

# Patrick Rowan's Skywatch: 40 years after Viking landing questions remain about life on Mars



The Viking lander of the surface of Mars. (NASA photo)



By [Patrick Rowan | Special to The Republican](#)

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"Life on Mars!" I'll never forget that bold headline 40 years ago on the front page of the Springfield Morning Union. NASA stunned the world with its announcement. Then they took it back.

The claim of life came 10 days after the first landing on Mars by Viking 1 on July 20, 1976. Its identical twin, Viking 2, landed on the other side of Mars on September 3. Each carried out the first ever tests for life on another world. And the last.

So... what happened?

Viking 1 raised the bar for robotic exploration so dramatically, it seems quite appropriate that it landed seven years to the day after Apollo 11's historic moon landing. So, even as Juno's mission at Jupiter unfolds, this 40th anniversary is a good time to look at Viking's lasting effect on the search for life on Mars.

(Both planets, incidentally, are easy to spot early these evenings: Jupiter lowering in the west, and Mars glowing its distinctive ruddy hue in the south.)

NASA's refusal to fly life detection experiments in the four decades since Viking has perplexed many, and now my own interest has led me down the rabbit hole. The reasons discussed range from budgetary constraints to the technical challenges of life detection, but all seem a stretch given the repeated rejection of proposals for affordable tests.

From my search, an unexpected pattern emerged: Perfectly reasonable inquiries were routinely derided, subjected to mindless stock answers, or just ignored. Annoying, I thought, but par for the course. Such behavior, however, from authoritative and trusted sources? That's just plain unacceptable.

Is it politics? Group-think? Whatever the case, the experience has strengthened my regard for Gilbert Levin, the designer and principal investigator for those Viking Labeled Release experiments that signaled life on Mars so long ago. He is Adjunct Professor in the Beyond Center of the College of Liberal Arts and Sciences of the Arizona State University.

He has since run the gauntlet, defending his minority opinion that the LR did indeed find life, and raising questions about the role of institutional culture in repressing or rejecting it as a matter of policy... or worse. Honestly, I'm beginning to see his point.

So, imagine my delight when Dr. Levin agreed to speak with me from his home in Maryland last month. He had just returned from Sweden, where he delivered a talk on the LR, and was invited to partake in the upcoming ExoMars 2020 mission.

That last part is fresh and exciting news, especially in light of NASA's most recent rebuff. Levin, in his capacity as Honorary Professor of Astrobiology at the University of Buckingham, participated in a proposal for the Mars Curiosity rover that researcher Barry DiGregorio submitted to NASA and the United Kingdom Space Agency.

Levin said the idea was to find "rocks that it had cracked open when it drove over those rocks...and take up-close, high resolution, high magnification images to see if there's anything in there that looks like microorganisms that exist on the rock surfaces."

"The UK Space Agency... thought it was a great idea" he said. "They... highly recommended the experiment and hoped that NASA would activate it on Curiosity. And indeed," he said, "the UK offered to pay for it ... most unusual."

"NASA, in 2015, rejected the proposal and rejected the UK Space Agency offer." Levin told me that in May this year, a NASA press release talked of directing "Curiosity to take close up images at high resolution and magnification of rocks that Curiosity's wheels had split open to look for a possibility that there could be endolithic type of microorganisms there." He said NASA "gave no indication of where the idea came from."

"The University of Buckingham put out a release describing the experiment, the proposal, and how NASA had rejected it a year ago, but was now implementing it as one of its own." Levin told me that although the University and proposers did not get credit, they decided that the important thing was to get the images, and were delighted to see that happening.

Returning to the Labeled Release discussion, Levin said "Much has happened in the 40 years" since Viking. To me, it sounded like an understatement.

Prior to his involvement with Viking, Levin improved a method for detecting biologic contamination in drinking water by labeling nutrients with tiny amounts of radioactive carbon-14. By measuring radiation, the gaseous by-product of microbe metabolism could be quickly detected.

Levin proposed a miniature version of his Labeled Release experiment as a life detection test on the Vikings, and NASA accepted. But before it could fly, and in order avoid confusion, four NASA-appointed panels established what readings would be accepted as proof of life.

Levin told me that the LR results exceeded those agreed-upon pre-mission criteria, but the GCMS instrument designed to detect organic matter -- the building blocks of all Earth life -- found none. So NASA declared "No organics, no life," retracted the life claim, and concluded that unknown chemical processes caused the LR's false positive.

Levin and Co-Experimenter Patricia Ann Straat, however, maintained that "the results are consistent with biology." In the coming years, Levin tried to disprove his own view through extensive analysis and testing, but instead strengthened the conclusion. He did not anticipate what lay ahead.

