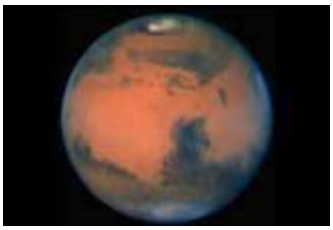

Your Ancestors May Be Martian

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Suppose that billions of years ago life developed on Mars. Primitive, tiny organisms that thrived deep within rocks and made a living from water and chemicals seeping through those rocks.

Now imagine that a huge asteroid collided with Mars. Millions of martian rock fragments were thrown into space by the force of the impact. Tough martian organisms hitchhiked on some of this ejecta. Many pieces went into orbit around the sun and, after hundreds of thousands of years, some of these collided with the Earth. Of those rocks, a few reached the surface. Some hardy martian organisms survived the journey, colonized the Earth and eventually evolved into the huge variety of life that we know today.

Just a few years ago this scenario would have been dismissed as wildly imaginative and highly improbable. Though still highly speculative, recent discoveries in several fields of science have shown that it is far from impossible -- our ancient ancestors might have been martians.

Enter the nanobes

It is not every day that a scientist discovers a possible new life form. Dr. Phillipa Uwins works in the Center for Microscopy and Microanalysis at Queensland University, Australia. Last year she was asked to analyze some rock samples taken from several miles under the seabed in a drilling operation off the coast of western Australia. The temperature at this location was around 300 Fahrenheit (150 Celsius) and the pressure was an incredible 2,000 times normal atmospheric pressure at sea level.

During an electron microscope examination, Uwins found what appeared to be tiny, dormant organisms only 20 nanometers across. (A nanometer is one -billionth billionth of a meter.) She named them "nanobes."

To Uwins' surprise, filaments grew when samples of the nanobes were given some food and exposed to normal temperatures and pressures. She was also surprised because the cell walls of the nanobes survived the intense radiation and vacuum of the electron microscope.

Uwins teamed up with two microbiologists to further investigate the nanobes. A range of chemical tests indicated that the tiny objects contained DNA. This finding challenged the notion that a "cell" 20 nanometers in diameter was too small to have room for this essential ingredient of life as we know it (it is also one of the arguments against the "nanofossils" in martian meteorites -- discussed below).

Here was a tough little critter that was able to survive the heat and pressure deep underground and, possibly, the vacuum and radiation of an electron microscope. The Queensland team may have found an organism that can survive a ride between the planets aboard a meteorite.

Creatures don't have to be as small as nanobes to survive space-like conditions. Several other examples of "extremophiles" (organisms that can survive very hostile conditions) have been found by other researchers in recent years, including bacteria that live inside nuclear reactors.

Meteorites from Mars

Rocks from Mars *have* made it to the Earth. Remember the fuss in 1996 when NASA scientists claimed they had found possible fossil evidence of ancient life in a meteorite from Mars? (That debate is still not settled.)

After being blasted from the surface of Mars, one small chunk of rock spent 16 million years in orbit around the Sun. Then some 13,000 years ago it collided with the Earth and landed in the icy Antarctic. In 1984, scientists searching for meteorites found it and named it ALH84001. Ten years later researchers figured out that ALH84001 had come from Mars. This was based partly on an analysis of the Martian atmosphere by the Viking spacecraft in 1977 -- but that is another detective story.

A dozen or so other meteorites are now known to have come from Mars. In 1911 one of them fell to Earth in Egypt and killed a dog. It took almost 80 years to recognize that the unlucky dog had been killed by a rock thrown from Mars. Planetary scientist and crater expert Dr. Jay Melosh, from the University of Arizona, has estimated that about half a ton of martian material falls to Earth each year.

Melosh observed that some of the martian meteorites showed no evidence of a violent shock when they were blasted into space from the surface of Mars. This meant "back to the drawing board" for theories about rocks ejected into space by impacts -- they were supposed to be partly melted by the intense heat from the shock wave.

Melosh worked out a theory that rocks near the surface could be launched into space without "shock heating." The effect is something like crumbs being flicked from a shaken picnic blanket.

