Conflict over underground nuclear tests

Detecting theirs . . .

Earlier this year, a dispute arose between the Department of Defense's Advanced Research Projects Agency and several nongovernmental scientists over the results of a conference on seismic detection of nuclear tests held last year at Woods Hole, Mass., (SN: 7/10/71, p. 22). Some of the conferees said earthquakes could be distinguished from explosions down to magnitude 4.0 on the Richter scale; ARPA said only that such discriminations could be made "below 4.5."

The question is vital to negotiation of an underground test ban treaty, which could be enforced in a way agreeable to all parties if violations could be detected and identified from seismic signals.

Last week at hearings before a subcommittee of Congress' Joint Committee on Atomic Energy, ARPA and other Government scientists seemed to modify their stance on the discrimination threshold, but emphasized other problems in identifying clandestine tests.

ARPA director Stephen J. Lukasik testified that, in principle, seismic discrimination down to magnitude 4.0 appears feasible. Most of the scientists testifying agreed with this number.

A nation wishing to cheat on a test ban, says Fred Holzer of the Lawrence Livermore Laboratory, can disguise its illicit activity. The properties of the rock in which the device is exploded affect the strength of the seismic waves. While an explosion of one or two kilotons in hard rock produces a seismic signal of magnitude 4.0, the same magnitude would result from a much larger explosion (15 to 20 kilotons) in dry, porous material. Devices up to 50 kilotons detonated in underground cavities may produce a signal of only 3.5.

Another evasion technique is to imitate a natural seismic signal, which is of longer duration and greater complexity than that of an explosion, by detonating a number of explosions in sequence. A fourth technique is to hide the explosion in a large natural earthquake.

In effect, Holzer, Lukasik and several other witnesses said that the ability to discriminate betweeen earthquakes and explosions down to magnitude 4.0 is negated by the ability of other nations to disguise their tests.

There is some disagreement on the effectiveness of evasion techniques. A country might wait a long time for a natural earthquake of sufficient magnitude to occur in the right place to hide a test. Barry Block and James Brune of the University of California at San Diego pointed out that testimony on the effectiveness of muffling an explosion in an underground cavity was based on only one very small (380 tons) explosion. From that one test, which Block says produced results differing by a magnitude of two from those predicted, Lukasik extrapolated to tests of up to 50 kilotons. This, says Block, is "unbelievable extrapolation."

But Sen. John Pastore (D-R.I.), wonders if the scientists are quibbling in an area where the distinction between 4.0 and 4.5 wouldn't make much difference. The question, he says, is at what point does it no longer matter if we can't detect an illegal test. "If it's a small enough shot, we can't even identify it with on-site inspection. At some point there ought to be a level of sanity in all of this madness."

. . . conducting our own

Sometime this week, the Atomic Energy Commission intended to detonate a five-megaton nuclear warhead under the Aleutian island of Amchitka. For a while, it appeared that the test, called Cannikin, might be canceled, but last week, President Nixon gave the AEC permission to proceed.

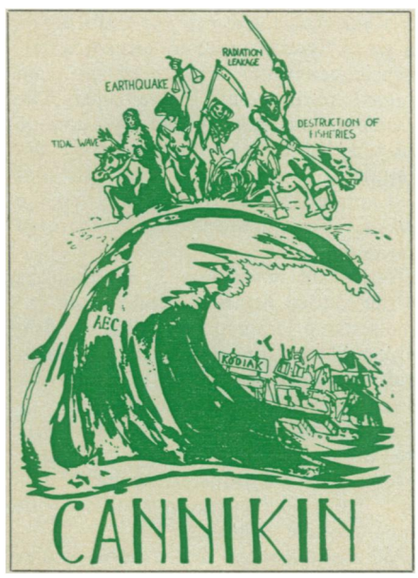
In his statement announcing the go-ahead, AEC Chairman James R. Schlesinger remarked that "some objections have been raised on environmental grounds." This was an understatement. Japan and Canada had protested vigorously, and Canadian Foreign Minister Mitchell Sharp warned that "Canada and other nations threatened will necessarily hold the United States responsible for any short- or long-term effects of this test."