In Barry DiGregorio's book, "Mars: The Living Planet," Levin described the reaction he got at the National Academy of Sciences in 1986, on Viking's 10th anniversary: "I said that 'more probably than not' the LR had detected

microbial life in the soil of Mars. This produced near-pandemonium among the scientific audience. At the reception ... prominent Viking scientists accused me of having disgraced myself, and science." This would become a recurring theme for Levin as he forged ahead.

As NASA shifted to less direct approaches -- searching for water and life-friendly conditions instead of life itself -- a revolution in our understanding of life was occurring.

Levin recalled the old view offered in his biology classes: "They taught me that life was a very thin membrane, very delicate, on the surface of the Earth only. Well, that's dead wrong" he said. "It's not delicate, it's the toughest thing known. It's tougher than steel. You can't destroy it."

He drew mental images of the new, expanded biosphere with verbal bullets: "It's in the atmosphere. It's in the stratosphere. It's in the ocean. It's beneath the ocean. It's at the lowest depths we've ever drilled to. It's everywhere except in hot magmas where there's molten rock...."



He cited life discovered in deep sea trenches as illustrations of "Stuff they never imagined 40 years ago when Viking was launched!" He believes that Carl Sagan's familiar admonition, "extraordinary claims demand extraordinary evidence" needs to take such new realities into account to be valid.

About Sagan, he said "Since



Mars, as photographed by Viking 1 in 1976.

*NASA photo*

his day, the claim of life on Mars has gone from extraordinary to ordinary", adding that it is now "very hard to imagine how Mars

could be sterile" -- a view that appears to be increasingly common. According to Levin, a few months before he died "Carl himself said we ought to reexamine Viking data."

Of the many attempts to explain away the LR data, Levin said "None is scientifically supportable. Everything discovered about Mars -- and Earth, where we find living organisms in places we thought they could never live -- nothing mitigates against the LR's absolute flawless performance in discovering life."

Before it went to Mars, the experiment was run on Earth "not hundreds, but thousands of times" according to Levin. "Never once did it make a false positive, or a false negative determination... an incredible record. It works every time. It works on Earth. It works on Mars" he said.

But the challenges came. "At first they said ultraviolet light destroyed life, and now they've found that's not the case" Levin said, referring to lichen and bacteria collected, tested and found viable after a year and a half of exposure to space on the outside of the International Space Station. "So, that excuse is gone" he said.

A possible solution to the missing organics was the detecting instruments' low sensitivity. And now that Curiosity has confirmed organic matter, NASA's original objection to the LR's finding of life is removed.

Back in 2008, NASA's Phoenix Mars lander found the chemical perchlorate -- what Levin calls "the one discovery they've made since Viking." He said they presented it as "the poison that prevents there being life", but then admitted

that many microorganisms on Earth actually eat perchlorate.... "So, you know, that's no longer an issue" he chortled.

Then came the suggestion that this same perchlorate fooled the Viking LR into giving false positive readings. Levin shot that one down too, showing that the LR dispensed with whatever produced the positive reading at temperatures way too low to destroy perchlorate.

Levin's tests searched soils around the world, along with imported soils, and a very wide variety of microorganisms for chemistries that might mimic the LR life results, but "never once did it make a false positive, or false negative" he said. Of over 40 alternative explanations that have been proposed, Levin says none have stood up his tests.

In 1996, NASA declared evidence of ancient Mars life in the meteorite Allan Hills 84001. Around that time, Levin concluded that the Viking LR experiment detected living microorganisms in the soil of Mars.

When NASA first dismissed the LR results, they were not aware of serious limitations in the GCMS instrument, yet still they consider exotic chemistry as "more likely," and the snubs continued.

In just one example, a 2006 NASA release marking 30th anniversary of Viking, makes no mention of the life detection experiments, even as it says "The Viking mission looms like a legendary giant".

Against this backdrop, I can only imagine how findings that actually add intriguing new details, however -- like the evidence of circadian rhythms uncovered in 2010 in the Viking data -- must be positively invigorating.

The confirmation of methane, water, and organics, and the growing body of evidence proving that Mars was more a hospitable place in the past don't hurt either.

With seven functioning probes currently at Mars, two of them on the surface, and one more en route, I asked Levin what kinds of hopes he had for future missions.

"Well, I am hopeful that this thing I just got on, the HABIT experiment on ExoMars 2020 – if I can last that long" he said with a laugh, "will get evidence confirming that Viking detected life."