Russians land hammer and sickle on Mars

The Russians landed a capsule bearing the hammer and sickle on Mars Nov. 27, Tass announced this week. Mars 2, launched May 19 (SN: 5/29/71, p. 367) ejected the capsule bearing the U.S.S.R.'s coat-of-arms as it approached the planet and then went into an orbit of 1,380 by 25,000 kilometers at an inclination of 48 degrees. The second Russian spacecraft, Mars 3, was still 136,000 kilometers from the planet at the time.

The Russians used the telex "hot line" set up between the Jet Propulsion Laboratory of the California Institute of Technology and the Soviet Union for communications about Mars 2 and 3 and Mariner 9 to inform U.S. space officials of the landing simultaneously with the Tass announcement. No mention was made in the Tass statement of scientific instrumentation aboard the capsule, or whether it merely crashed onto the surface or soft-landed. Most U.S. space officials believe, however, that if the Mars 2 capsule merely placed the flag on the surface, then the Mars 3 capsule will contain instruments to relay data concerning the Martian atmosphere and surface back to earth.

Mars has been enveloped in a global dust storm for over two months now (SN: 11/27/71, p. 355) that has obscured most of the surface to Mariner 9 television cameras. American scientists are eager to find out how the Mars 2 capsule fared through the storm. If the predicted 300-kilometer-an-hour or more winds are still active, says one scientist, "the going could have been rough." In addition, says Carl Sagan of Cornell University, since Mars is not in a vacuum like the moon, the possibility of a lander sinking into the dust on the surface is more likely than on the moon. (The moon's vacuum causes the moon's surface to be crunchy.)

Three in-course corrections were made with Mars 2—the last one, on Nov. 27 was performed automatically by the craft. Both Soviet craft weigh 10,230 pounds compared to the 1,200-pound Mariner 9. The Russian craft will make similar scientific measurements of Mars as Mariner 9 is doing, but the craft are also equipped with instruments for "in-flight" measurements en route to Mars.

The Soviets have not announced when Mars 3 will encounter the planet. It is expected that that craft will go into a different orbit around the planet, much as had been planned for Mariners 8 and 9 (SN: 9/12/70, p. 227) until Mariner 8 failed. Mariner 9's orbit is a near-polar one of 65 degrees inclination at a distance of about 17,000 by 1,380 kilometers.

Superheavy nuclei from Orsay's Alice

A heavy-ion accelerator is a machine especially designed to accelerate atomic nuclei that have been stripped of some or all of their attendant electrons (SN: 10/16/71, p. 266). If such nuclei are struck against other heavy nuclei, they may fuse with them and form superheavy nuclei. The superheavies are particularly interesting because some of them may be relatively stable, lasting millions of years instead of fractions of a second.

The machine called Alice at the Institute of Nuclear Physics at Orsay in France was the first heavy-ion accelerator designed for energies in the hundreds of millions of electron-volts to go into operation. In the Nov. 26 NATURE a French group working with Alice reports that experiments in which heavy nuclei are bombarded with other heavy nuclei do in fact produce the predicted fusions. They further note that there is some evidence that superheavy nuclei have been produced.

They used targets of germanium, cadmium and thorium and bombarded them with krypton ions at energies of 450 million and 500 million electron-volts. As the synthesized nuclei recoiled, they were slowed down in helium gas, transferred through a capillary and deposited on a steel rod in an evacuated chamber. Alpha particles coming from radioactive decay of the nuclei on the rod were recorded.

The energy of the alpha particles together with the half-life of the emitter can be used to determine what kind of nucleus is doing the emitting. On this basis many alpha particles with energies between 7 million and 9 million electron-volts were attributed to isotopes of polonium, which the investigators say might have been produced by fission of very heavy nuclei produced in the experiments. In addition there were some alphas and energies between 13 million and 15 million electron-volts that came from emitters with half-lives between 1/1,000 second and one minute. These cannot be attributed to elements of atomic number less than 102, say the investigators, and may be taken as additional evidence for the existence of superheavy nuclei.

