BIOLOGY

Is There Life on Mars?

Is man alone in space? Scientists disagree, but the planet Mars, with its wide range of temperatures and unbroken miles of sand, may provide the dramatic answer.

By JONATHAN EBERHART

See Front Cover

➤ WHAT ON EARTH kind of scientific experiment would make use of three gluey strings fastened to bullets and shot off in different directions? None, on earth, but Mars. . . .

Just such an experiment is actually being planned for delivery to Mars in the next few years, along with another curious gadget that amounts to an automated drinking straw with a test tube at one end. The "sticky strings" experiment is called "Gulliver" and the other is lovingly referred to as the "Wolf Trap."

On the sandy Martian surface, these devices will have to do the work of a whole army of biologists and biochemists. Gulliver will shoot off its strings, then reel them in with bits of soil, rock, and—with luck—microorganisms clinging to the sticky coating of silicone grease.

The strings will end up in a chamber in which they will be drenched with a radioactive nutrient solution to stimulate the growth of any bacteria. If bacteria are present, they will absorb the solution and give off radioactive carbon dioxide as they grow. The gas will be trapped on a chemically coated screen in front of a geiger counter. Any information from the counter will be radioed to earth.

Gullivers Successfully Tested

Several prototype Gullivers have already been tested successfully in areas as dissimilar as Death Valley and the woods of Rock Creek Park in Washington, D.C. The Wolf Trap starts its job by breaking its nose. A fragile glass seal breaks when the trap hits the ground, uncovering a long tube through which a sample of dust is sucked into several test tubes. The test tubes each contain a culture food that will encourage bacteria to grow.

As the dust settles to the bottom of the tubes, a light-sensitive cell causes a radio signal being monitored on earth to drop in frequency. As bacteria begin to grow, the signal rises again.

The Wolf Trap, named after its inventor, Prof. Wolf Vishniac, cannot distinguish between dust and bacteria. However, if the signal rises only in certain test tubes, and if the changes take place at certain hours and at greater-than-normal rates, it probably means that bacteria are present.

All sorts of other gadgets have been designed to detect life in one way or another. Not all of these devices actually look for living organisms. Some, like the gas chromatograph, which analyzes the individual gases in the atmosphere, can only tell if the right organic compounds exist to make life as we know it possible.

Mars is important not only to extend man's knowledge of the outer planets, but to tell him about his own home, the earth. It is impossible on earth to study the organic compounds that might have given birth to life, simply because any such compounds produced today would immediately be eaten by millions of ever-present microbes.

Mars, on the other hand, may provide the unique opportunity of a planet with a history similar to earth's, but which has never passed beyond the prebiological state.

If there is life on Mars, the discovery will have a profound effect on man's view of life in the rest of the universe. Some authorities have argued that so many factors are necessary to produce life that the odds against the same combination turning up again are almost astronomical.

However, most scientists now agree that if life has evolved independently on two different planets, it is virtually inevitable that life will be found elsewhere in the universe.

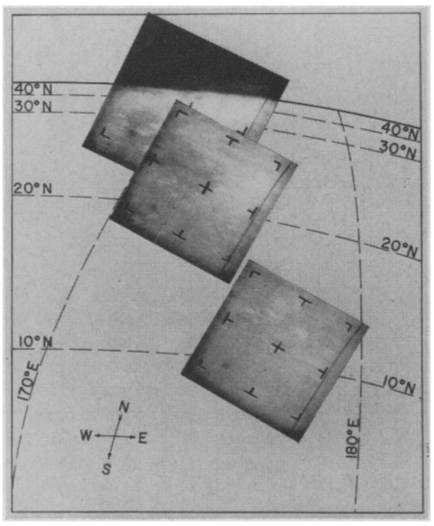
Sterile Instruments Necessary

Whether life is found on Mars or not, the planet is obviously a unique object for research. The problem of leaving the planet uncontaminated has created a new office at the National Aeronautics and Space Administration. Dr. Lawrence B. Hall holds the rather Buck Rogerish title of Special Assistant for Planetary Quarantine.

His job is to see that any and all rockets, probes and other objects arriving on Mars from earth are completely sterile. One single microorganism with a reproduction time of one month could, in only eight years, cover Mars with a bacterial population equal to that on earth. Terrestrial life has already survived and multiplied in simulated Martian environments. If it is hardy enough to survive Mars itself, one slip could ruin the planet forever for biological research.

