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COVER: Six research ships, scores of scientists and hundreds of instruments are now engaged in the Mid-Ocean Dynamics Experiment, a study of undersea eddies, "the weather systems of the deep sea." Here one of the ships deploys subsurface mooring along length of 5,000 meters to be anchored at depth of 500 meters. Instruments measure undersea currents and temperatures. See p. 376. (Photo: NSF)

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June 9, 1973

Promising tests for cancer

Protein assays offer an early diagnosis of cancer, but some problems have to be solved.

During the past decade, cancer researchers have found that a protein normally present in the fetus may pop up in children or adults with cancer. They named it the carcinoembryonic antigen (CEA). At first they thought the protein was specific for persons with cancer of the colon. Then they found that persons with other kinds of cancer can have CEA as well. Then they found that healthy persons have the protein too.

The most recent discovery, reported last week, is that persons with cancer have CEA in larger amounts than persons without cancer.

Specifically, the researchers have found that if CEA is present in the blood of a person above a specified amount, he or she very likely has cancer. If the protein recedes in the blood of a person being treated for cancer, the recession is a good sign that treatment is working. And if the protein increases in the blood during treatment, that is a sign that treatment is probably not working.

In brief, CEA is opening some valuable possibilities for the early diagnosis of cancer and for gauging the success of cancer therapy.

A number of institutions in the United States and other countries are coming up with these findings. One is Hoffmann-LaRoche in New Jersey. Jack Snyder of Roche reported some of the particulars of CEA testing last week at an international symposium on immunology and cancer. The symposium, held at the Johns Hopkins Medical Institutions, was sponsored by Miles Laboratories.

Having obtained clinical testing approval from the Food and Drug Administration, Roche ran 35,000 CEA assays on 10,000 persons. Some of the individuals were known to have cancer. Some were suspected of having cancer. Still others were thought not to have cancer. CEA was found in the blood of most, but not all, of the subjects. What was significant was the amount.

If a person had 2.5 to 5 nanograms of CEA per milliliter of blood, he or she possibly had cancer. If a person had 10 to 20 ng/ml of CEA, he or she most

likely had cancer. Ninety-seven percent of all persons with 20 ng/ml or more of CEA had cancer.

"CEA assays," Snyder reported, "also usually indicated what was happening during the course of therapy." If chemical, surgical or radiation therapy was working, the CEA in a patient's blood dropped. If therapy was not working, CEA in a patient's blood rose. For example, CEA increased in the blood of one patient several months after treatment began. Sure enough, she had a relapse.

Before the value of CEA as a diagnostic tool is assured and before CEA assays become standard procedure, however, some questions have to be answered. For example, is CEA specific for certain kinds of cancers but not for others? The persons Roche diagnosed for cancer turned out to have an assortment of cancers. But CEA molecules might be the products of specific kinds of cancers. Researchers are using immunological techniques to determine such specificity.

CEA tests also raise an ethical question. What is the point of diagnosing cancer early if patients cannot be treated early? Many of the patients indicated by the tests to have cancer did not develop tumors or other symptoms until months later. By the time a clinician knew exactly what kinds of cancer they had, it was often too late to treat them effectively. Only when CEA assays are linked with specific cancers, Snyder says, will early diagnosis make early treatment possible.

Then there is the question of how other fetal proteins might fit in with the diagnosis of cancer. Several other fetal proteins, notably the alpha fetoprotein (AFP), have also been found in large amounts in the blood and tissues of patients with cancer. Usually AFP is present in adults in amounts one million times less than those found in the fetus.

Patients throughout the world with cancer of the liver have been found to have 44 nanograms or more of AFP per milliliter of blood, Thomas Waldmann of the National Cancer Institute reported at the symposium. "It is clear," Waldmann declares, "that most but not

all cancers of the liver are associated with AFP."

Waldmann and his colleagues have also found that 80 percent of 79 patients with cancer of the testicles had 40 ng/ml of AFP. Patients with cancer of the lungs, pancreas or other organs also had elevated AFP levels, but not as much as patients with testicular tumors. Healthy adults usually had no more than 1 to 14 ng/ml of

AFP. But pregnant women, patients with cirrhosis of the liver and children with a particular autoimmune disease also had large amounts of AFP (above 50 ng/ml).

So AFP assays do not appear to offer as exacting a diagnosis of cancer as do CEA assays.

