Comet mission hits a snag

Scarcely a month ago, the National Aeronautics and Space Administration formally asked scientists to propose experiments for a spacecraft that would sweep past Halley's comet, eject a probe toward the comet's nucleus and then head off to spend a year cruising side by side with another comet, known as Tempel 2 (SN: 11/17/79, p. 343). For the past two weeks, however, both NASA and the scientists have been in a tizzy at the prospect that the envisioned mission — in the planning stages for years — may have to be scrapped, a victim of close-cut budgets.

The key to the current problem is a special motor, called the Solar Electric Propulsion System, or SEPS, that would have to be developed for the flight. It would produce a small but continuous acceleration from a tiny amount of fuel, enabling the craft to reach high speeds and maneuver extensively without the handicap of the large, heavy propellant supply that would be required by a conventional rocket motor. Although NASA has not planned to request initial funding for the spacecraft until fiscal 1982, the SEPS would be a major new technology, requiring funding to begin with the fiscal 1981 budget that is now in the Office of Management and Budget awaiting January transmittal to Congress.

The administration's budget request contains substantial extra funding for the space agency, but it is for helping with the various problems facing the space shuttle. The OMB is said to have left those funds intact, in light of heavy administration backing related to "national security considerations" (the Defense Department is counting on the shuttle's launch services), but several other cuts were made, including the start-up money for the SEPS, about $15 million.

As a result, NASA administrator Robert Frosch met with President Jimmy Carter on or about Nov. 30 to appeal for a restoration, with results reported to have been noncommittal. A number of scientists have written to White House science advisor Frank Press, further urging administration support, but as of Dec. 11, neither NASA sources nor scientists involved with the mission's planning appeared to know which way the wind was blowing.

The space agency had originally hoped to conduct a months-long velocity-matching rendezvous with Halley, but delays due to budget limitations caused the mission to be redesigned, with Halley receiving only a quick flyby (plus the nucleus probe) and the rendezvous taking place with Tempel 2 three years later in the flight. NASA's Comet Science Working Group has called Halley "by far the best choice" for a first comet mission of the rendezvous type, since it is "the only bright comet which displays the full range of cometary phenomena and has a sufficiently predictable orbit." But in the revised mission, many scientists feel that it is the long look at the "lesser comet" rather than the quick glance at Halley that would be the more productive.

The reason is the belief that comets are among the most primitive objects in the solar system, possibly formed in the early proto-solar nebula and "preserved" at great distances from the sun until their orbits are perturbed to send them inward. Thus the composition and structure of comets may carry clues to the way in which planets and other objects formed. Almost nothing is known, for example, about how planets coalesced from the dust and gas of the nebula; a long look at a comet's nucleus, says Cornell's Joseph Veverka, head of the comet working group, might reveal the size of the intermediate "lumps" that formed it, with valuable insights into accretion mechanics. The comet could also be studied both near the sun, while it was releasing abundant gas and dust for study, and far from the sun, when the spacecraft could safely approach the more quiescent nucleus to examine it from close up.

Yet the Halley flyby is also deemed important, partly because Halley's vast output of dust and volatiles while near the sun would enable sensors to detect measurable amounts of key trace elements and molecules. In addition, says Veverka, Halley has made far fewer trips through the near-solar region than have the shorter-period comets, so it is "fresher," giving scientists a chance to study interactions of dust, gas and charged particles that may apply to objects as seemingly removed from planetary studies as interstellar clouds. The probe that the passing spacecraft would send into the nucleus would further allow the sampling not only of the ionized molecules in the comet's outer "atmosphere," but also of the closer-in "parent molecules" from which they came.

NASA's problems with the mission are more complex, however, than simply dealing with a "yes or no." The European Space Agency would be building the little Halley probe, and the current uncertainty about the nominal mission's future has prompted NASA officials to reassure ESA that even if the SEPS is delayed (by either funding or development problems), a similar program could be conducted with two separate launchings — one for the Halley flyby and probe, the other for the rendezvous. This, however, opens up worries about whether the second flight might be scuttled in a later budget. Also, even with the SEPS, NASA will still have to get the spacecraft's funding started in FY 1982. Other candidate comet missions have been proposed, but some researchers feel that those suffer variously from reduced instrument-carrying capacity, less desirable target comets, or expensive, less energy-efficient trajectories. □

Exercise works against diabetes

Exercise has long been recognized as beneficial to persons with maturity-onset diabetes, a condition characterized by decreased insulin sensitivity (decreased ability of insulin to metabolize glucose) and an abnormally low number of insulin cell receptors. An explanation for why this is the case was reported by Philip Felig of Yale University School of Medicine at a recent symposium in New York on Nutrition and the Killer Diseases and is also reported by Felig and his colleagues in the Nov. 29 NEW ENGLAND JOURNAL OF MEDICINE. According to the researchers exercise increases both insulin sensitivity *and* insulin cell receptors.