The test site lies in a tectonically active area where many seismologists feared that an explosion could trigger an earthquake. Another danger was that it might generate a tsunami, a giant sea wave, that could flood the shores of Japan, Hawaii and western North America. While acknowledging these dangers, Schlesinger said he believed the odds on their occurrence were one in 10,000.

The AEC similarly discounted the objections of environmentalists and conservationists who saw a danger of radiation leakage into surrounding fishing waters and a threat to the bald eagles, peregrine falcons and sea otters that inhabit the island. Said Schlesinger, "Environmental damage has been exhaustively considered and overriding requirements of national security have, of necessity, taken precedence."

A similar device, called Milrow, was detonated beneath Amchitka two years ago (SN: 10/11/69, p. 322) and produced little apparent environmental damage. A recently published study by E. R. Engdahl of the National Oceanic and Atmospheric Administration revealed no evidence of changes in the natural seismicity of the area after Milrow and found, further, that the Amchitka area has been relatively stable tectonically during recent geologic time. But others pointed out that Milrow, a 1.2-megaton bomb, was much smaller than Cannikin.

The purpose of the test is to determine the explosive force and X-ray



Wide World Photos

Poster circulated in Kodiak, Alaska, last week by Kodiak Citizens Against The Amchitka Test.

yield of a Spartan missile warhead to be used in the Safeguard ABM system. The warhead is designed to intercept enemy missiles above the atmosphere and deactivate them with X-rays.

The Committee for Nuclear Responsibility and six other environmental groups tried to obtain a court injunction against the test on grounds that the AEC failed to give proper consideration to environmental hazards. After ordering the release of hitherto secret Government documents on the subject, a U.S. District Court ruled Monday that the dangers had been sufficiently considered. The attorney for the seven environmental groups said they would appeal the ruling.

Meanwhile, time was running out. The warhead had been lowered to the bottom of the 6,000-foot test shaft and the shaft was being plugged. The test could still be postponed, though rescheduling would cost an estimated $50 million to $100 million. Fishing boats had been warned away from the area, and it seemed unlikely that the test would be either halted or postponed. □

Learning and memory transfer: More experimental evidence

Until recently the transfer of learning and memory from one brain to another brain was straight out of science fiction. Then in the early 1960's investigators turned fantasy into reality by feeding brains from flatworms trained to respond to light or to navigate a maze to untrained flatworms, and found that the recipients aped the donors' behavior. In 1965, Ejnar Fjerdingstad of the University of Copenhagen took a crucial experimental leap from the worm to a vertebrate, the rat. He trained rats to go to light in order to receive water, then injected the brain material from trained rodents into naive ones. The recipients did not imitate the donors' learned habit right off, but they did acquire it faster than control rats that had not been injected, implying that the injected brain material indeed boosted learning.

There are now some 32 laboratories in the United States injecting brain extracts from trained amphibians, fish, mice and rats into untrained recipients, and the work seems to be achieving ample success in modifying the behavior of the recipients. Most brain transfers are limited to one species, although several labs are transferring brain material from one species to another, with some positive results.

What's more, the first memory molecule has been isolated, characterized and synthesized by Georges Ungar of Baylor University in Houston and by Wolfgang Par of the University of Houston. They first announced the achievement last December, and a technical report will appear soon in NATURE. What these investigators did was slowly to accumulate several pounds of brain from rats that had been shocked in the dark. They tested different fractions of this brain material for memory transfer ability in recipient rats until they narrowed the material down to what appears to be the actual memory molecule. It is a protein and dubbed "scotophobin," after the Greek words for "fear of the dark."

