Soviet space station is occupied again

The much-trafficked Salyut 6 space station, visited by numerous cosmonaut crews since the Soviet Union sent it into orbit in September of 1977, was boarded again last week. Cosmonauts Valery Ryumin and Leonid Popov were launched April 9 aboard their Soyuz 35 spacecraft and docked with the station the following day. Already docked at the facility's other end and awaiting the crew's arrival was the unmanned Progress 8 "freighter" capsule, which had been sent up late in March with a load of fuel and supplies to be transferred over by the cosmonauts.

Popov, a ten-year veteran of the cosmonaut program, was nonetheless making his first spaceflight. Ryumin, however, has spent more time in space than any other human being except cosmonaut Vladimir Lyakhov, together with whom he set a record of 175 days in orbit last year, virtually all of it aboard Salyut 6. The Soyuz 35 launching also makes Ryumin the only spaceman — either cosmonaut or astronaut — to take part in back-to-back space missions. The planned duration of the latest endeavor was not announced, but observers speculated that it could well include another record attempt, or at least a Soviet presence in space while the summer Olympic Games are taking place on Soviet ground.

The crew's work schedule began with a number of repair checks and inspections of Salyut 6, which had been unoccupied since last August. Plans also included medical and biological tests, earth-resources studies and other activities, presumably including some astronomical observations. □

Aluminum-senility link remade

Aluminum, one of the most abundant elements in the earth's crust, and an element not known to have any biological function, was implicated as a cause of senility in the 1970s by a team of Canadian researchers. A group of British investigators failed to confirm those findings, but now two U.S. scientists have managed to at least buttress the original results by taking a somewhat different approach.

Donald R. Crapper of the University of Toronto and his colleagues studied brain samples from eight healthy persons and from 16 senile ones. Four times as much aluminum was found in the neurons of senile brains as in the neurons of healthy brains, and the aluminum was especially prevalent in areas of the senile brains that were rich in neurofibrillary tangles. Such tangles are one of the major characteristics of senility (SN: 10/1/77, p. 219). Crapper and his colleagues, however, performed their aluminum assays with atomic absorption spectroscopy, which tends to destroy the elements it analyzes. The scientists who failed to confirm the findings of Crapper and his team were headed by J.R. McDermott of Newcastle General Hospital, Newcastle upon Tyne, England. They used the same method. But Daniel P. Perl of the University of Vermont College of Medicine in Burlington and Arnold R. Brody of the National Institute of Environmental Health Science in Research Triangle Park, N.C., decided to use a more sensitive analytical method — scanning electron microscopy in conjunction with X-ray spectrometry — to examine aluminum levels in the hippocampi of both senile and normal, aged brains. The hippocampus of the senile brain is known to be especially rich in neurofibrillary tangles.

Using this method, Perl and Brody report in the April 18 SCIENCE that they were able to detect a lot of aluminum in neurons containing neurofibrillary tangles in both senile hippocampi and in normal, aged hippocampi, but virtually no aluminum in normal neurons from either senile hippocampi or normal, aged hippocampi. While their study was not identical to that of Crapper and co-workers, Perl and Brody concluded that it does substantiate the findings of the former — that aluminum is somehow implicated in senility.

In addition to being naturally abundant in the environment, aluminum has also been introduced into our lives through various industrial products — airplanes, buses, trucks, windows, roofing, foil, cooking utensils and others. Patients with two neurological diseases other than senility have also been found to possess abnormally high levels of aluminum in their brains — those with Down's syndrome and those who have undergone long-term kidney dialysis. □

A tale of two toners

It is the best of times and the worst of times for Xerox Corp. — at least in regard to the possible existence of a carcinogen in their copy toner. It is the best of times, says company Vice President Horace Becker, because a suspected carcinogen, nitropyrene, has been virtually eliminated from Xerox copy toner, or chemical darkener. But it is the worst of times for Xerox, according to University of Texas researchers, because nitropyrene probably is not the culprit in the potential cancer hazard of long-term exposure to toners. Moreover, says the Galveston team, Xerox officials may have acted irresponsibly by not reporting toner test results "they probably have had for years."

Becker says Xerox Corp.'s involvement in the copy chemical controversy began a year ago when a Swedish researcher informed the company that carbon black — aggregates of carbon particles used in copy toner — tests "positively" in the Ames test. The test measures a chemical's mutagenicity — ability to change genetic material. A "positive" result indicates that the chemical should be further tested as a potential carcinogen.

