life sciences

ENZYMES

Orbital steering

An enzyme's role is to speed things up. All biochemical events in living cells depend on these protein catalysts to trigger chemical reactions a billion times more rapid than those occurring in laboratory situations. How they do this is an embarrassing mystery (SN: 2/1/69, p. 112).

A team of scientists from the University of California at Berkeley report formulation of a theory, supported by experiments, to explain the catalytic power of enzymes.

Speaking at the International Symposium on the Chemistry of Natural Products at Riga, U.S.S.R., Dr. Daniel E. Koshland Jr. announced his concept of orbital steering, a process in which atoms within enzymes are held at precise angles to permit them to join and form new molecular compounds in biochemical reactions. His experiments, performed with graduate student Dan Storm and Dr. Kenneth Neet, now at Case Western Reserve University in Cleveland, involved the reaction of ethyl alcohol with acetic acid to form ethyl acetate and by-product molecules of water.

Using holder molecules—bicyclic ring compounds—to prevent the experimental molecules from colliding at random, they found they could speed the reactive process to a million times its normal rate. The carefully selected holder compounds acted as catalysts.

The ability of these compounds to speed reactions, Dr. Koshland says, is related to the angles of approach of atoms in the reacting compounds; in this case, the bonding of a carbon atom in each acid molecule to an oxygen atom in each alcohol molecule. Altering the molecular shape of the holder compounds dramatically altered their catalytic power, further confirming the theory that catalysis is the consequence of steering atoms into precise alignments in order for chemical reactions to proceed.

ANTIBIOTICS

Task force to study animal feeds

Most animal feeds contain antibiotics, included to promote fast weight-gain in species raised for human food. However, these animals may harbor microorganisms that have developed a resistance to antibiotics, and some scientists fear that these resistant organisms may be passed on to human beings. In addition, some researchers feel that individuals themselves may develop antibiotic resistance over a period of time because they ingest drug residues in the meat of animals that have been dosed with them.

Recently, Great Britain banned the use of penicillin and tetracycline in animal feeds and has placed restrictions on the kinds and amounts of antibiotics that can be injected directly into animals (SN: 1/3, p. 26). As yet no action has been taken in the United States. But Food and Drug Commissioner Charles C. Edwards, in response to the British action, has appointed an 11-member panel to review all aspects of the use of antibiotics in animal feeds. Headed by Dr. C. D. Van Houweling of the FDA's Bureau of Veterinary Medicine, the panel will concern itself particularly with the possibility that antibiotic resistance in man is enhanced by long-term, low-level exposure from foods. In addition the National Academy of Sciences—National Research Council has begun a study of the question. Its preliminary results are expected to be issued in a report early this fall.

X-RAY ANALYSIS

Determining grain quality

If the green revolution (SN: 4/5/69, p. 335) is to succeed in staving off hunger and malnutrition, the genetically superior grains scientists design must yield crops not only in abundant quantities but also of high quality. The measure of quality is the crops' content of essential amino acids, those that the body cannot synthesize but which it must have for adequate nutrition. These include methionine, arginine and lysine-amino acids available to man only through his diet.

At a recent meeting in Vienna, Austria, sponsored by the United Nations and the International Atomic Energy Agency, two scientists reported a new technique for determining the protein quality of genetically new seeds before they are tested in the field. Dr. Melvin P. Klein, a physicist at the Lawrence Radiation Laboratory, with graduate student Leo N. Kramer, developed the technique, using X-ray analysis.

Bombarding sample seeds with X-rays stimulated atoms in those seeds to emit electrons. By analyzing the resulting electron patterns, the scientists could correlate what they saw with known energy patterns of essential amino acids, thereby determining the kind and quantity present in the sample. Using this technique, they say, agricultural geneticists can select new, mutant seeds on a scientific rather than trial-and-error basis, for initial field trials.

DIAGNOSIS

Test for thyroid cancer

Two years ago, Drs. Armen Tashjian of the Harvard Medical School and Kenneth Melvin of Tufts University School of Medicine discovered that an uncommon form of thyroid gland cancer results in a secretion of the hormone calcitonin. Now, with Dr. C. Stratton Hill of the M. D. Anderson Hospital in Houston, they have developed a diagnostic test that identifies tumors known as medullary carcinomas early enough for successful surgical removal.

Speaking at the annual meeting of the Endocrine Society in St. Louis, Dr. Tashjian reported the results of their experiments with the new diagnostic method on human beings. They infused calcium, which affects calcitonin levels, into patients and healthy volunteers over a four-hour period. While calcium infusions stimulated only a small rise in calcitonin levels in normal persons, it triggered a sharp rise in those with tumors.

Though medullary carcinoma comprises only about 10 percent of thyroid cancers, it has a strong tendency to run in families. Dr. Tashjian suggests the diagnostic test could provide a valuable screening technique for spotting tumors in these individuals. However, he stresses the fact that this new tool is highly specific for medullary carcinoma and is not applicable to other types of cancer.