HOW FOOD AND DRUGS FIGHT IT OUT

BY JOAN AREHART-TREICHEL

It happens every hour of the day, every day of your life. Dozens, hundreds of drugs, carcinogens and other potentially hazardous environmental chemicals bombard you. Your major defenses against these compounds are enzymes located in the portals of the body—skin, blood, lungs, liver and kidneys. These enzymes break down (metabolize) foreign compounds so that they can be excreted from the body and hence not build up and cause toxic effects.

The drug-metabolizing enzymes, however, don't automatically render drugs and other chemicals harmless. The way the enzymes perform is partially influenced by their genetically determined composition. Some people, for instance, lack enzymes that are critical in the breakdown of specific drugs. If they take these drugs, they can experience severely toxic effects (SN: 6/26/71, p. 439). The performance of drug-metabolizing enzymes is also influenced by how many drugs or chemicals present in the body at one time are competing for metabolism (SN: 5/29/71, p. 365). The behavior of drug-metabolizing enzymes is influenced by still another factor—diet.

Some of the ways that protein, fats, vitamins and minerals can alter drug-metabolizing enzymes and their activity were reported at the recent annual meeting of the Federation of American Societies for Experimental Biology in Atlantic City. In the view of investigators in this field, the impact of diet on the drug-metabolizing enzymes holds more practical health implications for people than does the influence of genes or of drug-drug interactions. Diet is something that each of us can control ourselves. This is not the case with genes, and only rarely true of multiple drug reactions.

The drug-metabolizing enzymes that nutrients primarily affect are the so-called microsomal enzymes, the FASEB meeting revealed. "Microsome" refers to the way the biochemist prepares the enzymes for study. The enzymes are located in a tubular membrane network in cells known as the endoplasmic reticulum.

Probably more is known about the effects of protein on the microsomal enzymes than about other nutrients. Twenty-three years ago, a toxicologist reported that protein deficiency increased the toxicity of certain drugs. Since then, a number of investigators have shown that protein deficiency in animals decreases the ability of the animals' microsomal enzymes to handle a number of foreign chemicals. For instance, when rats were put on a protein-deficient diet for several weeks, then exposed to pesticides, the pesticides were 2,000 times more toxic to them than to rats on an adequate protein diet.

How does protein deficiency damage the microsomal enzymes so that they cannot break down harmful compounds as rapidly as usual? T. Colin Campbell, a biochemist at the Virginia Polytechnic Institute, reports that it reduces the protein content of the enzymes and also reduces the activity of the cytochromes. The cytochromes are red-tinted compounds which comprise part of the microsomal enzymes and which participate in the breakdown of foreign chemicals.

It appears that adequate protein in the diet can protect one from the toxic effects of foreign chemicals by keeping the microsomal enzymes primed for action.

Unsaturated fats also seem to have a protective effect against foreign chemicals by priming the microsomal enzymes. When A. E. Wade of the University of Georgia School of Pharmacy fed corn oil (an unsaturated oil) to male rats, they metabolized drugs faster than if they had been on a saturated fat diet or a nonfat diet. The unsaturated fats, Wade has found, appear to hold the enzymes in place in the lipoprotein endoplasmic reticulum. Unsaturated fats, he reports, are also necessary for the proper functioning of the cytochromes in the enzymes. So eating unsaturated fats should help keep one's microsomal enzymes in shape.

Vitamin C, possibly vitamin A, zinc, magnesium, copper and calcium can also keep the microsomal enzymes primed for action, George C. Becking of the Environmental Health Directorate in Ottawa and several other toxicologists have found. How the vitamins and minerals actually affect the enzymes is still open to speculation, Becking says. In any event, a diet that is adequate in these vitamins and minerals should help keep the microsomal enzymes in top condition.

One nettling discovery has emerged, O. N. Miller of the Roche Research Center in Nutley, N.J., points out. The microsomal enzymes sometimes metabolize foreign compounds to a more toxic, rather than to a less toxic, state. This is the case with cancer-causing compounds which are actually innocuous until the microsomal enzymes get ahold of them. So from the vantage of cancer-causing chemicals, Becking admits, "It would appear to be better to eat a diet poor in those nutrients that enhance enzyme metabolism rather than to eat a diet rich in them. However, eating a diet poor in these nutrients would throw off the metabolism of other toxic compounds and would also upset important metabolic processes in the body. So the best solution is to eat a good diet, but to keep carcinogens out of the environment."

The message that emerges from the food-drug metabolism research, then, is that a diet adequate in proteins, unsaturated fats, vitamins and minerals is the best way to keep your microsomal enzymes in prime condition to detoxify toxic compounds. The message is a crucial one, since all of us are bombarded with an array of self-imposed, physician-imposed and environment-imposed chemicals, and we need all the preventatives against their toxic effects that we can get.

Meanwhile, Becking asserts, it is necessary that biochemists and toxicologists learn more about the interactions of nutrients and drug metabolism—not only to help people eat the most advantageous diets possible, but also to design standard diets for animals used in testing the safety of drugs and chemicals. "If a standard, nutritionally adequate diet could be adopted for long-term safety assessment tests, such as those required in carcinogenicity studies," he says, "some of the inter-lab discrepancies now reported might be avoided." □