

the University of California and Ein Shams University in Cairo. They have been using cosmic rays in an attempt to find chambers within the bulk of the Second Pyramid. One of the group, Luis W. Alvarez of the University of California at Berkeley, reported at last week's meeting of the American Physical Society that the result is negative. "I am convinced there are no chambers in this pyramid," he says, "and I'm surprised."

The search and the surprise both arise from experience with the nearby Great Pyramid. Once upon a time, in the tenth century of our era, there was a caliph of Cairo, Mamoon by name, who needed cash. Knowing that the ancient tombs were often full of it, he commenced driving a tunnel through the bulk of the Great Pyramid starting in the middle of the north face. He intended to drive right through to the middle of the south face, thinking that an architect with a sense of proportion would have put the burial chambers in the middle of the bulk. Had Mamoon continued as planned, he would have missed the burial chambers of Cheops entirely. The ancient Egyptians, wily as always where grave robbers are concerned, had put the chambers 26 feet to the east of the center line of the pyramid. An accidentally dislodged stone caused Mamoon's sappers to alter their direction and discover the Cheops chambers.

Under the Chephren pyramid is a chamber that has been known for a long time. Archaeologists hope it is a decoy, an empty chamber set up to fool thieves into thinking the tomb had

already been looted. In this known chamber equipment was placed to measure the cosmic rays that come through the pyramid. The idea was that if there were chambers in the bulk, more cosmic rays would get through in the directions where the chambers lay because there would be less material to absorb the rays.

Alvarez says he does not quite understand why there are no chambers in the Second Pyramid, but the archaeologists in the group have an explanation. As presented by one of them, the late Ahmed Fakry, it goes like this: The pyramid builders were engaged in experiment. In Cheops' pyramid they put chambers, but by the time they got to Chephren's, they had decided they didn't want chambers in the bulk of the pyramid.

The search for Chephren's grave is not over, however. Soon a team from the Stanford Research Institute will go to Egypt to use short-wave, short-range radar that can penetrate limestone to look for chambers under the known one. The radar will also look up because there is one outside chance of a chamber that escaped the cosmic-ray search, a room full of just enough gold to absorb just enough cosmic rays to look like solid limestone. If there is such a golden chamber it will give a banging big signal on the radar because gold is a good electrical conductor.

Meanwhile the swirling sands of the desert still conceal the secret the ancient priests intended them to keep. Will modern technology finally foil the intentions of these early morticians? We shall have to wait and see. □

Chemistry: Looking at the solution

Chemists go busily about their work producing, observing and trying to understand complicated chemical reactions. Many of these reactions, and some of the most important take place in solution. The basic processes of life, for instance, are the result of chemical reactions that take place in solution in cells. In many cases such reactions have been investigated as if nothing were involved except the reacting molecules. The solvent or solution in which the reaction takes place has been largely ignored.

Recent work suggests that the influence of solvents on reactions is much more important than has been previously realized. Some of the evidence for this conclusion comes from work done by John Brauman of Stanford University who used a technique developed by a colleague, John Baldeschwieler. The technique, called ion cyclotron resonance (ICR), works on

the same principle as cyclotrons used in physics. It allows chemists to record which ions or charged particles are or are not taking part in a reaction.

The Stanford researchers used the ICR method to study the relative acidity of various molecules. "The results have astounded chemists," says a summary in the newly issued annual report of the National Science Foundation, which has supported the research.

Strong acids transfer a hydrogen ion to weaker acids. This transfer can be detected by ICR and a scale of the relative acidities of molecules can be built up. Surprisingly, the experiments showed that the methyl alcohol, toluene and propylene are all stronger acids than water. In solution, water appears to be 100 times stronger an acid than the alcohols. Toluene and propylene show almost no tendency to act as acids in solution.

If the ICR findings are correct about

the true acidity of these molecules, then it is the solution that is responsible for the observed acidity or lack of it. Or as the NSF report puts it, "the only remaining explanation was that the interactions between reacting molecules and solvents were so important that they could completely control the chemistry observed."

In 1935 Michael Polanyi theorized that the energy of certain reactions should be that needed to remove solvent molecules from between reactants so that they could get together. The ICR work of Brauman and Baldeschwieler, for which they have received the American Chemical Society's Award in Pure Chemistry, seems to confirm this as does other recent work. "The studies," says NSF, "should help bring order out of many phenomena that have been difficult to understand, as well as turn up new surprises." □

Hormone switch: Clinical promise

A year and a half ago, Paul Brazeau and his colleagues at the Salk Institute in California reported that they had isolated, characterized and synthesized a substance from the hypothalamic region of the brain that switches off growth hormone. The factor was dubbed "somatostatin." They hoped that somatostatin might prove useful in treating patients with acromegaly, an abnormal enlargement of the face, hands and feet caused by an oversecretion of growth hormone. Tissue experiments with somatostatin indicated that it might (SN: 1/13/73, p. 26).

Now five acromegaly patients have been treated with somatostatin. It almost completely wiped out the production of growth hormone in their bodies. Samuel S. C. Yen and his colleagues at the University of California at San Diego School of Medicine report their findings in the April 25 *NEW ENGLAND JOURNAL OF MEDICINE*. Unfortunately, though, somatostatin's impact on growth hormone was brief. For this and other reasons endocrinologists are not sure that somatostatin is the answer to the treatment of acromegaly.

Still, Yen and his colleagues did find some unexpected effects of somatostatin on the patients. Aside from turning off growth hormone, which is secreted by the pituitary gland of the brain, it also turned off three other hormones: glucagon, insulin and prolactin. Prolactin is released by the pituitary, but glucagon and insulin are made by the pancreas. So somatostatin's "multitude of action at the level of the pituitary (possibly pancreas and peripheral tissue as well)

is vastly more complex than anticipated," Yen and his team conclude.

