

surface-sampling claw has revealed from its diggings that below the top-most layer of light surface material, the rest of the lunar soil is quite dark. Dr. Shoemaker coined the term "lunar varnish" to describe the charcoal gray particles, referring to a terrestrial phenomenon called desert varnish. This is a black coating found on some rocks in hot, dry areas such as the southwestern U.S., formed by deposits of iron and manganese oxides left by evaporating rainwater. On the moon, the subsurface blackening could be minerals left by upward-moving gases—an idea which supports the increasingly popular theory that there has been volcanic activity in the moon's geologically recent past.

More evidence of lunar gas comes from close-up photos of rocks whose surfaces are covered with tiny pits that may once have been bubbles formed in molten lava. Some scientists believe that if any gas remains in such pockets today, it could give a boost to the remote possibility of living microorganisms surviving on the moon.

Everything that fell under the gaze of Surveyor 3's TV camera—including the earth, Venus, the sun and the starry skies—received a skew glance. This was due to the spacecraft's surprise landing spot: halfway up the side of a 50-foot-deep, 650-foot-diameter crater, and tilted at an angle of almost 15 degrees. Though the tilt was not planned, it made possible the spectacular photographs of the sky that otherwise would have been above Surveyor's field of view.

Most impressive of these was a series of pictures of an eclipse of the sun by the earth, a phenomenon never seen before by any being on earth. Though the earth's disk was some four times larger than that of the sun behind it, the planet's atmosphere bent the sun's rays so that they formed "beads" of light visible from the moon around the dark edge of the earth. To determine the position of the earth as Surveyor 3 saw it, the scientists looked back at photos of earth's cloud cover taken by the ESSA-3 satellite the day before. By matching the beads with the white cloud cover and even with snowy mountain peaks, the scientists were able to determine Surveyor's view exactly.

LSD Harms Cells

The blood cells of LSD users bear out the grim suspicion, first raised two months ago: "Acid" damages chromosomes.

Whether the damage is permanent, whether germ cells are affected and whether a few doses of LSD can be taken safely under medical auspices—

these questions have yet to be answered.

But two separate studies on people who have taken LSD illegally show an excessive degree of chromosomal breaks in the blood cells. Completely apart from the question of heredity, the damage offers another danger—that of disease, possibly leukemia.

Investigators in Oregon and New York have discovered in some users a chromosomal piece that looks like the Philadelphia-1 chromosome. Ph-1 is strongly linked with chronic myelogenous leukemia. It is virtually non-existent in normal people.

That LSD may damage chromosomes first came to light in March in a test-tube experiment on cell cultures. Human studies began immediately in New York, Oregon and Pennsylvania. The Oregon analysis—the only one to be completed—revealed chromosome breakage three to four times normal rate in six out of eight users—a strikingly high rate, even though the sample was small.

Dr. Samuel Irwin of the University of Oregon and Jose Egozque of the Regional Primate Center in Oregon believe that both leukemia and an autoimmune disorder are possible from the damage they have seen. An autoimmune disorder is one in which the body manufactures antibodies harmful to its own tissues.

In New York, a study of three mothers, all LSD users, and their four children is revealing similar chromosomal breakage. The results are not all in, but one of the children shows blood cell abnormalities. This does not mean the mother's germ cells were damaged, says Dr. William A. Frosch of New York University's School of Medicine. The women took LSD both before and during their pregnancy. "We are pretty sure LSD passes through the placenta," says Dr. Frosch.

A third study in progress, however, poses a different picture. Led by Dr. Charles Shagass of the Temple University Medical School in Philadelphia, the analysis is being done on people given LSD for psychotherapy. In no case did the subjects take more than three doses of the drug. "So far we haven't seen anything to get alarmed about," Dr. Shagass reports.

"If there is an LSD effect, the question will be how much can one take safely," he adds.

None of these studies, however, will answer the key question of LSD impact on germ cell chromosomes and the possibility of hereditary damage.

Germ cells are extremely difficult to study, requiring operations on women and biopsies on men. Consequently, once the blood cell work is complete, investigators will resort to studying animal reproductive cells.

But the blood evidence does strongly suggest that germ cells have been affected, says Dr. Maimon Cohen, geneticist at the State University in Buffalo, who is working with Dr. Frosch and Dr. Kurt Hirschhorn of Mt. Sinai Hospital.

Leukocytes—blood cells—generally reflect what is happening elsewhere in the body, he says.

Saturn: Four Rings

Three and a half centuries ago, the pioneer Galileo observed what he thought were two mysterious objects in space, one on each side of the planet Saturn. The mystery went unsolved for 45 years, until Christian Huygens discovered that they were in fact a pair of concentric rings around the planet. In the 19th century another ring was found, bringing the total to three: an outer one, a bright central one and a dark inner one.

Now Walter A. Feibelman of the University of Pittsburgh's physics department has found evidence indicating a fourth ring. Such a ring had been sought before, but not seriously since 1909, when the American astronomer Edward Barnard came up with seemingly conclusive negative results. There have been enough hints at its existence, however, that the elusive fourth ring has been compared to the Loch Ness Monster—some see it, some do not.

Late last year, a rare event inspired Feibelman to take up the quest anew. Every 14.78 years, the rings of Saturn can be seen edge-on from earth, and the past winter marked one of these opportunities. It was during this occurrence, in fact, that other astronomers discovered and confirmed that Saturn has a tenth moon, now named Janus because one of the definitive sightings was made on Jan. 9, feast day of the Roman god of doorways (SN: 1/14).

Reporting the detection of the fourth ring took longer because positive identification could be made only by charting how much the ring darkened a photographic plate. Although the ring can be seen visually on a photograph, as can the satellite, Feibelman wanted to be as certain as possible that the thin line was not the result of instrumental or observational problems.