The discovery meant that organisms hiding within ejected rocks could survive the blast from a nearby asteroid impact. There are, however, many other hazards in a flight from Mars to Earth. Melosh investigated these hazards and was able to show that some organisms had a fighting chance of making the trip between the planets.

Surviving space flight

In his classic 1865 novel *From the Earth to the Moon*, science fiction writer Jules Verne wrote of a piloted space capsule being launched by a gigantic cannon. Verne was aware of the scientific error with this idea -- the astronauts would be crushed by forces thousands of times greater than the pull of gravity (1 G or an increase in speed of 32 feet per second every second). Verne knew that the steady and comparatively gentle rocket was the way to reach space, but his audience of the day was more likely to believe the cannon story.

For most creatures on Earth, exposure to several hundred Gs would be fatal. They have no hope of surviving the Jules Verne cannon blast, or a ride on a rock blasted into space by an asteroid impact. But some very primitive forms of life are so small and simple that they can survive enormous accelerations -- 10,000 G or more.

One way that scientists can test the ability of organisms to survive very high G forces is to fire them out of a cannon. This was recently done in Sweden and a substantial proportion of dormant organisms survived the launch conditions. Jules Verne had the right idea but the wrong organism.

Of all the rocks blasted from the surface of Mars into orbit around the sun, about one in 15 will eventually collide with the Earth. Some make it in thousands of years. Others may take millions of years. For organisms aboard these rocks the journey would be extremely hazardous, with freezing temperatures, deadly cosmic rays and ultraviolet radiation. But the rock spaceship provides some protection from radiation and cosmic rays, and the deep freeze may actually help some organisms survive the tough conditions.

Next, the organisms would have to survive the rigors of colliding with the Earth. The outside of a meteorite glows white-hot as it plunges into the atmosphere at 25,000 mph or more. Many burn up completely and never reach the ground. However, a small percentage survive and make it to the surface.

The inside of a meteorite is protected from the heat of re-entry because rock is a

very good heat insulator. People who have come across a freshly fallen meteorite sometimes report that a layer of frost has formed on its surface. The inside remained at the freezing temperature of space even though the outside glowed white-hot during reentry. Any organisms within the meteorite could therefore -- in theory -- survive to reach the surface of the Earth.

Finally, the organisms would have to make a home for themselves on their new planet. Billions of years ago the conditions on Earth might have been similar to those on Mars, so colonizing this planet may not have been difficult, compared with the hazards of getting here.

Of course, this scenario all depends on Mars having some tough forms of microscopic life billions of years ago. Maybe the exciting space missions to Mars planned over the next few years tell us whether this was the case or not.

Lifeboats in space

Another intriguing possibility is that meteorites may have acted as lifeboats ("escape pods" for Star Wars fans).

Giant asteroids and comets bombarded the planets up until the time that life is first thought to have arisen. Following some of these impacts the surface of the Earth would have been sterilized by temperatures much hotter than an oven, and any oceans would have boiled away. Perhaps the only escape for organisms was to be blasted into space and the really lucky ones returned to the Earth when things cooled down. The same rescue system could have worked for any life on Mars.

Maybe martians came from Earth

Even if the scenario of Mars life seeding the Earth is not correct, the reverse seems quite likely. Rocks all over the surface of the Earth have been found to contain microscopic life. It is hard to find places that don't have life. Hundreds of huge asteroid impacts have occurred on Earth since life first began. Without doubt some of these impacts would have launched rocks bearing microscopic life.

In his book "The Fifth Miracle," physicist Paul Davies discusses the origins and development of life on Earth. He pays great attention to the possibility of life being exchanged between Earth and Mars and concludes "It is therefore inevitable that life from Earth has reached Mars ... that is why I am certain that there was life on Mars in the past, and may well be life there today".

Paul Davies also notes that, 4 billion years ago, Mars may have been more suitable than Earth for the development of life. He argues that we should be prepared for the possibility, remote though it may seem, that we are descended from martians.

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