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.

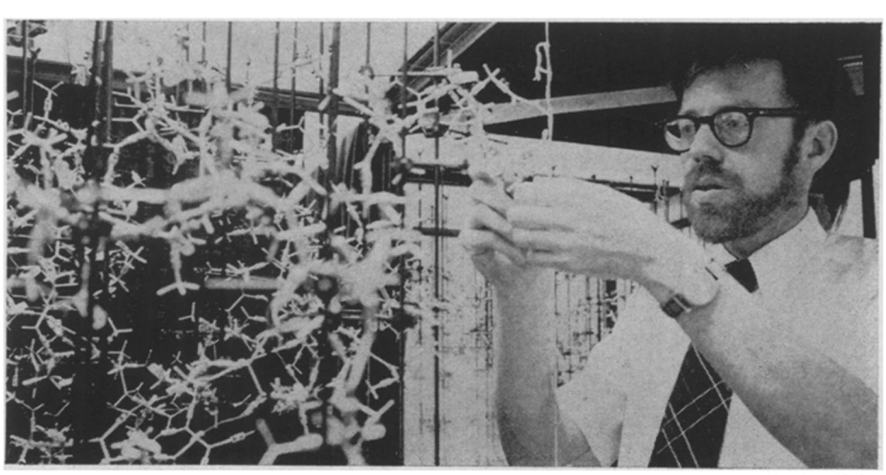
The protein that most recently joined the ranks of those to be partially deciphered is the enzyme lactate dehydrogenase (LDH), which occurs in most muscle tissue and is essential to the chemical conversion of glucose into energy for muscular activity. LDH is the first enzyme that functions within cells 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 molecules 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." □



Purdue Univ.

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

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