Although "it's a long way from the Ames test to cancer," says Becker, Xerox officials engaged in a considerable "amount of detective work" to isolate the suspect chemical in carbon black. Finally, the contaminant nitropyrene was identified and company officials worked with their carbon black supplier to reduce nitropyrene to about 0.1 parts per million.

Meanwhile, Marvin Legator and colleagues at the University of Texas also were testing copy toner. The researchers' toner curiosity had been piqued when they noticed Xerox repeatedly sending toxicologists to their university's annual genetic toxicology course. So Legator and co-workers performed the Ames test on a batch of toner, and then conducted a "transformation assay," which measures whether a chemical will "transform" mouse embryo cells into a cancerous state. Legator's toner tested "positively" in both experiments.

The Texas researchers and the Xerox Corp. each presented research results at the March Environmental Mutagen Society meeting. Legator says Xerox did not publicly present any of its data until his group decided to report its findings at the mutagen society meeting. Becker counters, "We didn't wait for Texas to trigger anything; we even submitted a paper [on the toner research] to SCIENCE magazine before we heard about Legator.... We haven't shoved anything under the rug."

Interestingly, Becker says Xerox officials submitted the paper to SCIENCE on March 4; Legator says the booklet of mutagen society meeting "preprints," including an abstract on the toner research at Texas, arrived in the mail about Feb. 22. Legator guesses that a Xerox official's discovery of the Texas abstract among the meeting preprints prompted Xerox not only to speak at the meeting, but also to submit a paper to SCIENCE. "I know damn well that, given the scope of work Xerox had performed, they had this information for years and it only came to light because we decided to present our data," Legator says.

The Environmental Protection Agency is expected to release in several weeks an evaluation of Xerox Corp. actions in this toner tale, says EPA spokesman Frank Kover. Lost in the controversy, however, is the fact that Legator's team was not testing a Xerox toner. In fact, says Legator, their Texas toner supplier assured them that the substance is not contaminated with nitropyrene. Since the toner still tests positively in the Ames and transformation tests, Legator says the potential cancer

hazard of long-term exposure to toners probably is not eliminated simply by removing nitropyrene. More animal tests are needed, he says, to determine the human risk associated with long-term exposure to airborne particles of carbon black. □

Mathematics teachers urge course reform

Responding to what it terms a "crisis" in school mathematics, the National Council of Teachers of Mathematics has set forth this week at its annual meeting in Seattle, Wash., a series of policy recommendations for mathematics education in the 1980s. Shirley Hill, Council president, challenged parents, policymakers and the general public to address three major problems that contribute to the crisis:

- School mathematics is not keeping pace with the changing needs dictated by developing technologies.
- Most students are not taking as much mathematics in high school as they will need for their future careers.
- The present shortage of qualified mathematics teachers is increasing dramatically, largely due to greater professional and financial rewards in other technological careers.

"Policymakers are not confronting the deepest problems," says Hill, "because the public and its representatives have been diverted by a fixation on test scores."

The Council recommends that mathematics programs at all levels concentrate on problem-solving, not just on acquiring techniques, and that the scope of basic knowledge of mathematics be expanded to include skills essential for the future, not merely those required for present needs. "Skills are tools, and their importance rests in the needs of the times."

In such a future-directed curriculum many skills formerly considered basic become obsolete. The Council cites as one example the continuing stress in elementary classrooms on multiplication and division of large numbers, even though all current work is done on calculators and computers. Indeed, the Council urges that mathematics programs take full advantage of calculators and computers at all grade levels, and that computer literacy become part of the education of every student.

The Council also urges that three years of mathematics in grades 9 through 12 should be required of all high school graduates, and cites evidence from a survey of parents supporting this recommendation. (In many states now only one year is required.) To help bring about this change, they urge colleges to stop awarding college credit for courses covering mathematics ordinarily taught in high school. This practice, the teachers believe, encourages students to take only the minimum requirements in high school. □

Tracking the chemistry of depression

There are times when emotional depression is normal and expected: following the loss of a loved one, divorce, separation or certain other stressful life events. What concerns researchers, however, are the "pathological" depressions that — while they may be triggered by loss or misfortune — often persist regardless of outside events. Many scientists believe most such disorders involve chemical shifts in the brain. And the success (albeit variable) of various antidepressant drugs during the past two decades tends to support this biochemical view of depression, according to some experts.