Still, Waldmann says, AFP assays are quite effective in estimating the success of cancer therapy. If a patient is suc-

cessfully treated for cancer, AFP levels in the blood decrease. Every patient found to have elevated AFP levels during treatment has experienced a resurgence of cancer.

The AFP assay, like the CEA assay, must be pinned to specific cancers, Snyder asserts. Then the assays might complement rather than oppose each other in the early diagnosis and treatment of cancer. □

Skylab's research program curtailed but continuing

As the frustrated, overheated crew of the Skylab orbiting workshop labored through their second week in space, the path to their two goals—salvage and science—began to sort itself out.

Despite a busy schedule of observations of the earth, sun and stars, most of the efforts of astronauts Charles Conrad, Paul Weitz and Joseph Kerwin were focused on a two-man spacewalk, finally scheduled for late this week, aimed at freeing the jammed solar panel that had crippled the mission from its beginning.

For several days, earthbound mission controllers in Houston considered extending the astronaut's stay an extra 10 days, which would carry them into a period when the space station would be in almost continuous sunlight. This would provide as much as 3,000 watts of additional power from Skylab's solar cells even if the jammed panel were not freed, as well as allowing extra time for photography and other experiments that have been shortened or postponed because of the reduced power available. But on Tuesday, following a study of risks, mission delays and other factors, program director William Schneider announced that "the review has resulted in the conclusion that there is no justification for any extension of the mission at this time."

As planning proceeded for the freeing of the stuck solar panel wing, there were at least heartening signs that the panel would work if it could be opened. Even in its mostly closed position, the panel was providing about 80 watts of power, proof that its connections were still intact. It was even being used to "trickle-charge" the batteries in the laboratory's spacecraft docking adapter. The adapter houses many of Skylab's scientific experiments, including the elaborate array of cameras and other scanners in the

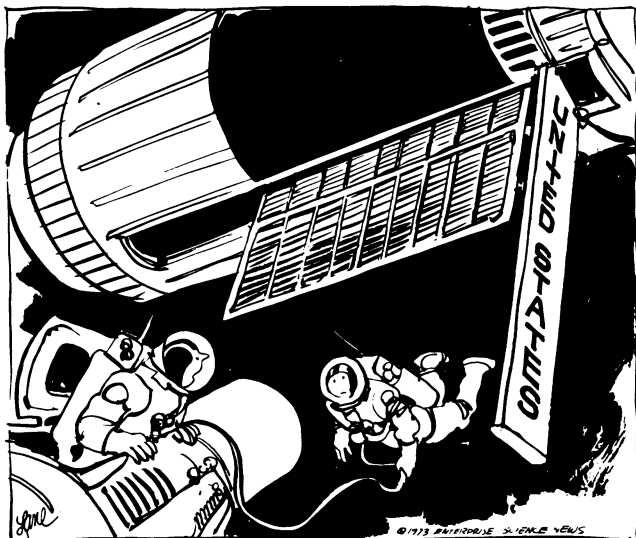
complex Earth Resources Experiment Package (EREP).

EREP is a much more sophisticated version of the system aboard the Earth Resources Technology Satellite (SN: 3/31/73, p. 214), which has already recorded numerous examples of pollution sources, geological structures, crop conditions and other features. Several apparent problems showed up with the EREP cameras, but have largely been traced to "glitches" in malfunction detectors and computers.

EREP has been one of the experiments hardest hit by Skylab's reduced power. Photographic passes that were to have taken in as much as 120 degrees of the earth's surface have been held to barely 40. An 11-minute scan of a swath from San Francisco to the Gulf of Mexico was all that remained of an originally scheduled 30 minutes. One 12-minute pass from the midwestern United States to the Virgin Islands was to have been almost three times that length. A scanning run of the sun with Skylab's solar telescope was shortened by some 50 percent because of the need to run the telescope at half speed.

Even so, Skylab has photographed earthquake fault zones in California, volcanoes in Mexico, strip-mining damage in the Ohio Valley, wetlands on the Georgia coast and urban sprawl in Atlanta. The Apollo telescope mount, whose four-winged solar array is open and working, has been providing four or five photo passes of the sun and sky a day.

Meanwhile, the astronauts rehearsed the tricky double spacewalk to free the guilty solar panel. On the weekend, officials had been allotting a full 10-hour workday for the actual freeing operation, but as procedures were refined, estimates of the necessary time dropped to as little as four hours or less.



ESN

"Houston control says try kicking it."



NASA

Skylab solar telescope photographed the sun's corona.