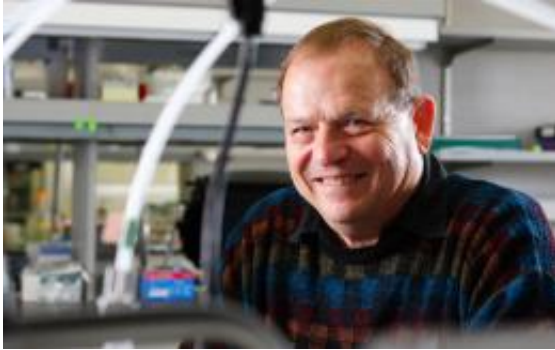


# Is the 'dead planet' full of life?

November 23 2011, By Cristy Lytal

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USC Dornsife professor Kenneth Nealson is working on an atmospheric monitor that will search for signs of life on Mars. Photo by Phil Channing.

(PhysOrg.com) -- David Bowie asked it best in his 1971 song “Life on Mars?” But when it comes to the question of whether there’s currently life on the Red Planet, USC Dornsife professor Kenneth Nealson is fairly confident that the answer is no.

“I’m highly skeptical about it,” said Nealson, his face creased by a smile, his thumbs hooked in his colorful, embroidered belt from Nicaragua.

Nealson, Wrigley Chair in Environmental Studies and professor of earth sciences and biological sciences, was addressing a group of USC students in a sunny room that serves as a kitchen, a library, an office and a conference room for his research team.

On the table, Bergey’s Manual of Systematic Bacteriology: Volume 3

shares space with a salt shaker, a bag of sunflower seeds, and jars of Nutella and peanut butter. Two signs are posted over the nearby kitchen sink - the periodic table and a warning appropriate for a planet that teems with life: “Help us become roach free: Do not leave dishes or sponges in the sink.”

Although Nealson doubts that [Mars](#) shares Earth’s pest problems, skepticism has not stopped him from serving as a member on one of the instrument teams for the Mars Science Laboratory, the space probe due to launch Nov. 26 that will travel for more than eight months before landing on Mars’ Gale Crater, where water once may have flowed.

He’s working on an atmospheric monitor that will search for signs of life mainly in the form of light methane, an isotope or variant of the element, which usually is produced by bacteria on Earth.

Nealson knows a thing or two about life and has spent decades studying it in its simplest forms. A maverick by nature, he has engaged in research that includes the exploration of bacteria’s chemical communication methods and the creation of bacteria-fueled batteries.

In his view, the reason that Earth swarms with life and Mars deserves to be called “the dead planet” has a lot to do with a single element: nitrogen.

While Earth’s atmosphere consists of nearly 80 percent nitrogen, Mars has only trace amounts. Smaller than Earth, Mars has only a third of our planet’s gravity. As a result, according to the speculation of many scientists, Mars did not have the necessary gravitational pull to hang on to most of its atmosphere. What remains is only a few thousandths of the density of ours.

A key component of all known living organisms, nitrogen occurs in amino acids, proteins and nucleic acids, including DNA.

“Nitrogen is a compound that has both single and double bonds and is very good at transferring electrons around, and none of us can figure out how you can do this without nitrogen,” Nealson said.

Without electron transfer, the basis of respiration, cells can’t get the energy that is necessary for life from nutrients, he added.

Although nitrogen provides a key ingredient for life on Earth, Nealson believes that other elements could substitute in the recipe for life on Mars. As a scientist at the Jet Propulsion Laboratory in the late 1990s, he hunted for telltale signs of life in the Red Planet’s atmosphere. Instead of searching for a particular chemical, such as nitrogen, his team took a more broad-minded approach and looked for anything that was present in a larger quantity than expected.

Nearly everything in Earth’s atmosphere is out of equilibrium by “at least a factor of a million,” Nealson said. If not for life, Earth’s atmosphere would comprise only a few parts per billion of oxygen rather than 20 percent. In addition, it also would not include what he called “weird molecules” like hormones and pheromones.

Life is messy; Mars is neat. Everything in its atmosphere appears to be exactly as it should be in accordance with planetary science, suggesting that neither little green plants nor little green men are releasing their dynamic hodgepodge of chemical byproducts into the rarefied Martian air.

Nealson puts the dead planet scenario in even simpler terms, comparing Mars to a sterilized, bacteria-free can of soup.

“There’s no reaction going on [in the soup] because you sterilized it,” he said. “These chemicals just will not break down without life there. And without any life around, they’re stable forever.”

Nealson's boyish blue eyes twinkle as he casually redefines life for everybody in the room.

“The real signal for [life](#),” he said, “is that it speeds things up.”

Provided by USC College

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