So even if somatostatin is not helpful in treating acromegaly, it may prove beneficial in treating patients with tumors dependent on growth hormone or prolactin. Or somatostatin may be beneficial in treating patients with diabetes, especially with juvenile diabetes. Abnormal elevation of growth hormone and glucagon has been shown to characterize juvenile diabetes. "Such beneficial effects should be ascertained or disproved in a relatively short time—say in a couple of years—in a great number of patients," Brazeau and Roger Guillemin, also of the Salk Institute, declare in an editorial in the same issue of the *NEW ENGLAND JOURNAL*. □

DOD to act on defoliation critique

A report on the extent of herbicide damage in Vietnam given to Congress in March by a committee of the National Academy of Sciences said herbicides caused "extensive and serious" damage to South Vietnam's inland forests and destroyed 36 percent of the mangrove forests in the Mekong Delta region. It found "no conclusive evidence" that herbicides caused birth defects and death among humans (SN: 3/16/74, p. 174), though this finding has provoked considerable controversy.

Now the Defense Department (the principal opponent within the Administration to a herbicide ban) will convene a committee next month to study what steps need to be taken to aid the damaged ecology. The formation of this committee is the first direct Government response to the NAS report.

Among the NAS committee's recommendations were that the U.S. provide financial support to a "Vietnamese effort to cope with the consequences of herbicide use." The committee said a massive restoration program could restore the mangrove forests within approximately 20 years. Otherwise, it could take the forests "well over 100 years" to recover.

The committee concluded that a systematic sampling program should be undertaken to determine whether dioxin—one of the defoliant widely used in South Vietnam—has entered the Vietnamese food chain. There have been preliminary findings of dioxin in shellfish. It also recommended that a prompt evaluation of hospital data be made to determine if there is any relationship between herbicides and birth defects, and that reports of death and illness among Montagnard children be further investigated. □

Electromagnetism and bone repair

During the past decade, scientists have learned that electrical stimulation can enhance bone repair or even induce the partial regeneration of amputated limbs (SN: 11/13/71, p. 322; 3/18/72, p. 184). They got to the point, however, where they could not justify using electricity to speed the repair of routine fractures because the technique involved putting electrodes through skin and next to bone.

So some of the pioneers in the field—C. Andrew L. Bassett, Robert J. Pawluk and Arthur A. Pilla of Columbia College of Physicians and Surgeons—decided to search for a means of manipulating the electrical environment so that surgery would not be required, that is, so an electric field could be applied outside the skin, yet still affect bone. They now believe that they've found it—pulsing electromagnetic fields of low frequency and strength. They report their findings in the May 3 *SCIENCE*.

Two legs on each of 43 dogs were broken. A pulsing electromagnetic field produced by rectangular coils was set up across one broken leg of each dog. The other broken leg of each dog served as a control. The electromagnetic fields were applied to the fractures for 28 days. Then the healing progress of all the fractured legs was examined. The orthopedic researchers found that the breaks exposed to the electromagnetic fields had healed better than the breaks not exposed.

"This study," they say, "demonstrates for the first time, to our knowledge, that low-frequency, low-intensity, external pulsing electromagnetic fields can be inductively coupled to a tissue to achieve an increase in the tempo of a repair response."

In addition to their animal work, they have tried the technique on six patients with bone fractures and will soon try it on four more patients with fractures. Here too the technique looks promising. "We would hope," Bassett told *SCIENCE NEWS*, "that if this thing can be carried along to its ultimate conclusion, that it would provide a rather simple method for the average physician who has to treat a fracture to do so with a simple plaster cast and just incorporate the proper equipment in the cast. It is something that patients don't have to come into the hospital to get done and have all the expenses of hospitalization or the hazards of the operation or anything else."

Bassett says they have not noted any adverse effects from using electromagnetic fields for a month on dog tissues. The dogs' untraumatized soft tissues and bone exposed to the fields appear

entirely normal. So he anticipates that if patients are exposed to an electromagnetic field for two or three months, they would probably not experience harmful effects. "I don't think anyone knows what long-term exposure might do," Bassett admits.

Although Bassett and his colleagues are enthusiastic about using electromagnetic fields to enhance bone healing, they also believe that the fields can be used to control a variety of biological processes. They have evidence, for example, that electromagnetic fields can increase nerve regeneration. □

Vinyl chloride pesticides banned

The Environmental Protection Agency last week suspended further sales of all pesticide aerosols containing vinyl chloride for use in the home, food handling establishments, hospitals and other enclosed areas. It requested immediate recall of these products from retail shelves. Some 28 products are known to be affected by the decision. In addition, Russell E. Train, EPA administrator, has asked for prompt Congressional action on the pending Toxic Substance Control Act that would make it possible to identify potentially dangerous chemicals such as vinyl chloride before they are marketed to the general public.

Vinyl chloride is a gaseous chemical strongly suspected to be the cause of a rare form of liver cancer known as angiosarcoma that has been diagnosed in 12 industrial workers engaged in the conversion of vinyl chloride to the plastic polyvinyl chloride. The cancer has also been found in test animals exposed to the chemical.

"I am seeking the immediate nationwide cessation of the sale of these pesticides and the recall of existing stocks," Train said. "While the public health implications to vinyl chloride from short pesticides bursts are undetermined, the link between the gas and the cancer is suspected strongly enough to make it prudent policy to ban further use of these products."

All manufacturers and distributors of these pesticides, including some outdoor products not affected by the suspension, have indicated a willingness to recall their products. "This is commendable but the time involved in ensuring voluntary compliance would delay achieving the most rapid possible removal of these pesticides from the marketplace," Train said. □