Panel: NASA "weak" in materials studies

In studying the possibilities of processing materials in space, largely to take advantage of the near-weightless environment, the National Aeronautics and Space Administration has conducted dozens of experiments aboard Apollo spacecraft, Skylab and sounding rockets. Now a committee of the National Research Council's Space Applications Board has concluded in a report that the program has been "weak," that some experiments were "poorly conceived and designed," that results were sometimes "shallow, incomplete or inconclusive," and that even the critical gravity-vector measurements were "not made with the precision needed."

The experiments, which are expected to continue on the space shuttle, dealt with such areas as growing unprecedentedly large, pure semiconductor crystals; combining otherwise immiscible materials; and separating biological materials by electrophoresis.

"It is noteworthy," says the report, "that the work that gave productive results had a sound base in terrestrial research." In the committee's view, however, this was often not the case. The report cites a particular set of crystal-growth experiments, for example, that indicated the possibility of significant improvements in "doping" — the emplacement of deliberate, controlled impurities to modify a crystal's electrical properties. What was lacking, the document suggests, was sufficient preparatory information about the degree to which improved "earth-bound" processes could approach a similar result. "Unfortunately," according to the report, "industry R&D in silicon-crystal growth processes has been extremely sparse for several years, a clear indication that of the many problems in developing new and improved electronic devices, those associated with the starting material had low priority."

The committee further seems to feel, in fact, that the near-term promise of such experiments is primarily in learning about how such processes work, rather than in leading to in-orbit manufacturing techniques. "The committee has not discovered any examples of economically justifiable processes for *producing* materials in space," the report says, "and recommends that this area of materials technology not be emphasized in NASA's program."

What NASA *should* do, the committee feels, is prepare a 5-to-10-year plan for its materials-processing program, encourage strong participation from the rest of the materials-processing community and establish a standing advisory panel to coordinate the research. In addition, the agency "should enhance the credibility of [the program with the community] by establishing a single, carefully organized, centrally coordinated, publicly announced peer review system" consisting of experts in the materials-processing field (though not necessarily in space processing), who in general "should not themselves be recipients of current NASA grants." Without such administration, "there is a possibility that NASA could generate a large, self-perpetuating program ... independent of and largely isolated from the many other earth-bound programs in materials processing."

This would be the initial phase, including adequate preparatory studies conducted on the ground. "If the first phase is successful," says the report, "the shuttle should assume the character of ... a national laboratory." Experimenters would pay to fly their projects, like any shuttle customers, but national laboratory status could mean that the researchers would not have to pay all of the high pro rata cost of in-orbit operations. □

Soyuz 29 to Salyut 6

Soviet cosmonauts Vladimir Kovalenok and Aleksandr Ivanchenkov were launched June 15 aboard their Soyuz 29 spacecraft, docking about a day later with the waiting Salyut 6 space station. The previous crew to occupy the station consisted of Yuri Romanenko and Georgi Grechko, who returned to earth three months ago after a record-breaking 96 days in orbit. Some observers predict that the new crew may also attempt a long-duration mission and that they may be visited by another pair of cosmonauts (as happened during the previous occupancy), taking advantage of the Salyut's double-docking capability. The successful docking must be particularly gratifying to Kovalenok, who was prevented by technical problems from coupling Soyuz 25 with the Salyut last October and had to return to earth prematurely. □

GOES-3 launched

The GOES-3 satellite, latest in a series of geostationary weather-watchers operated by the National Oceanic and Atmospheric Administration, was launched on June 16, en route to an equatorial position over the Indian Ocean. Besides its two U.S. predecessors, it joins similar satellites launched last year for Japan and for the European Space Agency. Together, the five probes cover the full 360° of longitude, providing day and night images of the earth's weather patterns, and are equipped to read out data from numerous data-collection platforms on land, ships, balloons and aircraft. The network will also play a major role in the year-long Global Weather Experiment, a 140-nation meteorological and oceanographic project to begin in December as part of GARP, the Global Atmospheric Research Program. □

Lack of receptors, load of cholesterol

About one person out of every 500 has familial hypercholesterolemia (FH), a genetic disease that causes heart attacks. Those individuals inheriting the mutant gene from only one parent (heterozygotes) typically suffer a heart attack as early as 35 to 40 years old. The one person in a million that inherits a mutant gene from both parents (homozygote) usually has a heart attack before the age of 15. In this disease the levels of a cholesterol-containing molecule in the blood, known as low-density lipoprotein (LDL), are sky-high, and so-called scavenger cells, laden with cholesterol, settle in all the organs of the body — including the arteries.

During the past five years, Joseph L. Goldstein and Michael S. Brown of the University of Texas Health Science Center in Dallas have mapped out the pathogenesis of the disease. Goldstein, reporting their findings at the recent meeting in Miami of the Endocrine Society, said that the cardinal characteristics of FH apparently result from a genetic defect in a cell surface receptor for plasma LDL. This research is particularly important because FH can serve as a prototype for a whole class of disease that results from defects in receptor molecules. Other regulatory proteins, such as polypeptide hormones and plasma transport proteins, also have cell surface receptors that can be defective.

Using three different model systems and building on the work of others, the researchers pieced together the following story. Needing cholesterol for their plasma membranes, cells can either make it themselves or glean it from the LDL in the blood. They prefer to get it from the LDL. Cells snare the passing LDL in coated pits on their cell surfaces. These pits are enriched for receptors. Even though the coated pits contain only two percent of the surface of the human fibroblast, they contain 50 to 80 percent of the LDL receptors. The receptors in these pits couple with the LDL molecules and the pits pinch off into the cytoplasm and deliver the LDL molecules to lysosomes where enzymes can free the cholesterol. The cholesterol is then used in plasma membrane synthesis.

In FH, Goldstein and Brown found that cells of FH homozygotes don't have LDL receptors, while those of FH heterozygotes have a reduced number. This explains why the disease is worse in homozygotes. Because it can't enter the cells, LDL backs up in the bloodstream. Moreover, perhaps because the liver cells are not receiving feedback, they start producing more LDL and the plasma levels skyrocket. Only the scavenger cells can take up LDL. As LDL plasma levels increase, these cells take up progressively more and more until they are completely lipid-laden, and clog the arteries. □