Many delicate and critical spacecraft parts are manufactured and assembled in sterile "clean rooms" to prevent minute particles of dust from causing the downfall of a multi-million-dollar project. Clean rooms are only one of the kinds of tools needed to make sure that no microorganism sets "foot" on Mars.

NASA's first step was to find the most appropriate method of sterilization. Chemicals will not do; only heat and radiation will penetrate to the interiors of many spacecraft assemblies. Radiation is expensive, dangerous, and sometimes damaging to materials. The final solution: heat.



NASA

MARS PHOTOGRAPHED—Mosaic of the first three photographs taken by Mariner 4 shows the overlay of the photographs, the relative position of the third photograph to the other two and the Martian coordinates.

Once that has been established, a whole new class of hardware that can withstand the sterilizing process without sacrificing any reliability must be developed. Then comes the clean room stage—putting things together. Once the spacecraft is assembled, everything must be sterilized again, inside and out, in case of contamination during handling.

Perhaps the trickiest problem will be to keep the spacecraft sterile from this point, throughout testing and launch, until it reaches outer space. Some kinds of tests will have to be run in places where clean room standards are not possible. However, this should only cause surface contamination, which can easily be eliminated with gases such as ethylene oxide.

One technique now being investigated is to seal the assembled craft inside an airtight container and then sterilize it by heat right through the container's walls. Once the container-and-contents had been launched into space, the seal could be removed automatically, letting the spacecraft finish its journey alone.

But Is There Life?

Tens of billions of dollars will ultimately be spent, first searching for life on Mars, and then landing a man there. Not everyone, however, believes that the venture is worth it. Dr. Philip H. Abelson, editor of Science, the journal of the American Association for the Advancement of Science, has said that "in looking for life on Mars we could establish for ourselves

the reputation of being the greatest Simple Simons of all time."

Dr. Abelson advocated experiments on earth to further simulate the Martian atmosphere and environment. Such tests, he said, might eliminate the need for sending a landing device all the way to the planet. The wide temperature range, for example, said Dr. Abelson, is unfavorable to life as we know it. During one day the temperature can go from a comfortable 80 degrees Fahrenheit down to 60 degrees below zero.

Bacteria Survive Freezing

Some kinds of earthly bacteria, however, have survived and even multiplied during several months of being frozen for 23½ hours every day. One way Martian organisms could adapt to a radical freeze-thaw cycle would be to evolve some kind of internal antifreeze system.

Dr. Abelson argues that there appears to be no more than 0.1% oxygen in the Martian atmosphere. Other scientists, however, note that many earthly bacteria survive without any oxygen at all and that some even find it poisonous.

The first step in the let's-find-out-about-Mars program has already been taken, as indicated by this week's front cover. The photo on the cover shows the enhanced form of the first picture taken by Mariner 4 causing the features to come out more strikingly. It is approximately 12 miles across.

The fantastic Mariner 4 spacecraft crossed 325 million miles of space and sent back a whole series of photographs of the planet, taken from as close as 5,700 miles. It withstood cosmic rays, solar winds, micrometeoroids, and space dust, and collected data about most of them throughout the trip.

However, Mariner could do little to help answer the Big Question. Able to see objects no smaller than about two miles across, Mariner could not even positively identify the famous "canals" that have often been observed to criss-cross the Martian surface.

Mars Atmosphere Thin

One important fact learned by Mariner, however, and one which could have a lot to do with the presence or lack of life, is that the atmosphere of Mars is as thin as that 20 miles above the earth. In addition to reducing the possibility of highly developed life, the rarified atmosphere poses major problems to designers of Mars-landing spacecraft, which are almost certainly limited to the use of retrorockets for soft landings. If the atmosphere were more dense, winged gliders might have provided a lighter, less failure-prone solution.

Is there life on the Red Planet? No one knows. Although many scientists believe otherwise, there is still a possibility. Nothing we have learned about Mars specifically rules out the chance. If there is life, meaning that man is not alone, the consequences will be felt at every level of civilization, from science to philosophy, from family life to religion.

• Science News Letter, 88:74 July 31, 1965

CHEMISTRY

Cyclobutadiene Made

➤ AN ORGANIC COMPOUND which other chemists all over the world have been trying to make for at least 60 years has been produced for the first time by Dr. Rowland Pettit, a University of Texas professor of chemistry.

