chemistry

From our reporter at the 164th meeting of the American Chemical Society in New York

Pesticide synergists and human health

Insecticide synergists are chemicals that, while not toxic in themselves, increase the toxicity of a given pesticide. The synergist is known to tie up chemical-metabolizing enzymes in insects temporarily so that the pesticide can exert stronger effect.

Only a handful of synergists are used in commercial pesticides, but one—piperonyl butoxide—is present in a commonly used aerosol insecticide. H. B. Matthews of the National Institute of Environmental Health Sciences has been interested in the effects the synergists might have on the health of persons who spray the product. He has found that when rabbits are exposed to the synergist in its usual aerosol form, it impairs the chemical-metabolizing enzymes in their liver and lungs.

Whether people who use the synergist insecticide would experience a similar impairment of lungs and liver enzymes is not known, but possible, Matthews indicates. Such an inhibition might temporarily tie up the body's ability to detoxify other environmental chemicals or drugs.

Possible detriments of a high-protein diet

The best advice scientists can offer after half a century of nutrition research is to eat a well-balanced diet. Recent research by Williard J. Visek of Cornell University supports this view. When people eat too much protein or have an unbalanced diet, harmful amounts of ammonia may be released.

The cell culture experiments show that ammonia slows the growth of normal cells more than that of cancer cells. Ammonia changes the character of RNA, the cell's regulator of protein manufacture. Ammonia alters the rate at which thymidine is used for DNA, the cell's genetic material.

The unanswered question of these findings, however, is the one underlying the bulk of medical research: Do the 180 trillion cells in the human body act the same way they do in tissue cultures? In this case Visek believes they might because cells in the body are exposed to ammonia every time protein is digested.

The whys of organ regeneration

Only a handful of tissues and organs, such as the liver, kidney and skin cells, regenerate themselves if damaged or removed by surgery. Various hormones have been shown to induce this regeneration, and to work through a secondary hormone messenger, cyclic AMP. Colin G. D. Morley of the Pritzker School of Medicine, University of Chicago, now has evidence from studies with rats that a protein in the blood can also help the liver regenerate.

What is unusual about the protein is that it appears to act on only one organ. Hormones generally act on more than one kind of target tissue. Morley is now trying to find out whether this "liver regenerating serum factor" may also work through cyclic AMP.

A similar protein regenerating factor has been identified in chicken skin cells. A protein has also been found to enhance nerve cell growth (nerves cannot regenerate themselves, but they can repair damaged fibers).

Putting protein pep into soft drinks

Whey, a by-product in cheese-making that is sometimes viewed as a highly polluting waste, can become a nutritious food ingredient, reports Michael J. Pallansch of the U.S. Department of Agriculture.

A number of experimental processes remove lactose and salts from whey. The resulting liquid can be dried to a powder containing 30 to 90 percent protein. This protein, the Washington chemist has found, can be added to soft drinks with positive results. Even after the soft drinks have been stored a year, the fortified proteins have little effect on its flavor or color. Pallansch has also been experimenting with making meringue, a desert topping, from the high-protein whey. When concentrated powders of whey are reconstituted with water and beaten in a high-speed mixer, they make a good amount of stable foam with 30 percent solids. Some heat denaturation of the protein, however, appears necessary to produce the most stable foam, and heating alters the flavor. The flavor, Pallansch says, can be improved by adding sucrose, which, at the same time, improves the stability of the foam.

Bacteria, memory and behavior

While scientists are trying to come to grips with the chemistry of memory and behavior in mammals (SN: 8/12/72, p. 100), Robert M. Macnab and Daniel E. Koshland of the University of California at Berkeley have evidence that bacteria exhibit a primitive form of memory and behavior patterns.

Their work, which they reported at the ACS meeting and on which they will be elaborating in a forthcoming PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, shows that bacteria have a sense of time and migrate by comparing the past with the present. If the bacteria are rapidly transferred to a new environment identical to the old, they swim normally. This is crucial since it shows the mechanics of transfer do not cause a response. If they are transferred to a richer environment (more nutrients), they swim smoothly for a time, then revert to their normal, slightly erratic, swimming pattern. If they are transferred to a poorer envionment, they tumble constantly and are unable to maintain a constant direction, until after a short time when their "memory" fades and they swim normally again.

Fungi as tire disposals

Scrap tires are not just an eyesore, but a serious waste disposal problem. They cannot be burned or buried and may no longer be incorporated into new tires. However technology exists to reduce tires to scrap. Walter J. Nickerson and Marcel D. Faber of the Rutgers Institute of Microbiology have found that a variety of fungi and yeast will grow on the scrap, using the carbon in it. As a result, the scrap is reduced to a powder.

With the powder, unproductive land may be put to agricultural use. When the powder is mixed with sand, water retention is markedly increased. When the powder is mixed with clay, water flows better through the clay. Nickerson and Faber successfully grew kidney beans in sand that contained the powder.