

acre-feet of runoff are produced by operational seeding, with what measure of statistical significance and at what cost per acre-foot.

Dr. Kahan says the hope is to increase the snowpack accumulation by 50 percent over the long-term average for each location within the project area. Once the level has been reached seeding there will be cut off to avoid any danger of causing a flood threat. Much of the seeding will be conducted by automated ground-based generators placed at very high and remote locations. They will release silver iodide on radio command and report back on their performance.

A Great Lakes experimental snowfall modification project currently underway has an objective different from the Colorado projects. Here the goal is to reduce the massive recurrent snowfalls along the south edge of Lake Erie in the Buffalo area by spreading the snow farther to the south. Detailed data are not yet in, but early work tends to demonstrate the basic feasibility of the concept. □

CRYSTALLOGRAPHY

Deciphering proteins

In biology, form and function go hand in hand. The architecture of a molecule, governing its ability to interact with other molecules with compatible structures, determines how it functions in the body. Hence molecular biologists—seeking precise knowledge of biochemical events—are becoming molecular architects, focusing their attention on drawing blueprints of living molecules.

Proteins are among the primary targets of this research. Though the chemical and crystallographic tools are essentially in hand, determining protein structure remains a complex and time-consuming process (SN: 9/21/68, p. 298). While scientists hope that by the

end of the decade atlases will contain maps of hundreds of proteins, complete structures are available now for only about a dozen, and partial blueprints have been drawn of only a few more.

The protein that most recently joined the ranks of those to be partially deciphered is the enzyme lactate dehydrogenase (LDH), which occurs in most muscle tissue and is essential to the chemical conversion of glucose into energy for muscular activity. LDH is the first enzyme that functions within cells to be unraveled. Its three-dimensional structure was reported last week in London by a team of Purdue University scientists speaking at a symposium marking the 80th birthday of Nobel laureate Sir Lawrence Bragg, a pioneer in the techniques of X-ray crystallography that makes these architectural studies possible.

Drs. Michael G. Rossmann, Margaret Adams and their colleagues at Purdue grew crystals of LDH to fix its internal molecules into a regular three-dimensional array and then bombarded them with X-ray beams that reflect off those molecules in readable scatter patterns. After collecting more than 100,000 pieces of data from X-ray diffraction, the investigators turned them over to a computer for analysis and generation of maps pinpointing the positions of the amino acid molecules that constitute the total protein.

The enzyme, they found after about six years of work, contains approximately 310 amino acid molecules, and, structurally, is composed of four subunits. Instead of being a long, single chain of amino acids folded into a three-dimensional configuration, LDH is built of four separate polypeptide or short amino acid chains.

Knowing the three-dimensional or tertiary structure of LDH, scientists are now halfway in their attempt to decipher it completely. The remaining unknown is its primary structure, the sequence of specific amino acid mole-

cules in the four chains. X-ray crystallography pinpointed the spatial positions of those amino acids but told nothing about which molecules they are. That is a problem of chemical analysis, which is being conducted in other laboratories and should be completed soon.

In an effort to hasten the rate at which protein structures become available, the Massachusetts Institute of Technology is establishing a center for the New England area. MIT's Dean Robert A. Alberty of the School of Science points out that although techniques of structure analysis are reasonably well developed, the equipment and trained workers in the field remain clustered at a few large institutions and are not generally available to individual biologists and chemists. Says Dr. Alberty, "The net effect (of the Center for Macromolecular Structure) will be to hasten the development of understanding of fundamental molecular interactions which are the basis of living systems." □

METHADONE

Cracks in the panacea

The treatment of heroin addiction with the use of methadone, a synthetic narcotic, is becoming popular at a rapid rate. Ten years ago methadone was used mainly as an aid in detoxifying addicts and was little known by the general public. Now there are methadone-maintenance programs in more than a dozen cities, including large-scale programs in New York and Washington, D.C.

The programs have mostly received favorable publicity. But a number of scientists are beginning to object to the notion that methadone-maintenance should be the preferred mode of treatment for heroin addicts.

The new programs are based upon the demonstrated success of an experimental methadone-maintenance program begun six years ago by Drs. Vincent Dole and Marie Nyswander at Beth Israel Medical Center in New York.

The traditional detoxification procedure with methadone consisted merely of substituting methadone for heroin and then gradually decreasing the dosage until the addict is off drugs altogether. Given the opportunity, such a patient often reverts to heroin use. Drs. Dole and Nyswander therefore increased, rather than decreased, the dosage of methadone being given as a heroin substitute. At high dosage levels, methadone blocks the effects of heroin, so that a patient maintained on methadone cannot get high from heroin or other opiates even if he tries.

Two years ago a Columbia University evaluation team endorsed the Beth



Purdue Univ.

From crystallographic data, Dr. Michael Rossmann built a 3-D model of LDH.

Israel program and recommended that it be expanded (SN: 12/21/68, p. 621). The great majority of the more than 500 addicts admitted to the methadone-maintenance program at that time were free of heroin addiction, the figures showed.

Although such statistics account for the widening acceptance of methadone-maintenance programs, whether the treatment amounts to a cure depends partly on the definition of cure. The Beth Israel program does not admit addicts with obvious psychopathology, and Dr. Nyswander argues (SN: 2/4/67, p. 116) that the main problem of most addicts is a physical one.

Other scientists regard a physical dependence on heroin as merely part of a larger, mainly psychological problem. Drs. Albert E. Myers, Geraldine Fink and Caleb Davis of Brookdale Hospital Center in Brooklyn told the annual meeting of the Eastern Psychological Association in Atlantic City last week that a methadone-maintenance cure should be regarded only as a social cure.

