ROCKY START

Did meteorites seed Earth with the building blocks of life?

Ever since the discovery of organic molecules in a meteorite that landed in Australia about half a century ago, scientists have been tantalized by the possibility that the building blocks of life originated in space. New research is shedding light on how such compounds might have formed and found their way to Earth.

Fred Ciesla, a planetary scientist at the University of Chicago, and Scott Sanford, a NASA astrophysicist, say our solar system was on the fast track to create life before Earth existed. The scientists made a computer model of the solar nebula—the disk of gas and dust from which the Sun and planets formed 4.6 billion years ago. The primordial debris included icy grains containing frozen water, ammonia and carbon dioxide, among other molecules.

Ciesla and Sanford simulated the movements of 5,000 ice grains over a million years in the turbulence of the solar nebula, which tossed them about like laundry in a dryer, lofting some "high enough [so] that they were being irradiated directly by the young Sun," says Ciesla. High-energy ultraviolet radiation broke molecular bonds, creating highly reactive atoms that were prone to recombine and form more stable—and sometimes, more complex—compounds.

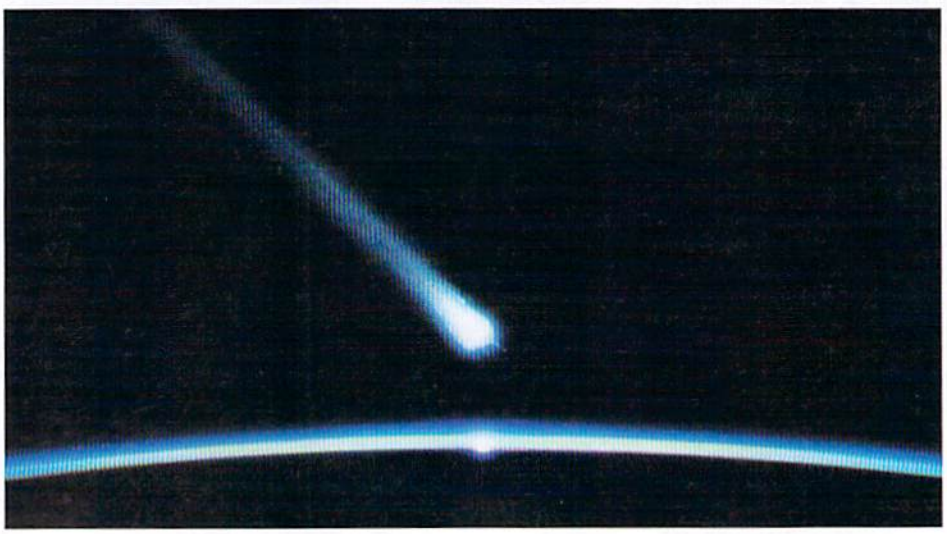
Ciesla and Sanford say this process could have generated organic molecules such as amino acids, amphiphiles and nucleobases—the building blocks of proteins, cell membranes and RNA and DNA, respectively.

Some of these organic molecules found their way to small rocky bodies—planetesimals—that littered the early solar system. Those, in turn, combined to form comets, asteroids and planets, including ours. Thus young Earth, Ciesla theorizes, was infused with organic molecules fabricated in space. Additional organic compounds, he suggests, could have formed later in Earth's primordial soup or were delivered to our planet by comets and meteorites.

The odds of meteorites reaching Earth got a boost from Jupiter, say Rebecca Martin, a NASA Sagan Fellow from the University of Colorado, and astronomer Mario Livio of the Space Telescope Science Institute in Baltimore. When the solar system was forming, Jupiter's gravity prevented nearby planetesimals from coalescing. The bodies smashed into one another, breaking into fragments that settled into an asteroid belt 158 million miles from Earth. If a young Jupiter had passed through the belt while settling into its orbit around the Sun, it would have scattered the asteroids; if its orbit had been too far from the belt, asteroids would have accumulated and constantly bombarded the Earth, rendering it lifeless. Instead, the asteroid belt provided just the right amount of asteroids to courier compounds to Earth without pounding it into oblivion.

Both studies point to the possibility of life on other planets. Ciesla says, "If the process that we describe did play a role in the formation of the organics that we see in meteorites, then we expect basically every solar system to contain" organics. However, only 4 percent of the known solar systems in our galaxy possess a Jupiter-type planet in the right place to create an asteroid belt like ours. "There could be more asteroid belts out there," says Martin, "but we just can't see them yet." –KER THAN

"Something pretty mysterious had to give rise to the origin of the universe."
–RICHARD DAWKINS



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