Life's ingredients may have 'sprinkled' on Earth

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Life's ingredients may have 'sprinkled' on Earth
A component of DNA might survive space and sprinkle onto planets
By Dave Mosher
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Space.com
Updated: 11:52 a.m. ET Sept 11, 2007
Some crucial ingredients for life on Earth may have formed in interstellar space, rather than on the planet's surface.

A new computer model indicates clouds of adenine molecules, a basic component of DNA, can form and survive the harsh conditions of space, and possibly sprinkle onto planets as the stars they orbit travel through a galaxy.

"There may be only a few molecules of adenine per square foot of space, but over millions of years, enough could have accumulated to help make way for life," said study co-author Rainer Glaser, a molecular chemist at the University of Missouri-Columbia.

Glaser and his team's findings are detailed in a recent issue of the journal Astrobiology.

Spacey chemistry
Adenine is one of four "letters" of DNA's alphabet used to store an organism's genetic code. Glaser said the idea that large, two-ringed organic molecules like adenine formed in space may seem outrageous, but current evidence leaves the possibility wide open.

"You can find large molecules in meteorites, including adenine," Glaser said. "We know that adenine can be made elsewhere in the solar system, so why should one consider it impossible to make the building blocks somewhere in interstellar dust?"

Using computer simulations of the cold vacuum of space, Glaser and his colleagues found that hydrogen cyanide gas can build adenine. Like pieces in a set of tinker toys, hydrogen cyanide serves as adenine's building blocks; the small molecules bond together into chains and, with a little wiggling, eventually assemble into rings.

Although adenine's first ring needs a tiny energy boost from starlight to form, Glaser said the second ring of the molecule self-assembles without any outside help.

"When you want to have a reaction, you usually need to heat it up," Glaser said. "It's remarkable to find a reaction that doesn't require activation energy. If you do this reaction in space, this is a huge advantage because it takes a long time for a molecule to be hit by a piece of light."

Seasoned for life?
Glaser said adenine's ringed shape helps it absorb and release any excess energy without breaking apart, making it stable enough to form concentrated clouds that planets can drift through.

While getting adenine safely onto a rocky planet's surface is a less developed idea, Glaser said many chemists have barely toyed with the notion that life's basic ingredients formed off of the planet's surface.

"We're at a very early stage of anybody even thinking about these things," he said. "The discussion of life's origin has been highly focused on the idea of a warm pool of liquid on the planet's surface." But Glaser said recent discoveries of planets around distant stars is changing that focus.

"Chemistry in space isn't the chemistry most of us are trained for," Glaser said. "We should take a much bigger approach: Where are all the chemicals in the galaxy and its solar systems, and what can you do with them?"

Antonio Lazcano, an evolutionary biologist at the National Autonomous University of Mexico who has studied life origins for the past 30 years, said Glaser and his colleagues' work is compelling.

"We already know hydrogen cyanide is abundant in interstellar clouds, and it's been suggested that comets can bring some of that material onto planets," Lazcano said. For Glaser and his team's idea to be widely supported, however, adenine needs to be detected in the deep space clouds, Lazcano said.

"The likelihood of detection is very small, but it's still possible," he said. "If astronomers can better eliminate background noise, I think we'll have equipment sensitive enough to detect adenine dust clouds."

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