [solar wind](#) might destroy all [life](#) on Earth.

As for Earth's atmosphere, it protects life because the water, carbon dioxide and other gases in it absorb solar radiation in its harmful ultraviolet-light form. The parent stars of other solar systems would emit radiation as well, and the [planets](#) orbiting them would need the same kind of protection.

Of course, life on Earth also alters the chemical composition of the atmosphere—Earth's atmosphere lacked gaseous oxygen until plants started growing here some million years ago. So molecules like oxygen in the atmosphere of another planet would be one indication—not proof—that there are living things there.

Scientists have been studying the planets of our own solar system for more than 50 years, looking for evidence of past or present life, among other things. Launched in 1967, the Soviet Union's Venera 4 was the first probe known to land on and send back data from another planet.

The mission revealed that Venus' famously soupy atmosphere is made up almost entirely of [carbon dioxide](#) with a surface temperature hot enough to melt lead, making it a very unlikely place to harbor life.

Today, NASA's Mars rover, Opportunity, has been sending back reams of data about the red planet since it landed there 12 years ago. Living well past all expectations, Opportunity not only transmits landscape photos and the occasional tweet, but also collects and analyzes soil and atmosphere samples. It's been an invaluable research tool, but has found no direct evidence that life ever existed on Mars, and has revealed that the planet's atmosphere is too thin to protect it from the sun's radiation.

The discovery of thousands of planets orbiting nearby stars has nevertheless greatly increased speculation that there may be some kind of life on a planet outside our solar system. In the past 20 years, we have confirmed the discovery of almost 2,000 planets, called exoplanets, beyond our solar system. Four thousand other exoplanet candidates await confirmation.

The ones most likely to harbor life would be smallish, rocky planets like Earth. Larger planets tend to be composed of hydrogen gas, the most abundant element in the universe, and to not have a solid surface. Good candidates for life would also occupy what scientists call the habitable zone—the zone in which a planet's distance from the [parent star](#) makes [liquid water](#) possible. The [Kepler mission](#)—a space observatory launched by NASA in 1997 to search our galaxy for just these kinds of Earth-like planets—has found one candidate that meets both requirements, Kepler-452b. So the chances of life on another planet are high. However, we have no direct evidence yet of life anywhere other than Earth.

The real question is, will we ever find the planet we're looking for, given that we'll have to survey the planetary systems of the universe's

estimated 1 billion trillion stars? And if we do find that planet, will we even recognize the life it harbors? There's no real reason why we should expect to discover life as we know it orbiting a star many light years away from our home [solar system](#). There's so much we don't know that we are severely limited in our ability to even think about the question.

Provided by Tufts University

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