Whether or not this is the first evidence for superheavies remains to be judged. There is an earlier claim for a quite different experiment by a group working at the Rutherford Laboratory in England under the leadership of A. Marinov of the Hebrew University in Jerusalem (SN: 2/2/71, p. 127). Although the Orsay group includes a note acknowledging the work of the Marinov group, others have criticized it heavily. In the same issue of NATURE the Marinov group gives some ground but not all to its critics.

What the Marinov group had done was to expose tungsten targets to high-energy protons in the Proton Synchrotron at the CERN laboratory in Geneva. The idea was that a proton striking a tungsten nucleus in just the right way would make it recoil to strike and fuse with another tungsten nucleus. The element to be produced in this way would be atomic number 112 or eka-mercury. On the ground that eka-mercury behaves chemically like mercury, the samples were subject to chemical processes that separate mercury. Spontaneous fissions in the separations were attributed to eka-mercury since spontaneous fission of mercury is so rare as to be nonexistent.

The critics allege that in spite of the care taken by the Marinov group californium 252 could have contaminated the samples. In their present paper the Marinov group agree that further analysis shows that up to 70 percent of the fissions observed by them could have come from californium 252 but contend that the remaining 30 percent cannot be so explained. □

Growth hormone and fetal nutrition

Growth hormone has long been a subject of debate in endocrinology circles. Evidence from research animals has suggested that although GH is continually present in the body, it moves into action only during a select time of life—the rapid growth years of adolescence. GH has not appeared to influence fetal development. Maternal GH does not seem able to cross the placenta in significant quantities. And when the pituitary, the source of GH, was removed from either maternal or fetal animals, the fetuses continued to develop normally throughout gestation. Now, however, a University of California School of Medicine team has found that maternal GH can indeed affect the fetus, by mobilizing crucial caloric reserves in its mother.

As the Los Angeles investigators—Stephen Zamenof, Edith van Marthens and Ludmila Grauel—report in the Nov. 26 SCIENCE, restriction of the amount of calories given rats from day 10 to day 20 of pregnancy results in significant decreases in body weight, placental weight, cerebral DNA (cell number) and cerebral protein of the offspring at birth. But decreases did not usually occur if mothers on the restricted diet were treated with GH. GH had little effect on fetal development in mothers whose diets were adequate to start with. These results, the investigators comment, make sense in view of other known facts—that GH is known to enhance carbohydrate metabolism and that glucose is the nutrient most critical to the fetus.

Whether these animal experiments will offer therapeutic applications for pregnant women is too early to say. However GH is known to rise naturally in women late in pregnancy. The purpose of this increase could well be to get maternal nutritional reserves to the fetus. Thus, Zamenof says, it is quite possible that in cases of maternal malnutrition, GH injections might mobilize reserves that the fetus needs. □

Cosmic antimatter and gamma rays

One of the great mysteries of cosmology is: Where is the antimatter? According to basic laws of particle physics there should be equal numbers of particles and antiparticles, but observation shows that our region of the universe is composed overwhelmingly of matter.

Various cosmologists have proposed to explain this by separating the matter and antimatter into large regions belonging exclusively to one or the other. If this is so, then at the boundaries between regions, matter and antimatter should come together to produce a steady rate of annihilation reactions. Annihilations would produce large numbers of pi mesons, and these in turn would decay to gamma rays.

If enough of these gamma rays are being produced, evidence of it should show up in the spectrum of cosmic gamma rays received at the earth. In the Nov. 22 PHYSICAL REVIEW LETTERS F. W. Stecker, D. L. Morgan Jr. and Joseph H. Bredekamp of the Goddard Space Flight Center report the possible find of some such evidence. They have calculated the cosmic gamma-ray spectrum that annihilation would produce, and they see a possible fit between their calculated spectrum and measurements made by J. I. Vette, Duane Gruber, J. L. Matteson and L. E. Peterson in the energy range around one million electron-volts.

