

University of Cincinnati
Report of Research Program

Dr. Ernest C. Foulkes will report on:

Mechanisms of renal handling and renal damage following exposure to cadmium;

The neurophysiologic changes induced by lead and mercury as affecting synaptic transmission;

Behavioral studies in lead intoxicated rats.

There is a lack of correlation between the degree of damage produced by cadmium and the levels of metal found in renal tissue of rats and rabbits when exposed to cadmium oxide or cadmium chloride. By determining the rate of equilibration of ^{109}Cd between kidney cortex and plasma, the presence could be demonstrated of more than one cadmium compartment at a time when the greatest renal damage was apparent. The total Cd concentration may be, therefore, less meaningful than the size of the discrete cellular cadmium pools when attempting to relate renal damage to the presence of the metal.

Lead chloride blocks synaptic transmission by competing with calcium for presynaptic receptor sites and thereby reducing the amount of transmitter release from synaptic nerve terminals.

In behavioral experiments it appears that lead intoxicated rats have considerably more difficulty than controls in mastering a learning task requiring visual discrimination.

Dr. Suskind will report on progress in:

Water quality toxicology studies;

Fibrogenic aspects of coal dust and leachates;

Clinical studies.

At the present stage of development, when compared with data available from toxicologic and epidemiologic studies, the cell assay system appears to be a very suitable one for determining preliminary drinking water standards for suspected toxic agents. Three organic substances found in hospital waste water were studied. They are hydroquinone, 2,4-dinitrophenylhydrazine, and 1,3-dinitrobenzene. Spontaneous locomotor activity was measured. Even at low concentrations dinitrobenzene elevated locomotor activity. At the same low concentration, the toxicity of the compound could also be demonstrated in vitro. Hydroquinone had no effect on locomotor activity.

The fibrogenic aspects of coal dust and its leachable components were studied using cell culture models. The effect of coal leachates of hydroxyproline synthesis in L-cells indicates that the total synthesis of hydroxyproline is nearly the same for Pennsylvania and Utah, and the synthesis of hydroxyproline parallels that of protein during the seventh growth period. The effect of Pa extracts is more pronounced than Utah extracts. A comparison of the ratio of total hydroxyproline to total protein reveals that cultures exposed to Pa coal leachates have a higher ratio than the control, whereas the cultures of Utah coal leachates have a ratio less than that of the control.

When human cell lines WI-38 (embryo lung) were used, there was a significant effect on collagen synthesis in response to Pa and Utah leachates. Both Pa and Utah coal cause substantial increase in the ratio of total hydroxyproline to total protein in WI-38 cell cultures.

Clinical studies of the following problems have been carried out during the last year: meat wrappers' asthma, a group of workers exposed to di-isocyanate, welders in an agricultural machinery plant, surgeons exposed to prosthesis plastics: methyl methacrylate and styrene, bronchial asthma caused by phthallic anhydride sensitivity, an in-depth evaluation of patients with lead poisoning receiving chelation therapy. This latter study relates to the effect of EDTA on zinc metabolism.

Research efforts in all major areas of emphasis were expanded during the past year. In addition, the following projects were initiated:

1. The study of trace metals in relation to lipid metabolism and atherosclerosis in experimental animal and man.
2. The effect of acid mists and particulates on the pulmonary metabolism of benzo(a)pyrene in the isolated perfused lung.
3. Neurophysiologic and behavioral changes in rats exposed to SO_2 , H_2SO_4 , and particulates.
4. The effect of inhalation of platinum, lead, and other base metal components of automotive exhausts on pulmonary defenses such as alveolar macrophages.
5. The toxicology of vinyl chloride: fetal toxicity, trans-placental effects, the role of nutrition and ethanol in VCM toxicity, and a study of industrial workers involved in PVC transportation, processing and product manufacturing.
6. The allergenic characteristics of specific aroma aldehydes and the quenching action of mixtures.
7. Thresholds of sensory detection of petroleum hydrocarbons in human subjects.
8. The effects of lead and mercury on synaptic transmission and spinal cord and sympathetic ganglion.
9. The study of cadmium levels in hair, kidney, and liver as related to age.
10. The health risks of human exposure to waste water.