as did fresh, unfrozen organs. Further work with Yoko Mullen, William Clark and Josiah Brown showed that when the thawed pancreases were transplanted into adult rats, they produced insulin and were able to reverse experimentally induced diabetes. Injecting pancreas cells into human patients has already met with some success in treating diabetes (SN: 9/4/76, p. 150).

The most important factor in freezing pancreases, the researchers say, is the slow rate of cooling. Maximum survival of organs occurred when the temperature had been decreased 0.28° per minute, taking more than four hours for the specimens to reach −78°C.

"The best cooling rates to study cell structure may be rapid," Mazur says. "But organ survival is better with slow freezing. The cells dehydrate as they freeze and ice doesn't form inside them. So there is no danger of damage during thawing."

Mazur and co-workers also found that survival of the pancreases required a high concentration of a protective additive, dimethylsulfoxide. As water in a cell freezes, the ions normally present concentrate in the smaller and smaller amount of liquid. High concentrations of salt damage cells, so dimethylsulfoxide may work because it dilutes the ions during freezing.

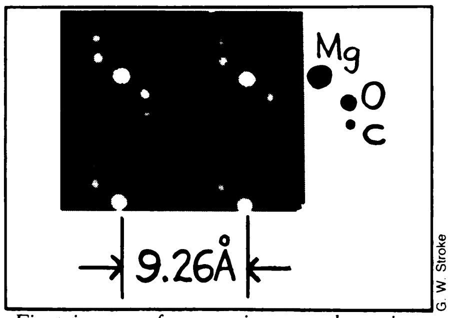
The researchers hope their techniques will lead to future organ banks, storing thousands of genetically classified specimens of essential organs, similar to the banks of frozen blood already common in hospitals around the world. □

Seeing atoms in a crystal

Little by little the once invisible atom is becoming visible—or at least capable of being imaged more or less photographically, generally by highly sophisticated techniques. The latest of such techniques can make images of atoms in a cross section of a crystal. It was developed at the State University of New York at Stony Brook by a group led by George W. Stroke and including M. Halioua, V. Srinivasan and R. Sarma. According to an announcement by the National Science Foundation, the new technique is considered "a major advance in the field of crystallography."

The method combines the oldest probe of crystal structure, X-rays, with optical computation and holography, to produce an image of the locations and relative sizes of the atoms in a crystal. The X-rays yield information in digital form about the locations and sizes of the atoms. This is turned into a visible image by a computer that processes the data and then "writes" a hologram based on the information obtained by the X-rays. This computer-processed hologram can then be treated like an ordinary photographic hologram. Illuminated by laser light of the proper frequency, it will produce the sort of three-dimensional image that holograms are famous for, and the image represents the location of the atoms in the crystal. The NSF says the new method could replace the older method of determining atomic locations by making maps of the electron density in crystals.

One of the first examples is the enlarged image of a magnesium bromide tetrahydrofuran complex. The magnesium atoms show up largest. The smaller pairs on either side of each magnesium are oxygen atoms, and the two smallest and outermost images are carbon. Two full unit cells of the crystal and parts of two others are shown. The actual space between two magnesiums in the crystal is 9.26 angstroms.



First image of atoms in crystal section.

Possible applications of the new method cover the whole range of crystallography, from geology and materials sciences to medicine and molecular biology. Stroke places particular emphasis on the biological aspects of crystallography, saying that the method "provides the scientist with a new tool to help unlock the mysteries of chemical and biological functions of molecules, for example, the functions of antibiotics and the body's natural immunological defenses." □

Seafarer: Cautious approval by NAS

When the Navy announced that it wanted to build the world's largest radio antenna—covering thousands of square miles with a grid of buried cable—environmentalists and others complained that electric and magnetic radiation from the huge project might harm people or animals in the area. After six years of preliminary work and more than 40 separate studies, the issue is still in doubt. Now a committee of the National Academy of Sciences has added its weight to the argument that biological or ecological damage should be minimal.

Called project Seafarer (in an earlier incarnation known as Sanguine), the antenna is designed to improve communication with submarines, which must now slow down and come close to the surface to receive messages. The fear is that within a few years such action would expose them to unacceptable risk of detection, as enemy tracking technology becomes more sophisticated.

Radio signals of much longer wavelengths than those now used would permit contact with a submarine hundreds of feet below the surface, going full speed. But these low frequency waves must be broadcast by proportionally larger antennas.

Three sites are now under consideration for Seafarer: Nevada, New Mexico and the peninsula of northern Michigan. Taking the Michigan proposal as an example, one can begin to comprehend the size of the effort. A cross-hatched grid of two-inch cables, each 30 to 80 miles long, and spaced three to five miles apart, would be spread out across parts of seven counties. A total of 2,400 miles of cable would be required in Michigan and an even larger amount at one of the western sites. Depending on which one site is finally chosen, the entire system would cover between 3,000 and 4,000 square miles.

Those concerned with possible environmental effects of the project cite recent studies that indicate many animals rely on electromagnetic fields for their livelihood. Some birds apparently use the earth's magnetic field as an aid to navigation and some species of fish use weak electric fields to detect and capture prey.

Along most of the cables, the ground-level radiation would be quite small—an electric field only one-third as large as that near an electric light bulb and a magnetic field intensity less than that of the earth's in the region. Near the ground terminals, however, the electric field might be large enough to produce biological effects.

In its preliminary statement based on the study of this data, the NAS committee concludes that "the evidence evaluated so far indicates that at Seafarer frequencies such weak-field effects should not be cause for concern." It did recommend, however, that "additional study of available options with respect to ground terminal design specifications" be considered. A final NAS report will follow later, and the Navy's own environmental impact statement is expected in a few months.

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Another possible application of long-wavelength radio for military communications is also under consideration, but is not being so openly discussed. The scheme would involve a vertical antenna hanging in a roughly 10-kilometer-deep hole. This would set up waves that would be transmitted inside the earth, rather than bouncing off the ionosphere. In principle, rock layers of the earth's crust should act as a waveguide to conduct such waves and they would be practically impossible to jam. Details on how far plans for such a project have gone remain classified. □