of the more than 3,000 men and women on Death Row in America, are poor. Thus, the ironic definition of capital punishment: "Those who lack the capital, get the punishment."

'An Eye For An Eye'?

Because the argument most often used to justify capital punishment, particularly in the "Bible Belt," where it is most in force, is the "eye for an eye" idea of retributive justice found in the Old Testament, the contribution of Rabbi Gershon Winkler is among the most valuable in this collection. Rabbi Winkler begins by quoting from the Talmud: "A court that has executed someone as infrequently as once in seven years, is a murderous court; others say, even once in seventy years."

After detailing the great lengths to which Jewish courts in the Hellenistic period went to *avoid* executions, Rabbi Winkler writes that, while Jewish law does not rule out capital punishment, it "certainly made it close to impossible to sentence someone to death, did everything possible to delay execution, and leaned toward every possibility of acquittal rather than seeking conviction. In our own time, these rules would appear politically incorrect, albeit reasonably compassionate; two thousand years ago, however, they were extraordinarily compassionate, and reflect an attempt at wrestling a balance between respect for the sanctity of life, and respect for the needs of society."

Today, we are going in the opposite direction. Where Jewish law in the time of Christ had moved *away* from executions, an America that calls itself Christian (after the Christ who preached mercy, forgiveness, and love) is turning increasingly *toward* capital punishment.

Mahatma Gandhi and Martin Luther King, Jr., warned that "the eye-for-an-eye philosophy leaves everyone blind." That is certainly not what is meant by "blind justice"! Let us hope that *Frontiers of Justice,* and other similar attempts to bring the real horrors of the death penalty into public debate, will lead this nation to a *real* blind justice—one that is both fair and based on law.

America will then be returning to its true, anti-oligarchical roots, as American patriot and Declaration of Independence signer Dr. Benjamin Rush helped to plant them, when he launched the movement to abolish the death penalty in our country in 1787. As quoted in *Frontiers of Justice,* Rush and his fellow Leibnizians based their movement on the belief that, as opposed to the harsh and bloody laws that marked the British monarchy over which the Revolution had just triumphed, mild and benevolent ones should characterize republics. If we are to salvage this first republic established on Earth, the death penalty must go.

—Marianna Wertz

The Puzzle of Life on Mars

On July 20, 1976, seven years to the day after the first astronauts landed on the Moon, the Viking I spacecraft landed on Mars. Its sister ship, Viking II, landed six weeks later.

Aboard both spacecraft were instruments given the task of answering one of the most profound questions posed to science: Has life developed on any planet in the solar system besides Earth?

Mars was the best candidate for a "yes," because, like Earth, it appears to have had a warm and wet past. Also, like Earth, the inclination of its axis of rotation produces seasons, and it is neither too far from nor too close to the sun to preclude the possibility of incipient life forms. It was also known that Mars, unlike our nearby moon, has an atmosphere.

Of the three scientific instruments aboard the Viking landers, one was developed by Dr. Gilbert Levin. His "Labeled Release Experiment" placed a drop of radioactive nutrient on a sample of Martian soil, and measured the gas released. The experimental result—radioactive gas emerging from the soil sample—suggested the presence of life. For the twenty years since, Dr. Levin has insisted that these results show that there is life on Mars. But, for most of these two decades, the overwhelming majority of the scientific community has insisted that Viking found *no* life on Mars, in large part because *today's* Martian conditions could not support life.

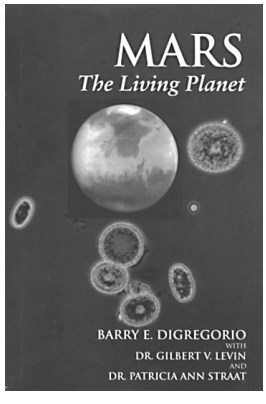
No one has come up with a plausible explanation for the results Dr. Levin's experiment sent back to Earth, however. And, what's more, few in the scientific community have shown interest in developing the *new* experiments for current Mars missions, suggested by Dr. Levin to continue the search for the truth.

Mars: The Living Planet is Dr. Levin's story.

Life's Changing Envelope

One thing scientists have recently learned is, not to be too hasty making absolute statements about where life can and cannot exist. Author DiGregorio has done an excellent and exhaustive job of summarizing the research of the past few years, which indicates that life can exist under many conditions that were previously thought to be prohibitive, including conditions found on Mars.