Six healthy but unathletic young men participated in the Yale researchers' study. The men were measured for insulin levels, insulin sensitivity and insulin cell receptors. They were put on a constant carbohydrate diet and subjected to cycle exercise for one hour four times a week for six weeks. At that time their insulin levels, insulin sensitivity and insulin cell receptors were again measured and compared with base-line measurements.

As the investigators report, the exercise did not increase the subjects' insulin levels, but did result in 30 percent greater insulin sensitivity and a 50 percent increase in insulin cell receptors, suggesting that the binding of insulin to the increased number of receptors probably contributed to greater insulin sensitivity.

If exercise can increase insulin sensitivity and insulin cell receptors in healthy subjects, the researchers conclude, it probably also does so in maturity-onset diabetics and explains why exercise can help correct the disorder. □

Better insulin use through chemistry

While insensitivity to insulin is the problem in maturity-onset diabetes, it is a shortage of insulin itself that characterizes the less common, but more serious, juvenile-onset disease. For more than 50 years diabetics have been treated with insulin injections, a therapy that is not completely successful in mimicking normal insulin release. When insulin is supplied through injections the amount is not regulated by blood glucose levels, so there is often not enough insulin to stimulate sufficiently the biochemical reactions that remove glucose from the blood. Inability to regulate insulin can lead to significant tissue damage, causing blindness, heart attacks, strokes and other diseases.

To make insulin release responsive to the metabolic requirements of the body,

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. . . Insulin

Rockefeller University scientists now propose a chemical approach. They have synthesized an insulin derivative that can be regulated by glucose levels. Other systems being developed elsewhere rely more on bioengineering, such as the insulin pump (SN: 3/24/79, p. 182), and on biological material, such as implantable pancreas cells (SN: 4/21/79, p. 261; 9/22/79, p. 200).

The new strategy, reported by Michael Brownlee and Anthony Cerami in the Dec. 7 SCIENCE, involves attaching a handle, a sugar group, to the insulin molecule without interfering with insulin's activity in the body. The sugar handle can be grasped by a plant protein, called a lectin, and released when there are other sugars available for the lectin to bind. Consequently, a high level of glucose would displace insulin-sugar molecules from the lectin surface. In medical applications, the amount of insulin released from the lectin to act on the body's metabolism would be proportional to the quantity of glucose in the blood.

In experiments so far Brownlee and Cerami have synthesized a stable insulin derivative containing a sugar called maltose. In animal tests the insulin-maltose compound was nearly as effective as the unmodified hormone in lowering blood glucose. The insulin-maltose binds to the plant lectin called concanavalin A and, during short exposures to glucose, the modified hormone is released in proportion to the quantity of glucose present.

A practical insulin delivery system could be developed using a solution of lectin-bound insulin-sugar in an implantable hollow fiber with appropriate permeability characteristics, Brownlee and Cerami propose. The fiber walls must have pores large enough to allow glucose and the modified insulin to pass through, but small enough to trap the larger lectin protein. It would be possible also to adjust the relationship between blood glucose level and hormone release by combining insulin derivatives containing sugar groups with different affinities for lectin. The next steps in the research will be to construct the implantable device and test its effectiveness in animals. □

Leg 69 finds seabed 'gravel pit'

Dreams of seabed burial of hazardous wastes may edge closer to reality as a result of a discovery made during Leg 69 of the Deep Sea Drilling Project.

Beneath two miles of water, 600 feet of mud and 150 ft of solid rock, Leg 69's scientific team found a highly porous rock formation that had been "perfectly sealed" from penetration and alteration by the ocean. Sealed water-tight for an estimated two million years, the porous, rubble-filled zone (like "a gravel pit," says one researcher) was found to have a pore pressure significantly less than the pressure of the overlying water. As a result, when the *Challenger* broke the seal — a layer of flinty rock called chert — the ocean rushed in to equalize the pressure. Just as the water was sucked into the low-pressure reservoir, so, the researchers propose, toxic chemicals and radioactive wastes might be pulled into similar "pits" beneath the sea floor and trapped indefinitely.