They make the suggestion subject to a number of conditions, however. First, annihilation is not the only contributor of cosmic gamma rays. At energies below one million electron-volts, the spectrum appears to be definitely that of a power law and thus there must be an important source not related to annihilation. Second, at energies well above one million volts, the observations are not conclusive enough to decide and several rival hypotheses have been introduced. More precise measurement here is needed.

Another condition that affects the shape of the calculated spectrum is the assumption of a particular density for intergalactic matter. Absorption and scattering of the gamma rays in interactions with an intergalactic medium of this density cause a peak in the spectrum to appear near one million electron-volts. A fourth condition is imposed by evidence that at certain high red-shifts (that is, distances) the intergalactic medium is strongly ionized. Such ionization would affect the transport of gamma rays through those regions, and changes in the spectral curve are made to account for this.

Rule of amino acids in ribosomal RNA synthesis

To molecular biologists the cell is a murky, yet intriguing underworld. The more one explores, the more there is to discover. This is certainly the case with ribosomal RNA.

About 15 years ago only one kind of RNA—messenger RNA—was thought to be present in the cell to help carry out DNA's instructions for protein production. Since then several other kinds have been identified as well. One is transfer RNA, a molecular adaptor that attaches to a free amino acid in the cell. Another is ribosomal RNA. Ribosomes are made of both RNA and protein. They serve as stepping stones across which messenger RNA moves. When messenger RNA moves along the ribosomes, transfer RNA-amino acids make contact with it. Messenger RNA then orders each amino acid into a sequence —a polypeptide, or protein chain.

The finer points of all this DNA-RNA-protein operation—how RNA itself is made from DNA, for example—are still far from understood. Some light on the synthesis of ribosomal RNA however, is shed in a report in the Nov. 24 NATURE NEW BIOLOGY by T. D. Stamato and D. E. Pettijohn of the University of Colorado Medical Center.

Using a hybridization technique they established that, although about a third of the bacterial cell RNA molecules grown in the presence of amino acids consist of ribosomal RNA, less than seven percent of the RNA molecules grown in the absence of amino acids are ribosomal. They also found that 30 or 40 seconds after restoring amino acids to the starved cells, the synthesis of ribosomal RNA is restored.

These findings, say the Denver biophysicists, suggest that the production of ribosomal RNA molecules is not frozen in the middle or toward the end but rather at the very beginning of transcription. How blockage at the beginning takes place is not known, but they offer two possible explanations. One is that RNA ribosomal transcription depends on a protein activator and in a situation where no amino acids are forthcoming, the activator deteriorates. Then when amino acids are added back to the cell, the protein activator gets working again. Or blockage might be caused by a repressor protein. Such a repressor might sit on the RNA polymerase, an enzyme involved in ribosomal RNA transcription, or occupy the place on the DNA molecule where RNA polymerase usually makes contact in order to carry out transcription. □

Arecibo resurfacing

The largest radio telescope in the world is the thousand-foot-diameter wire mesh reflector built in a natural hollow near Arecibo, Puerto Rico. Astronomers have long wanted to replace the mesh with a more solid surface capable of reflecting shorter wavelengths than now possible.

The funds were finally approved by Congress a few months ago, and last week the National Science Foundation announced that it has let a contract for $3.8 million to the Garland Division of LTV Electrosystems Inc. to replace the mesh wtih perforated aluminum sheeting. This will enable the telescope to receive wavelengths between 6 and 1,000 centimeters. The present lower limit is 50 centimeters.

The accuracy of the new surface will nowhere be allowed to deviate more than 3.2 millimeters from a perfect sphere. This will greatly increase the resolving power: 100 times for radio and 1,000 times for radar. Astronomers using the telescope expect to see 20 times more radio sources than the presently known 5,000. □