Several groups are now working with scotophobin. William Braud, a psychologist at the University of Houston, for example, reported at the first annual meeting of the Society for Neuroscience last week in Washington that he has been injecting extracts of crude rat brain (which he believes are scotophobin) into fishes' brains. The recipient fish indeed exhibited fear of the dark. The fear lasted up to 10 days in some fish, but usually not more than six days and was an on-again off-again phenomenon.

Rodney Bryant of the University of Tennessee confirms this short, transient effect. He reported at the neuroscience conclave that he has injected synthetic rat scotophobin into the brains of hundreds of goldfish. While the fish indeed exhibited fear of the dark and resisted learning to swim into the dark, the fear was of brief duration. "I would not say scotophobin is a memory molecule at this point, but memory linked," he said.

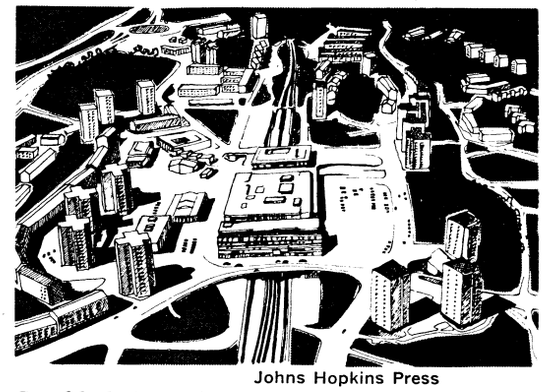
Then Ronald Hoffman, a biophysicist at the University of Houston, reported that after teaching goldfish to swim through a triangle to get food, he injected their brains into other fish. All swam to the triangle without prompting. Yet here again instilled learning lasted but a day or two. Hoffman is now working on the isolation and purification of the learning molecule involved. He thinks it is a protein-RNA complex.

Even these vertebrate experiments, though, haven't convinced everyone that learned information can be transferred chemically from one organism to another. Scientists who believe that memory is primarily a function of the neural pathways of the brain, requiring an intact brain, particularly score the possibility that memory is solely a cellular, or biochemical, phenomenon. Nonetheless those investigators doggedly pursuing biochemical packets of learning and memory avow that they have analyzed their results statistically and that the behavior of recipients is definitely not chance. Those workers tend to agree, though, with William Byrne of the University of Tennessee and author of a book on learning and memory molecules that far more brain material must be obtained, scrutinized and tested before biochemistry's true role in learning and memory can be delineated. □

Humans and cities: The European answer

It has become a kind of truism that the United States lags far behind Europe in urban planning—and that such land-use planning may be a fundamental determinant of the quality of peoples' lives and environments. In a book published this week by Johns Hopkins Press, Ann Louise Strong, director of the University of Pennsylvania's Institute for Environment Studies, provides a detailed description of some of the key European urban developments. The book, *Planned Urban Environments,* amply proves United States' backwardness—but the author is often remiss in producing evidence that the quality of the lives of the residents of the European developments matches the glitter and attractiveness of the developments.

If a single conclusion comes from the book, it is that there is no single



Johns Hopkins Press

Stockholm's Vällingby Center.

way to approach urban planning problems and thus to produce habitable human environments. In the United States, for instance, environmentalists have sometimes tended to see high-rise apartment buildings as unmitigated evils. In Tapiola, a newly planned city outside of Helsinki, however, high-rise buildings are made harmonious with the natural environment through careful spacing and imaginative architecture. Other European developments likewise have aimed at meeting local or national needs in diverse ways.

"In the Netherlands, amenity is the national government's basic reason for wishing to limit metropolitan growth. . . . Most nations, including Sweden, Finland, France and Israel, are concerned primarily with the economic implications of concentrated economic growth. . . . France and Finland fear that further concentration in Paris and Helsinki will contribute to the weakening of other urban centers." And, the author continues, a prime concern in Israel (as well as the Netherlands) is preservation of limited arable land for agricultural use. These diverse needs