"It was extraordinary," said Marcus G. Langseth of Lamont-Doherty Geological Observatory of finding a low-pressure formation in the sea floor. Langseth and Joe Cann of the University of Newcastle-upon-Tyne, England, were co-chief scientists on Leg 69. "A hell of a thing to explain ... unbelievable," said Roger N. Anderson of Lamont. Anderson and Mark Zoback of the U.S. Geological Survey in Menlo Park, Calif., reported on the discovery at the American Geophysical Union meeting last week in San Francisco.

The find was the chance child of a project designed to compare thermal effects at two different sea floor sites. Both sites, one cooler than the other, are located near the equator between the Panama Canal and the Galapagos Islands.

At the cooler site, says Langseth, the rocky basement was rough and fractured, often protruding through the thick sediment layer. Water was able to circulate easily through the sediments and basement and cool the crust. But at the warmer site, says Langseth, the thick sediments successfully stifled any heat loss from the smooth underlying crust. The unrelieved heat began to transform the sediments into hard chert — "a self-sealing system," says Anderson. Capped by thick sediments and chert, no water was able to enter the basaltic basement rocks.

When the Leg 69 scientists drilled through the cap, they detected the flow of water from a temperature change as the cold ocean rushed into the warm basement rock. In addition, experiments manned by Anderson and Zoback measured the permeability of the rock and the rate of water flow. An inflatable rubber "tire" (SN: 10/6/79, p. 232) sealed off a portion of the hole and water was pumped in, allowing a measure of the "thirst" of the rocks. According to Anderson, 4,000 gallons of water were pumped into the rock in 40 minutes with no significant change in the pore pressure. Even after pumping, the rock continued to gulp 40 gallons per minute. (Leg 70 will check to see if the flow is continuing.) The final clue to the pit's structure came from an ultra sonic camera, a tool first used on Leg 68. A scan of the hole's interior showed a loose rubble of pillow-like lavas. In most ocean crust, this is cemented by water-precipitated minerals; in this case, the voids may provide storage space for wastes.

"The sludge from a city, for instance, could be pumped in there and the rock would continue to suck water in and hold it," says Anderson. "Instead of returning the waste, it would all be sucked down." But such projects are years in the future, he stresses. The extent and characteristics of such features must be examined, he notes. As he points out, the DSDP has previously drilled in chert but, until now, has never done experiments that would detect the downward rush of water. For now, says Anderson, what's needed is "a drilling schedule, a program to study it ... [and] help from the Department of Energy." □

Antihistamines can fight colds

Antihistamines are widely used as over-the-counter preparations against colds, but their efficacy has remained unproved; studies attempting to document their effectiveness have contained serious flaws, such as a lack of suitable controls or subjects using other drugs in addition to antihistamines. J. Campbell Howard Jr. of the Schering Corp. in Kenelworth, N.J., along with colleagues at Schering, the Milton S. Hershey Medical Center in Hershey, Pa., Georgetown University School of Medicine in Washington and the Fletcher (N.C.) Medical Center have attempted, in a clinical trial, to eliminate the flaws of previous studies and document the effectiveness of antihistamines in relieving cold symptoms. They report in the Nov. 30 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION that they have been able to do so.

The trial included 271 subjects at Hershey, Georgetown and Fletcher. They had the first symptoms of colds but no other upper respiratory disease. None of the subjects used drugs that might affect their cold symptoms other than the antihistamine being studied. Half of the subjects received a test antihistamine called chlorpheniramine maleate and half received a placebo. The investigators did not know which subjects were receiving which tablets. The subjects' cold symptoms were then measured over the next six days by both themselves and the researchers. Particular attention was paid to the symptoms that antihistamines are supposed to help — nasal congestion, sneezing and nose-blowing.

Results from the trial at all three medical centers, Howard and his team report, showed that the antihistamine was superior to the placebo in providing symptomatic relief and in lessening the duration of symptoms of the common cold. Statistically significant differences and trends favoring the antihistamine were found on the first day and as late as the seventh day. The antihistamine was observed to counter sneezing and nose-blowing and was especially effective in alleviating nasal congestion. □