"The fact that a person is off heroin and is no longer out on the street mugging and shoplifting to support his habit is gratifying," says Dr. Fink, a psychiatrist in charge of the Brookdale methadone-maintenance program, "but it does not necessarily mean he is healthy."

Deprived of the insulation from reality heroin affords, a patient on methadone will usually be found to be suffering from tremendous psychological pain when examined at close range, Dr. Fink states.

The result is often that he switches to another drug.

An evaluation of the methadone program at the Morris J. Bernstein Institute at Beth Israel published this month in the *AMERICAN JOURNAL OF PSYCHIATRY* indicates that 20 percent of the patients there are using drugs such as alcohol, amphetamines and barbiturates. The proportion of patients at Brookdale with nonheroin drug problems, especially alcohol, is closer to 50 percent, Dr. Fink reports. She attributes these problems to the addicts' continued psychological desire to get high, a desire not cured simply by blocking the possibility of getting high on heroin.

"To be really cured, the addict usually needs psychotherapy," Dr. Fink concludes, "and he needs to be moved from methadone treatment into drug-free treatment."

In addition to these therapeutic caveats, Dr. Davis says that methadone is a potential source of social problems too. Two months ago the methadone program operated by the Blackman's Development Center, the largest such program in Washington, D.C., was temporarily closed when Federal offi-

cialists claimed the center was failing to take enough precautions against the leakage of methadone to persons not part of the treatment program. The center quickly reopened, but the authorities made it clear they were worried about the increasing abuse of methadone.

Methadone may indeed become a serious drug problem in many communities, says Dr. Davis. Novice drug abusers who are not full-fledged heroin addicts and have not built up a tolerance for methadone are quite capable of getting high from the drug, he points out.

It is also possible to use methadone as a euphoric agent by injecting it into a vein instead of taking it orally, the

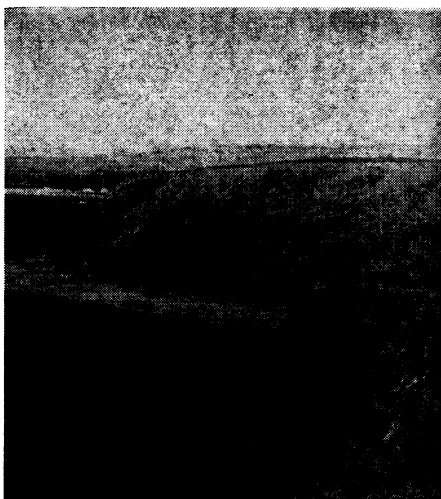
way the treatment centers prescribe. Many blacks in ghetto areas where illegal methadone is becoming available blame government officials for introducing yet another narcotic into their neighborhood, Dr. Davis reports.

Scientists at Brookdale Hospital are not claiming that the possible social problems and therapeutic inadequacies of methadone are sufficient reason for jettisoning all methadone-maintenance programs. If there are problems with methadone, there are also problems with every other kind of treatment for heroin addiction.

"Everyone knows the good points about methadone," says Dr. Davis. "We just think it's time to start talking about the other side of the picture." □

PROTESTS OVER TESTS

Rerun on Amchitka



AEC

Crumbling shores caused by Milrow.

When the Atomic Energy Commission touched off a nuclear device of at least one megaton 4,000 feet below the surface of remote Amchitka Island last October (SN: 10/11, p. 323), the shock waves sent gushers of mud and water from streams and lakes squirting 50 feet into the air and turned the surrounding sea to froth.

But nothing much else happened. Slight ground motion generated by the blast was felt at Adak Naval Station 175 miles to the east. But there was no damaging earthquake or tidal wave, no radiation escaped, and the 4-by-42 mile island's best known residents, an estimated 3,000 North Pacific sea otters, apparently were not particularly disturbed.

Nonetheless, many Alaskans, for whom earthquakes and tidal waves are not distant happenings but fresh memories, remain edgy about what the AEC is up to in one of the world's most seismically active areas. Their nervous-

ness found expression this legislative session in a joint resolution introduced by state Rep. Carl Moses, a Republican who lives in the village of Unalaska, a settlement of 300 persons in the Aleutians about 500 miles east of Amchitka.

The resolution urged the AEC to discontinue plans for tests larger than the one detonated last year.

The State Affairs Committees of the State House and Senate scheduled a public hearing on the resolution and invited the AEC to testify. The agency showed up in force last week, with a 10-man delegation headed by Robert Miller, chief of the Nevada Operations Office.

What the legislators got was five and a half hours of minutely detailed reasons why they shouldn't worry about an even bigger device, dubbed Cannikan, which the AEC hopes to detonate in the fall of 1971.

For the usual security reasons, the AEC declined to say exactly how big this second of a proposed series of three shots would be. But Dr. Harry L. Reynolds, associate director of the Lawrence Radiation Laboratory, said, "We do not expect the effects of Cannikan to be significantly different from those of Milrow," the first test.

The reason was that the second shot would be detonated at 6,100 feet, compared with 4,000 for Milrow. As a result Dr. Reynolds says, ground acceleration and maximum water pressures should actually be lower than they were in the initial test. Since the second device will be larger, however, the shock forces will affect a wider area.

"The yield of Cannikan will be somewhat higher," says Miller, "but within our ability to predict the effects with accuracy."

The effects predicted were more gushers from lakes and streams and