NATURAL SCIENCES

Cell response to cold

Certain plant and animal cells cannot long tolerate temperatures below a certain point—about 50 degrees F. for the plants and 74 degrees for the animals—but other plants and animals appear to be immune to cell damage at far lower temperatures. Hibernating mammals seem to be able to have it both ways, depending on the season.

Drs. James M. Lyons of the University of California at Riverside and John K. Raison of the Australian Commonwealth Scientific and Industrial Research Organization think they have part of the explanation after two years of joint work in Australia and California.

The two researchers postulate what they call a phase change, in which mitochondria, the energy producers of cells, undergo a major slowing of activity when the threshold temperatures are reached.

Enzymes in the membrane surrounding the mitochondria produce energy by converting carbohydrates into carbon dioxide and water. The energy is then used by the mitochondria to make adenosine triphosphate (ATP) for the energy-consuming processes of the cell.

The phase change, say the two researchers, apparently interferes with this metabolic process at some point. This reduces the energy available to the cell and leads to a buildup of toxins, they suggest.

They believe the interference comes in the lipids associated with the enzymes of the mitochondrial membrane. In the cold-sensitive cells the lipids contain more saturated fatty acids than in the cold-insensitive cells and are less flexible at low temperatures.

Hibernating animals convert their mitochondria to the type possessed by cold-blooded animals when the hibernating season arrives, the researchers say.

TOXICITY

Support for linear theory

The linear theory of toxicity of environmental pollutants—radioactive substances, heavy metals and others—has been given an edge over the threshold theory by work at the University of Rhode Island.

The linear theory holds that any amount of certain pollutants will cause at least some damage to organisms; the threshold theory says a certain minimum amount must be present before there is damage.

The controversy will have to be resolved on a pollutant-by-pollutant basis. But Dr. Harold W. Fisher and graduate student A. Russell Malcolm of URI report that work they have done on the effects of certain common water pollutants with human cells in vitro at least indicates the linear nature of the toxicity of 18 chemicals.

The two researchers report that even the smallest amounts of certain substances—including cadmium, zinc, mercury, rotenone and the herbicide 2,4D—damaged cultured human cells.

ENVIRONMENTAL HEALTH

Test for lead poisoning

Lead poisoning is a serious problem in central cities where children sometimes eat peeling lead-based paints. Lead from automobile exhausts is also believed to have reached toxic levels in some places (SN: 6/6, p. 560).

Badly needed has been a simple test to detect incipient lead poisoning in children. Lead blocks delta-aminolevulinic dehydrase, essential in the manufacture of hemoglobin; with lead poisoning, delta-aminolevulinic acid (ALA) is excreted in abnormal amounts in the urine. A commonly used laboratory test is assay of ALA in urine, but the test is unwieldy and difficult to use on a mass scale.

The Connecticut Agricultural Experiment Station—involved with lead toxicity because the problem is regarded as essentially nutritional—has come up with a simple test that it says could be applied on a mass scale.

In the test, a piece of ion-exchange paper is mailed or otherwise distributed to parents. The paper can then be dipped in the urine of children and be mailed back to a laboratory for analysis—thus eliminating the need for the child to go to a clinic for urinalysis.

The test detects lead poisoning before clinical symptoms become noticeable. A pilot study in Hartford Conn., indicates it is feasible.

PARTICULATE POLLUTION

Fly ash has farm use

One of the more noxious products of power plants and other coal-burning installations is fly ash, a fine, abrasive particulate material. Fly ash acts synergistically with sulfur oxides—also released from power plant stacks—and aggravates lung damage.

Most of the fly ash is removable with electrostatic precipitators, but the problem then is what to do with it. If it enters waterways it is a pollutant. Hauling it away to landfills or flushing it into special lagoons costs from 50 cents to $3 a ton.

Dr. David C. Martens, an agronomist at Virginia Polytechnic Institute and State University, says experiments he has done show that fly ash improves the fertility of some soils. Certain trace elements in the ash are required by plants, he says.

Dr. Martens is also investigating the possibility of combining fly ash with some soils to make it usable as a building material for structures such as ski runs and amphitheaters.

ENERGY

System cleaner, more efficient

In a study for the National Air Pollution Control Administration, United Aircraft Research Laboratories proposes a combination electric power generating system they say would virtually eliminate sulfur oxide emissions (SN: 8/29, p. 187).

The system would first gasify coal or oil, a process that removes most of the sulfur usually found in these fuels. Then it would burn the gas in a turbine generator system. The hot exhaust from the gas turbine would be used to produce steam for a steam turbine that would also be connected to a generator.

The main benefit of the system would be the improved efficiency from using the now wasted heat from gas turbines, which are commonly used by power companies for peaking power.