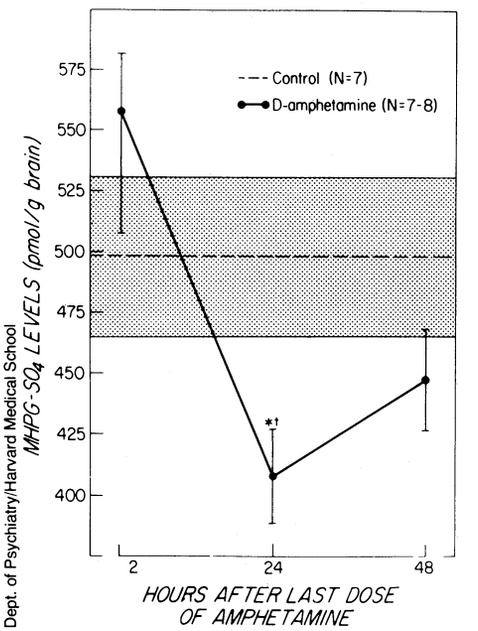
Pinning down the exact chemical mechanisms of such serious depressions is another matter. But researchers have been making steady progress toward this end, and recent studies in both animals and humans are consistently pointing toward specific neurochemical abnormalities in certain types of depressions.

Some of the latest work involving the study of behavior and brain tissue of experimental rats offers convincing support for what has been suggested in preliminary studies of humans: that manic-depressive illness, drug-induced depression and perhaps certain other forms of the disorder are accompanied by abnormally low levels of a brain chemical substance called MHPG. The results strongly indicate that the inability of a depressed individual to find pleasure in a normally rewarding experience — a job promotion, pay raise or whatever — may be related to these biochemical abnormalities in the brain.

To induce such an insensitivity to reward in rats, a Harvard University Medical School team suddenly withdrew the animals from amphetamine after administering the drug in increasing doses for several days. Amphetamine withdrawal has been shown to produce depressive symptoms in humans. But the experiment may also be valuable in "shedding some light on the pathophysiology of some naturally occurring depressions [such as] bipolar manic-depressive depressions," says Harvard psychologist Geraldine Cassens. She presented the research in Hartford, Conn., last week at the annual meeting of the Eastern Psychological Association.

During the experiment, the rats learned that by pressing a lever they could receive a pleasurable pulse of electricity through electrodes implanted in the hypothalamus area of the brain. Through a complex procedure that entailed electric current stimulation only on certain lever presses, the researchers were able to measure the animals' "reinforcement behavior" — an indication of their sensitivity to, or "enjoyment" of, the rewarding stimuli.

After their last, and highest, amphetamine dose, the rats exhibited extreme sensitivity to the electric pulses. But during the next 24 to 48 hours, each of the rats showed a "marked decrease in sensitivity" to the electric current, compared with no essential change in control rats that had been injected with salt water. The experimental rats continued to show varying levels of "depressed" behavior until most returned to normal from 96 to 144 hours after withdrawal. However, for two of the rats, it took 9 to 11 days to return to baseline levels of sensitivity to electrical stimuli. In addition, the rats during withdrawal also exhibited other symptoms such as extreme passivity and little spontaneous motor activity.



Rat brain MHPG *levels drop drastically following withdrawal from amphetamine.*

Such symptoms are similar to those observed in humans who are "crashing" following prolonged amphetamine use — as well as those with naturally occurring depressions, particularly of the manic-depressive type — according to Cassens and Joseph J. Schildkraut, professor of psychiatry at Harvard and director of the neuropsychopharmacology laboratory at the Massachusetts Mental Health Center in Boston. But Schildkraut has also found that correlating almost exactly with the intensity of depressive symptoms in certain patients is a significant drop in levels of MHPG, which is a metabolite of the brain transmitter norepinephrine. The implication of low norepinephrine (as measured through MHPG) as a cause of certain depression has still been open to some question, though, because such chemical levels cannot be measured directly in the brains of living persons; they must be measured peripherally in the person's urine or blood.

However, in the second stage of their studies with rats, Cassens, Schildkraut,

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