His work represents a solution to one of the classical problems of organic chemistry, according to Dr. William Shive, chairman of the university's chemistry department.

Existence of the compound, cyclobutadiene, has been considered theoretically possible since before the turn of the century and efforts to produce it have been in progress for the last 15 years in leading laboratories, especially in Germany, Britain and the United States.

Repeated failures, however, had led some outstanding chemists to believe production of cyclobutadiene was impossible.

Dr. Pettit's results were published in the Journal of the American Chemical Society, July 20, 1965.

Dr. Michael J. S. Dewar, Welch professor of chemistry at the university, said he was especially gratified by Dr. Pettit's results because they lend support to some of Dewar's own theoretical calculations. "It is important as a check on chemical theory. It gives us a better knowledge of how organic compounds behave," he said.

Cyclobutadiene belongs to a large class of compounds which chemists label aromatic, but unlike other aromatic compounds it is very unstable. Dr. Pettit started work on the problem about a year ago, using iron compounds.

Associated in the work with Dr. Pettit were George Emerson, a post-doctoral student from Austin; Lewis Watts, a graduate student from Oil City, La., and Jimmie Fitzpatrick, a graduate student from Jonesboro, La.

• Science News Letter, 88:75 July 31, 1965

PUBLIC SAFETY

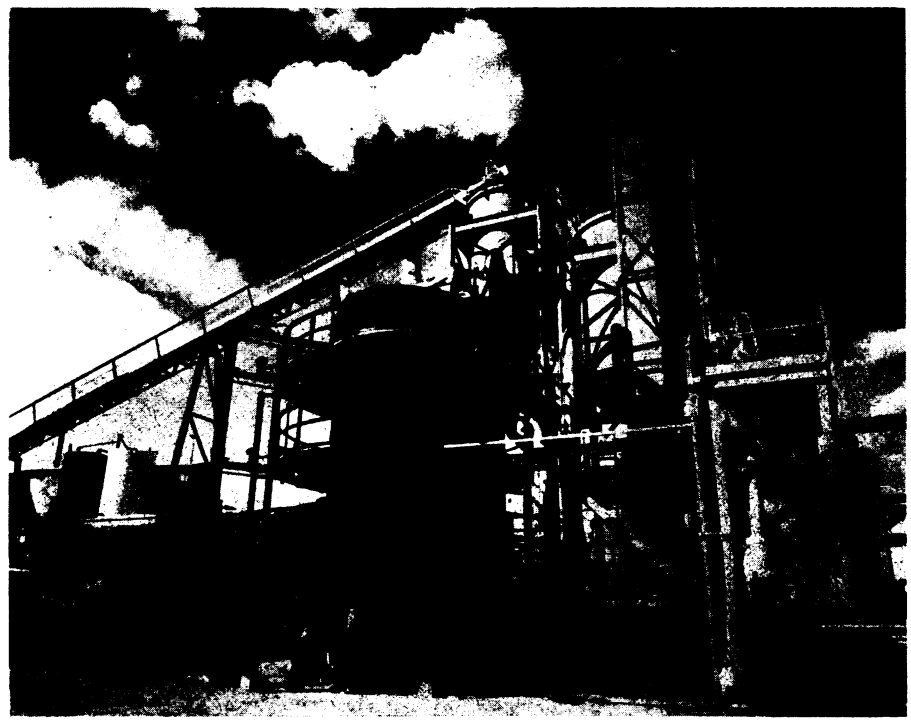
Yellow Reflecting Tape Marks Construction Area

➤ YELLOW REFLECTING TAPE is being applied on Michigan highways for temporary markings in construction areas. When applied to a clean, dry pavement, with an adhesive primer, the tape has such lasting qualities that even snow plows have failed to dislodge it.

The adhesive bond can be broken and the tape removed, leaving no confusing marks to distract the motorist, Harold H. Cooper, Michigan State Highway Department traffic division director said in Lansing, Mich.

In the past, paint was used, although it was difficult to remove when the need for temporary marking in no-passing zones ended.

• Science News Letter, 88:75 July 31, 1965



Molybdenum Corporation of America

RARE EARTH PLANT—This roaser complex at the California Rare Earths Plant of Molybdenum Corporation of America is used to roast bastnasite ore from the corporation's huge Mountains Pass Calif., mine, a step in the process for extracting the various rare earth oxides.