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COVER A scanning tunneling microscope image of a platinum-carbon replica of the ripple phase of dimyristoylphosphatidylcholine bilayers in water. The replicated surface can be best seen by turning the image 90° counterclockwise. Large ripples are spaced approximately 12 nanometers apart and are about 4.5 nanometers in amplitude. The image was taken by using a NanoScope II digital STM at 1 nanoampere and 20 millivolts bias. See page 1013. [J. Zasadzinski *et al.*, University of California, Santa Barbara, CA 93106]

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Soviet Science

A broad sample of the status of Soviet science was presented on 14 February at the AAAS annual meeting in Boston. Twelve presentations by Russians dealt with fields ranging from ecology and microbiology to space science and engineering research. The symposium, arranged by Yevgeni Velikhov, Vice President of the Soviet Academy of Sciences, at the invitation of Alvin Trivelpiece, Executive Officer of the AAAS, was further evidence of a thawing in U.S.S.R.–U.S. relations.

One must have reservations about judgments formed on the basis of 20-minute talks, but some impressions follow. Soviet scientists range in quality, but there are creative, dynamic, world-class individuals among them. They have been handicapped by a lack of computer capabilities and by a paucity of good instrumentation. In the past, opportunities for individual initiatives have been few. As a result, in general, Soviet science lags behind that in the United States. The lag is not great, and in space science the Russians excel at this time.

An example of where the United States leads, although not distantly, is in biotechnology. A number of U.S. companies have produced interferons alpha, beta, and gamma, interleukin-2, and tumor necrosis factor. The Russians have also made substantial quantities of these substances and have completed clinical tests on some of them. They have made human growth hormone and growth hormones that can be used in cattle, pigs, and chickens. They have changed some of the amino acids in these hormones to enhance stability. They have engaged in animal gene engineering to obtain transgenic animals, including fish. They have introduced genes into plant cells. Through gene engineering they have created superior organisms for the synthesis of amino acids and riboflavin.

For a short time with Sputnik the Russians held leadership in space, but this was followed by nearly three decades of U.S. leadership. The world center for excitement about results of planetary exploration was the Jet Propulsion Laboratory in Pasadena. But as a result of bad judgment and bad luck in the United States, excitement is shifting to the Institute for Cosmic Research (IKI), near Moscow. While the United States enjoyed the spotlight, the Russians were not idle. They compiled 14 man-years of space flight versus 5 man-years for the United States. They also developed a reliable launch vehicle for planetary exploration and used it in extensive studies of Venus. The Vega mission to Venus and Halley's comet, launched in December 1984, involved investigators from more than a dozen countries, including some from the West. American and European journalists were present at IKI when the Vega machine encountered Halley in March 1986.

The next big scheduled solar system event is the Soviet mission to Phobos, a satellite of Mars. Two Vega missions will be launched during July 1988 to conduct extensive exploration of the planetoid. Each of the Vegas will carry about 25 different experimental packages, many of them provided by Western European countries. American scientists were invited to participate and were eager to do so, but U.S. authorities did not permit U.S. hardware to be placed aboard.

One of the Vegas will fly slowly 30 to 80 meters above the surface of Phobos. It will direct an intense laser beam at the surface to vaporize some of it. The products will be analyzed by time-of-flight mass spectrometry. In another experiment an energetic ion beam from the spacecraft will strike the surface, and mass spectra of the resultant ions will be observed. By these methods, the elemental and isotopic composition of Phobos's surface will be determined. These are but two of the experimental packages.

The Russians have developed a powerful launch vehicle capable of lifting 100-ton payloads into space. They are currently planning many space missions, including extensive exploration of Mars. In their planning, they are involving a large number of countries. They have expressed eagerness to have U.S. participation, even a partnership, in a mission to obtain a sample return. The United States is preparing to launch a number of solar system missions during the next 4 years, if the shuttle is functional, but the United States should not persist in a policy of going it alone while the Soviet Union successfully promotes international cooperation in space research and compiles an impressive record of scientific achievement.—PHILIP H. ABELSON