CHEMISTRY

Enzymes incognito

When a foreign protein enters the blood stream, it is usually recognized as foe, not friend, and is attacked by antibodies. Many human diseases are caused by enzyme deficiencies, but the body's immune system prevents most foreign enzymes from being sent in to function in place of the missing ones.

A research team from Rutgers University has developed a way to send enzymes into the blood stream in disguises that prevent their recognition and destruction by the immune system. Abe Abuchowski, Frank F. Davis, Theo van Es, Nicholas C. Palczuk and John McCoy presented their findings at the American Chemical Society meeting in Mexico City.

The team coupled several types of enzymes to molecules of the inert polymer polyethylene glycol. The polymer forms a flexible coating on the enzymes that prevents recognition. The substrates within the body, on the other hand, can penetrate this coating, find the active site on the enzyme and react with it. The team coupled polyethylene glycol and beef liver catalase and introduced the coated enzyme into the blood streams of catalase-deficient mice. The enzyme retained its full activity while circulating in the bloodstream. Uricase, an enzyme derived from fungi that breaks down uric acid (and thus could potentially relieve uric acid build-up in gout patients) was coupled to the polymer coating, but has not yet been tested. Another enzyme, phenylalanine ammonia-lyase, might be sent in to reduce blood levels of tyrosine and ammonia, substances needed for the growth of tumor cells, Davis says.

Swallowing the bad news

No environmental news is good news, it sometimes seems. The cheerless discoveries during the past year of organic chemicals, some known carcinogens, in the drinking water supplies of many U.S. cities is a prime example of that bad news. But research on this problem is, quite clearly, important and continuing. L.H. Keith of the Environmental Protection Agency's Athens, Ga., research laboratory, told the American Chemical Society in Mexico City about latest findings.

They analyzed drinking water from 10 cities (Seattle, New York, Miami, Tucson, Ottumwa, Iowa, Grand Forks, N.D., Cincinnati, Lawrence, Mass., Philadelphia and Terrebonne Parish, La.) with five water sources: uncontaminated upland water, groundwater, water contaminated by agricultural run-off, water contaminated by industrial wastes and water contaminated by municipal wastes.

By concentrating water samples on activated carbon filters, they found 50 different organic contaminants bringing to 117 the types of organic chemicals found by such analyses. Pesticides, herbicides, halogenated aliphatic compounds, chlorinated aromatic compounds, aliphatic hydrocarbons, aromatic hydrocarbons, plasticizers, miscellaneous industrial organics and some compounds of possible natural origin were detected. The lowest number of compounds were found in Tucson, which uses groundwater. To the great surprise of the researchers, Keith told SCIENCE NEWS, the highest number of compounds were found in Miami, which also uses groundwater. How many of the 50 compounds are suspected or confirmed carcinogens, Keith did not know.

The findings mean, Keith says, that analytical techniques are getting better. The chemicals were usually found in concentrations from 0.01 to 5.0 parts per billion, and, he says, "five years ago, we couldn't have found most of them." Much analysis and matching of spectra once done by hand is now computerized. But full interpretation of the findings, Keith says, awaits determination by health researchers of the effects of those contaminant concentrations on living systems.

BIOMEDICINE

Menopausal estrogen use and cancer

From the 1960's to present, millions of women have taken estrogen hormones to alleviate the symptoms and aftereffects of the menopause. Such usage has now been linked with an increased risk of cancer of the uterus, according to three scientific studies.

Two of the investigations, reported in the Dec. 4 NEW ENGLAND JOURNAL OF MEDICINE, were conducted on 634 women in Seattle hospitals by Donald C. Smith and on 282 women at the Kaiser Permanente Medical Center in Los Angeles by Harry K. Ziel. Patients with cancer of the uterus were matched with a similar group of women without cancer or with another kind of cancer. The different groups were then examined for prior use of menopausal estrogens. The results showed that users of the hormones faced a 5-fold to 14-fold increased risk of developing uterine cancer.

The third study came to light during Food and Drug Administration hearings on Dec. 15 and 16. Conducted by Thomas Mack of the University of Southern California, it indicated that among postmenopausal women who took estrogens, the risk of developing uterine cancer was greater than their combined risk of developing cancers of the breast, lungs, ovaries and colon. The FDA should soon recommend what, if any, measures should be taken.

Making cell-free interferon

Interferon is a sugar-protein produced by cells in the body in response to a virus attack. Sidney Pestka and his team at the Roche Institute of Molecular Biology have now synthesized human interferon in a cell-free system by using exogenous messenger RNA that codes for the molecule.

"Human interferon," they report in the October PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES," may be the first biologically active eukaryotic protein synthesis in a cell-free system dependent on exogenous mRNA. The synthesis . . . indicates that the cell-free system not only is capable of synthesizing the primary amino acid sequence, but also has the capacity for performing those posttranslation processes, if any, required for producing a biologically functional molecule."

They have now found that the chemically treated cells can regain their susceptibility to infection if they first synthesize proteins. These proteins, they conclude, may well be the cell material that helps the RNA tumor virus infect cells. The protein, they theorize, may help stabilize and circulate the DNA made from the RNA tumor virus.

The cell: Cancer virus's helper?

The genetic core of the RNA tumor virus is transcribed by the virus's enzyme, RNA-dependent DNA polymerase, into a copy of DNA. This DNA then presumably incorporates itself into the DNA of a susceptible cell and makes the cell cancerous.

Scientists haven't known which, if any, cell functions are involved in the early stages of RNA tumor virus infections, namely completion of the synthesis of viral DNA and its integration into the cell's genes. Now it appears that cell proteins may play an accomplice role, R.C. Roa and Subir K. Bose of St. Louis University School of Medicine report in the November PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

First Roa and Bose used the chemical ethidium bromide to treat mouse cells infected with a particular RNA tumor virus. The drug inhibited virus replication and the transformation of the infected cells into cancer cells, but it took a long time to achieve these effects. So Roa and Bose postulated that during this time the cells lost some material required for viral infection.