life sciences

ENZYMOLOGY

Chemical basis of enzyme activity

Enzymes act with incomprehensible speed and precision to stimulate or catalyze biochemical reactions. How they do it is virtually unknown.

However, successes in elucidating the three-dimensional structure of some enzymes, and in making one, have brought promises that insights into their functioning would be next. Most recently, scientists at Rockefeller University in New York and Merck Institute of Therapeutic Research in Rahway, N.J., reported the synthesis of ribonuclease, a 124-amino-acid-molecule enzyme that breaks down unwanted RNA (ribonucleic acid), to be eliminated by the body's metabolic processes (SN: 2/1, p. 112).

Working collaboratively on ribonuclease, researchers from Merck and Harvard report in the just-published April PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES that the specific chemical basis for the biological activity of an enzyme has been identified for the first time.

Using a nuclear magnetic resonance procedure to measure molecular changes that occur when proteins interact within the body, Dr. Oleg Jardetzky and coworkers at Merck and Dr. Edward Dennis of Harvard were able to identify the active sites in the chemical structure of ribonuclease and thus define its mechanism of action.

Ribonuclease catalyses the chemical breakdown of RNA in a two-step reaction involving just three of the enzyme's 124-amino-acid molecules, they found. Says Dr. Jardetzky, the definition of molecular changes occurring in this process may provide a model for establishing a relationship between the chemical structures of an enzyme and its unique biological activity.

BACTERIOLOGY

Skin cleansing before shots unnecessary

"There is no experimental evidence that skin bacteria are introduced into the deeper tissues by injection and thereby cause infection," says Dr. T. C. Dann in the July 12 LANCET.

"Currently used antiseptics cannot act in the time allowed in practice (usually about five seconds), and possibly cannot cause complete sterility at all," the researcher contends. He is with the University College of Swansea in Great Britain.

In a six-year study, more than 5,000 injections were given to patients by various routes from intradermal to intravenous, without any form of prior skin preparation. "No single case of infection, either local or systemic, ensued," Dr. Dann reports, challenging traditional medical practice of swabbing the skin before giving an injection.

AGRICULTURE

Cousin organisms found in plant and animal

From studies of a plant virus, the alfalfa mosaic virus, comes discovery of a microorganism in plants that is closely related to three similar organisms that infect animals. The implications of this unique relationship are being investigated by the scientists who spotted it, Dr. Richard O. Hampton of the U.S. Department of Agriculture's Research Service at Corvallis, Oreg., and Drs. James O. Stevens and Thomas C. Allen of Oregon State University.

Reporting in the July issue of PLANT DISEASE REPORTER, a USDA magazine, the scientists said electron microscopy revealed the presence of the mycoplasma in infected plant tissues. After it was artificially grown in culture, comparative studies showed its close relation to microorganisms found in animals. "We have found that both the virus (alfalfa mosaic) and the mycoplasma can be transmitted from plant to plant by aphids, and also by rubbing sap from infected plants onto healthy ones," Dr. Hampton observes. Whether or not the mycoplasma can be transmitted from plant to animal remains to be seen.

BIOCHEMISTRY

Abnormal DNA linked to blood cancer

Double-size rings of genetic material in the cytoplasm of cells have been associated with granulocytic leukemia (white blood-cell cancer). But the meaning of the find is still in doubt.

"We do not know whether the DNA abnormality is a symptom or a cause of leukemia," says Dr. Jerome Vinograd, who, with graduate student David A. Clayton, discovered the oversized DNA in the mitochondria of cells. Both researchers are at the California Institute of Technology and report their findings in the April PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

Mitochondrial DNA is normally found in the form of a small ring five microns (one five-thousandth of an inch) in circumference. However, in all 14 leukemia patients studied by Dr. Vinograd, dimers, or 10-micron DNA rings, were seen in the mitochondria of white blood cells. Control patients showed no such abnormality.

"Significantly, in the course of the study we have found that the treatment of patients with antileukemia drugs substantially lowers the frequency of circular dimers," Dr. Vinograd reports.

PHARMACOLOGY

Anticholesterol drug tests

Clofibrate is a drug that lowers cholesterol levels in human beings, reduces triglycerides and removes fats from tissues. Theoretically, individuals taking clofibrate regularly could prevent, or at least significantly reduce, their chances of having a heart attack.

To test this theory, the World Health Organization is coordinating an investigation of the drug. During a five-year period, 15,000 healthy adults, with no sign of heart disease, will take clofibrate. If the drug has prophylactic value, the incidence of heart attacks among these persons should be statistically very low.

The volunteers will be men between the ages of 30 and 49, recruited from urban and suburban dwellers in Budapest, Edinburgh and Prague.