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SEMT

Society of Electron Microscope Technology

Affiliated to the Royal Microscopical Society

THE E-M GOES GREEN

Friday, 22 February 1991

at

IMPERIAL CANCER RESEARCH FUND
Lincolns Inn Fields, London WC2

PROGRAMME

2.00 Sampling and identification of air-borne mineral fibres

Tony Rood (Health & Safety Executive, London NW2)

2.35 Use of XRMA to monitor marine heavy metal pollution

Jim Nott (Plymouth Marine Lab.)

3.10 Tea

3.30 How a British worm copes with environmental warming

Carole Winters (University College, Cardiff)

4.05 Lung response to noxious agents

Ann Dewar (Cardiothoracic Institute, London)

4.40 Chairman's Summing up and general discussion

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ABSTRACTS

SAMPLING & IDENTIFICATION OF AIR-BORNE MINERAL FIBRES

Tony Rood (Health & Safety Executive, London NW2)

A survey of environmental levels of air-borne mineral fibres (particularly asbestos) has been carried out in conjunction with the Department of the Environment. Samples for the survey were taken by drawing air through membrane filters which were prepared, by a modified Jaffe wick procedure, for TEM examination. Fibre sizing and identification were carried out in a Philips EM400T, energy dispersive X-ray analysis being the main method of analysis, supplemented by SAED. Data from all potential categories of asbestos pollution indicate that the risk to the general public is extremely low.

USE OF XRMA TO MONITOR MARINE HEAVY METAL POLLUTION

Jim Nott (Plymouth Marine Lab.)

XRMA is customized for monitoring heavy metals within the tissues of marine organisms. Sites of uptake, intracellular accumulation, transport and excretion are identified, analysed and quantified. Cryopreparation techniques are required to prevent the translocation or loss from specimens of soluble metal species. In marine invertebrates, metals are detoxified by systems of chemical binding and intracellular compartmentalization. XRMA investigations have concentrated on marine molluscs and crustaceans and even within these restricted groups there are marked inter-species differences in the biochemical and cytological processes which reduce metal bioavailability. Some detoxification systems also protect the carnivores which ingest the metal-laden tissues of the prey. This results in the bioreduction of metals along a food chain. These processes are investigated by XRMA which can be tuned to observe the complex interactions which operate at all levels within and between the biota and polluted environments.

HOW A BRITISH WORM COPES WITH ENVIRONMENTAL WARMING

Carole Winters (University College, Cardiff)

The earthworm, Aporrectodea longa, which experiences an apparent obligatory physiological resting state ('diapause') in the temperate summer, was collected from February through to October. Morphological examination of the chloragocytes, and quantitative electron probe X-ray microanalysis of their constituent chloragosome granules prepared by cryoultramicrotomy and air-dried smearing, were undertaken over this period. Worms entered diapause in May, and emerged from it between August and September. The long-term energy reserves in the form of lipid and polysaccharide were accumulated by early diapause and gradually consumed during diapause. In addition there was considerable change in structure and composition of the chloragosome granules, and the adaptive significance of these changes is discussed in the broad control of the different ecophysiological strategies evolved by stenohaline earthworms to resolve the problems posed by dry climatic conditions.

LUNG RESPONSE TO NOXIOUS AGENTS

Ann Dewar (Cardiothoracic Institute, London)

The efficiency of the lungs as a gas-exchange unit can be affected by a range of substances, which can arrive by various routes, such as inhalation, ingestion, intravenous (1).

Two common responses in the lung are Adult Respiratory Distress syndrome (ARDS) and fibrotic disease, and TEM has contributed greatly to understanding their pathogenesis. ARDS can be produced by many noxious substances eg. paraquat, high concentrations of oxygen, and involves acute life-threatening changes. These same agents, and many others including asbestos, X-rays, and bleomycin, can cause more chronic fibrotic disease where the alveolar walls are thickened by interstitial collagen. Ultrastructural studies have shown that both these responses involve damaged epithelium, damaged endothelium and interstitial oedema, indicating a difference of tempo rather than of type of damage (2).

There is an increasing link between the exposure to Hard Metal (an alloy of tungsten and cobalt) and an unusual giant cell variant of interstitial pneumonia (3). TEM shows that there are two multinucleated cell forms, giant epithelial cells and giant macrophages. Using SEM with X-ray microanalysis we identified tungsten in paraffin sections of biopsy material and in Araldite sections of bronchoalveolar lavage cells.

EM can contribute directly to the diagnosis of alveolar lipoproteinosis, an uncommon disorder where the alveolar spaces are full of phospholipid material. In some cases, the patient's high exposure to finely divided quartz is strongly implicated as the cause. In other cases, diagnosed as idiopathic, X-ray microanalysis has subsequently demonstrated silica. The significance is still being evaluated. SEM and TEM combined with XRMA is proving increasingly valuable in identifying the nature of inhaled particles (4).

References

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(2) Corrin B, Dewar A, Rodriguez-Roisin R, and Turner-Warwick M. Fine structural changes in cryptogenic fibrosing alveolitis and asbestosis. J. Pathol. 1985; 147:107-119

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(4) Johnson NF, Haslam PL, Dewar A, Newman-Taylor AJ, Turner-Warwick M. Identification of inorganic dust particles in bronchoalveolar lavage macrophages by energy-dispersive X-ray microanalysis. Arch. Environ. Health. 1986; 41: 133-144.