BIOLOGY

From our reporter at the meeting of the Federation of American Societies for Experimental Biology in Chicago

Pollution particles may invade gut

Ingestion of small solid particles must be considered potentially hazardous, an investigator from Brookhaven National Laboratory reports. Formerly it was believed that although breathing particulate pollutants causes lung damage, the particles do not penetrate the gut. Now Darrell D. Joel has evidence that particulate matter can penetrate the intestine and congregate in lymphoid tissue.

For several weeks, Joel and colleagues fed mice water contaminated with carbon particles. The carbon particles were visible in the outer layer of the intestine and in the lymphoid tissue 120 days after exposure to the contaminated water. No particles were seen in other tissues.

Although carbon particles do not damage the tissues, they have indicated where scientists should look for damage from other solid particles. Workers at Brookhaven have begun experiments exposing mice to more hazardous pollutants such as asbestos and silica.

Garbage reveals food use trends

In Tucson, researchers have been going through the garbage trying a new approach to the study of nutrition. William L. Rathje and Gail G. Harrison of the University of Arizona are monitoring changes in food purchase and use, important factors in diet. The researchers wanted a simple and inexpensive method guaranteed not to bias the behavior of the people being studied. The methods of archaeology were applicable, they decided. "Archaeologists have long used refuse from ancient cultures to reconstruct behavior; modern household garbage is no less a reflection of the behavior of those who have generated it," Rathje explains.

The garbage project, as it is called, examined refuse collected by the city sanitation division from each of several hundred households. Items were sorted into more than 150 categories. The researchers analyzed their data using correction factors for garbage disposals, pets, compost piles, gardens and fireplaces.

Rathje and Harrison examined the response of consumers to rising food costs. They found that the total quantity of food brought into households of all income levels decreased between 1973 and 1974, but that decline continued in 1975 only for the higher income groups. The other groups substituted cheaper items and decreased the amount of food discarded. All groups purchased less solid animal protein food, and the lower income groups increased their purchase of grain products. Input of sugars and sweets remained constant, although prices rose considerably.

Molecules in cell development

By examining calf embryonic cells in culture as they specialize into adult muscle fibers, a group of French researchers is probing the molecular processes involved in differentiation. They are analyzing the spectrum of proteins synthesized at different stages during the cells' development and are investigating mechanisms which may control the changes.

A cell uses the information stored in a gene by creating RNA molecules that contain a specific message. This messenger RNA travels from the cell nucleus to the protein building machinery in the surrounding cytoplasm. Francois Gros and colleagues at the Pasteur Institute have evidence that the collection of messenger RNA molecules in a cell parallels developmental changes.

The researchers found that the myoblasts, embryonic cells committed to become muscle cells, contain about 3,000 types of messenger RNA not found in uncommitted embryonic cells. Most of the new RNA types are present only in small amounts and probably direct the synthesis of proteins that are specific to muscle cells.

Later in development, myoblasts fuse and begin developing the structures typical of muscle. Gros and co-workers found that although more than 90 percent of the detectable proteins are present in cells both before and after this fusion, several proteins unique to fused cells could be identified. Most of these new proteins are different forms of enzymes that are present in the myoblasts.

The researchers cannot yet choose between two mechanisms that might control the proteins a cell makes. Certain genes may be copied into messenger RNA more rapidly at different stages or the cell may destroy some messenger RNA molecules more rapidly at different times. The data of Gros, however, do exclude a model where stable messenger RNA is continually made and must wait for the appropriate time for expression.

Role for fever in rabbits

Fever may be more than a symptom of disease, it may be crucial to survival. Recent studies of fish and of lizards (SN: 7/24/76, p. 55) demonstrate that animals infected with bacteria have a higher death rate if they are prevented from raising their body temperatures. Now Linda K. Vaughn and Matthew J. Kluger report similar results from studies on a mammal.

The University of Michigan physiologists injected live disease-causing bacteria into rabbits. They then recorded changes in body temperature during the next six days. Significantly more rabbits survived of the group in which body temperatures increased more than 1.5°C than of those that developed less fever. The researchers point out that they cannot yet conclude that the fever causes the improved survival, because both ability to develop higher temperatures and increased survival rates might be linked to other aspects of the rabbits' health.

Fertilization traps proteins in eggs

A sperm penetrating an egg triggers an array of events that alter both the metabolism and the structure of the egg. In many organisms an envelope, which surrounds the egg outside the cell membrane and beneath the jelly layer, becomes elevated away from the surface of the egg. Biologists have suggested that this effect is due to a change in the permeability of the envelope. If macromolecules released within the egg cannot escape, water will rush in, expanding the envelope.

In the eggs of the South African clawed toad, Tatsuro Nishihara and Jerry L. Hedrick of the University of California at Davis now have evidence that a layer at the outer border of the envelope, which appears after fertilization, is the molecular barrier. Previous work with Ron E. Wyrick showed that the electron dense-layer forms from interaction of molecules in the jelly layer and others released within the egg. In their most recent work, Nishihara and Hedrick observed the movement of ferritin, an iron-containing protein which is clearly visible with electron microscopy. They found that ferritin could permeate an unfertilized egg, but not a fertilized one. When ferritin was introduced into the egg and then the egg was fertilized, the ferritin penetrated the envelope but could not cross the electron dense layer. The researchers suggest that layer blocks exit of macromolecules as well as entry of additional sperm into the egg.