For example, none of the experiments on the Viking landers indicated

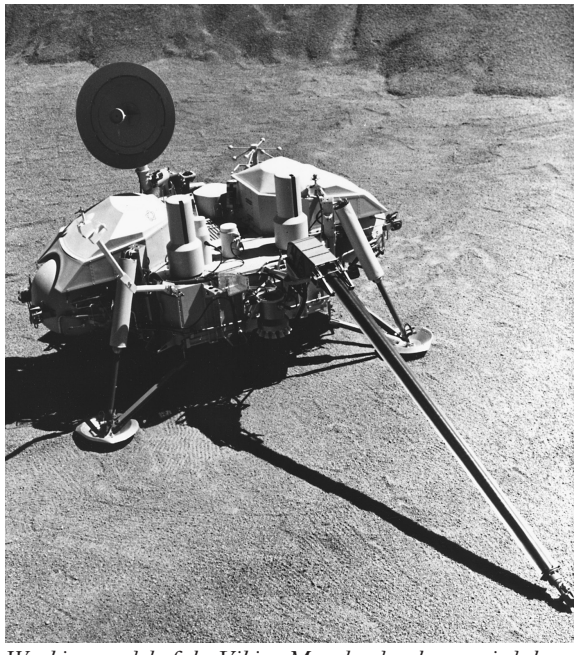


Mars: The Living Planet
by Barry E. DiGregorio
Berkeley, Frog, Ltd., 1997
365 pages, hardbound, $25.00

the presence of organic materials on or near the surface of Mars. But, could there be life which required neither organic material, nor the ability to undergo photosynthesis?

DiGregorio reports that in 1995, Dr. Todd Stevens and Dr. James McKinley, of the Pacific Northwest Laboratory in Washington State, discovered anaerobic bacteria living on nothing but volcanic basalt rock and oxygen-free water, at a depth of 1,500 meters in the groundwater of Columbia River basalt aquifers.

These rock-eating bacteria were subsequently named "Subsurface Lithoautotrophic Microbial Systems," indicating an organism which manufactures organic nutrients from inorganic substances (such as basalt rock). According to DiGregorio, Dr. Stevens stated that the Viking life science experiments would not have been able to detect such life forms, should they have existed on Mars.



NASA

Working model of the Viking Mars lander that carried the life-detection experiment designed by Dr. Levin.

It is now broadly believed that there may be liquid water beneath the surface of Mars. While it is too cold and the atmosphere is too tenuous for liquid water to exist on its surface, there is no doubt that Mars was once, and may still be, a geologically active planet, with volcanoes and other features that could warm the frozen soil under the surface, to allow water to exist in its liquid state.

Another problem which many have pointed out is, that there is little radiation-shielding on Mars, owing to its thin atmosphere and lack of an ozone layer, and the ultraviolet radiation that strikes the planet would be lethal to life. In response, DiGregorio reviews the variety of methods organisms on Earth have developed to protect themselves from UV radiation.

For example, there are organisms which encapsulate themselves in water for protection. Others use a process of biomineralization, in which the incorporation of a small particle of iron, produced by the organism itself, protects it from ultraviolet light. It has also been observed that snow algae store dust and metals within their cell structure to use as nutrients, as well as for protection from solar UV.

In addition to the cosmic rays and UV radiation that bombard the surface of Mars from space, there is also, most likely, a constant decay of radioactive materials present to the Martian soil, which, it has been argued, could be lethal to life. Author DiGregorio counters, by reporting the 1989 discovery of a radiation-resistant microorganism living *inside the core* of the Three Mile Island nuclear reactor in Pennsylvania. These cells apparently survive the extreme radiation environment by producing enzymes which repair their DNA as they metabolize.

Thus, given the evidence, any true scientist would certainly conclude that it is too early to close the book on the possibility that life on Mars does exist .

Designing New Experiments

Dr. Levin has not been discouraged by the opposition encountered from nearly the entire exobiology profession. He has continued to propose new experiments to collect data relevant to the question of life on Mars.

He has focussed on one unique characteristic of living systems, the fact that they are chiral (left- or right-handed). In 1996, the U.S. contributed the "Mars Oxidant Experiment" (MOX) to the Mars '96 lander developed by the Russian Space Agency. Designed to identify and measure oxidants in the Martian soil, MOX included a fiber, proposed by Dr. Levin, coated with two versions of an amino acid with opposite handedness. Dr. Levin suggested that a Martian soil reaction to the left-handed isomer of the amino acid, would be an indication of the presence of life.

Although the Russian Mars '96 spacecraft did not make it to Mars (or even out of Earth orbit), Dr. Levin has continued to propose experiments for the Mars landing missions planned by NASA for the next decade.

These have included modifying the "Thermal and Evolved Gas Analyzer" already slated to be flown on the NASA Mars Surveyor '98 lander, to include a life-detection experiment. That proposal was not accepted, the initial reason being, that searching for life was not included in the mission.

After the August 1996 announcement by scientists that evidence of past life on Mars had been detected in Mars meteorite ALH84001, Dr. Levin proposed his experiment again. This time, he was told that the process of sterilizing the spacecraft to prevent Earth contamination, was too expensive.

Nevertheless, the excitement over the Mars meteorite has renewed scientists' interest in including life-science experiments on upcoming unmanned Mars missions.

This is an excellent book. It is a fitting tribute to a man who has stubbornly insisted that scientists should search for the truth, and should mobilize to find answers to puzzles they cannot answer. If that kind of drive is applied to the puzzle of life on Mars, mankind may be able to begin to put some of the pieces together—even before we are on the way to Mars—to discover the answer ourselves.

—Marsha Freeman