Feibelman photographed the planet with the 30-inch refracting telescope at the Allegheny Observatory, University of Pittsburgh.

On any of the exposures "a very thin extension of the nearly edge-on ring system can be seen," Feibelman reported in the May 20 NATURE.

The thin ring "extends to more than twice the known ring diameter" (or a total of 340,000 miles), and is so faint

it cannot be photographed except with a large telescope. However, when two or three photographic plates are viewed in superposition, the thin line of the fourth ring can be clearly seen.

Printed reproduction of the "D" ring is extremely difficult. Feibelman therefore made tracings of the density of the photographic emulsion, and these clearly show the presence of matter in the plane of the other three rings but at a much greater distance from the planet.

Water for Peace

Of all the water on earth, about 97 percent is in the oceans; only about one ten-thousandth of the total is available to man in streams and lakes.

Of his allotted ten-thousandth, man now controls only about 6.6 percent.

Matching this available water to rapidly growing numbers of people is the underlying theme of the International Conference on Water for Peace now in its second week in Washington, D.C.

The urgency of such an effort is underscored by a report prepared by the U.S. Interdepartmental Committee on Water for Peace. Nearly two-thirds of all the people living in the developing nations of the free world—about one billion people—get their water from unsanitary sources, the report notes. Water-borne disease kills up to 10 million, mostly infants, every year.

Yet, City Planner Constantinos Doxiadis observes, man can have all the water he needs, given time and the determination to bring pure water to everyone.

The most difficult problem to be faced is population growth, he advised delegates attending the conference's first plenary session.

Nearly 5,000 delegates from 90 nations and 19 international organizations were invited to the 10-day conference.

President Johnson announced in an opening address that the U.S. would establish a Water for Peace office in the State Department to coordinate this country's approach to international water programs.

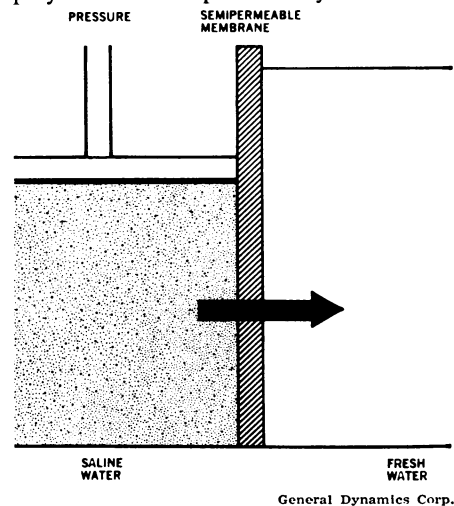
He also called for establishment of regional centers to promote research and the training of scientists and engineers. The first two centers, he suggested, should be in operation within two years.

The technology that finds, purifies and transports water was on display at the conference. Besides well-drilling equipment and pumping and treatment systems for municipal water supplies, a large number of firms displayed desalination processes.

To date, most desalination plants have been distillation units such as

the 150-million-gallon-a-day colossus to be built near Los Angeles. A bill authorizing \$57.2 million in Federal participation in its construction was signed into law by President Johnson, just in advance of the conference.

Units employing reverse osmosis, apparently one of the most promising second-generation processes, were displayed at the exposition by a number



General Dynamics Corp.
The principle of reverse osmosis.

of major U.S. corporations including Westinghouse, Aerojet-General, American-Standard, General Dynamics and Du Pont.

An experimental variation on the reverse osmosis process was unveiled by Du Pont.



Du Pont
Du Pont's hollow polymer fibers.

Normally, reverse osmosis involves pumping salt water under considerable pressure against a membrane that will pass fresh water while excluding salt.

In the Du Pont process, trade named Permasep, the plastic membrane is spun into hollow fibers thinner than human hair. A production model desalinator envisioned by the company's engineers would have 20 million fibers in a one foot diameter sealed tube seven feet long.

Water Funds Drop

All new U.S. support for the International Hydrological Decade, a major pillar of the Water for Peace program, has been dropped by the Senate in its version of the Interior Department appropriation bill.

The IHD, two years old this January 1, is a world-wide, 10-year program aimed at better development and use of the world's water resources. It was first proposed by the United States and is now sponsored by the United Nations Educational, Scientific and Cultural Organization.

The Senate cut the U.S. share in the IHD from \$2.168 million requested to last year's figure of \$168,000.

Earlier, the House had proposed to cut the requested \$2 million increase in support to \$500,000 (SN: 5/13), declaring that this is not the time for "a foreign aid program for water."

House and Senate conferees will now have to agree on the depth of the cut.

Much of the \$2 million increase was to have gone for exchange of scientists and students of hydrology with other participating nations, according to Dr. Raymond L. Nace, chairman of the U.S. National Committee for the IHD.

NSF: Same Ceiling

The National Science Foundation—the only Federal agency charged solely with the support of research—is starting to walk stoop-shouldered after three years under a low budget ceiling of around \$500 million. This year is no exception.

The House of Representatives has trimmed \$31 million from the \$526 million authorization requested by the NSF; the amount still represents a \$15 million increase over the budgets of the previous two years.

Most of the increase will go for research in four areas of science: chemistry, social sciences, atmospheric sciences and oceanography. In particular, the House Appropriations Committee made a point of seeing that \$4 million requested for the National Sea Grant Colleges program was preserved intact.

A study by the National Academy of Sciences provided one reason for boosting the NSF's appropriation: the cost of chemical research, the Academy found, has been going up at a rate of more than 15 percent a year.

The NSF requested only \$25 million this year for its University Science Development Program, part of the national Centers of Excellence plan to bring almost-great universities up to the top rank. This is a \$10 million decrease from the \$35.6 million appropriation of last year. Under this pro-