pollutant effects of substituting oil for coal under the ' Clean ' Air Act at a much earlier stage than if we have to wait for the agriculturalists to report a new rot in aspidistras, brussel sprouts, or rhubarb.

**Dr G. I. Watson—Chairman**

Dr Pinsent needs no introduction but his subject may seem unusual unless you know of his particular interest in the soil and water of the South-west peninsula. He has also established a transatlantic link with a colleague in Vancouver where similar investigations are being conducted. Dr Pinsent is going to tell us about the hazards of soil and water.

## HAZARDS OF SOIL AND WATER

**Dr R. J. F. H. Pinsent**
*General practitioner, Birmingham*

It is impossible to consider all the hazardous interactions which can occur between man and his surroundings. I have completely omitted much that we know of flood, tempest, volcano and earthquake, so I shall deal with two variants of the three common biological ecological cycles. This is the old story of natural forces such as rain dissolving naturally occurring organic and inorganic substances which are carried by water to the varied plant and food chains, until they eventually reach man. When man appeared he began to make hostile surroundings by digging holes to bring combustible minerals to the surface. Dr Swinburne has told us that " what goes up is breathed and what is not breathed comes down ", and so we get surface contamination. We sink oil tankers and we dump tin cans and these are hazards with which you are all quite familiar.

There is a range of 41 major and minor trace substances of which 18 are supposed to have biological functions which are essential to life. The remaining 23 are in the comfortable position of being ' not proven ' because we cannot say that a substance is absolutely inert and free from hazard. The community is exposed to hazards to which it has to adapt and this multiple series of adjustments is the cumulative process which we regard as adaptation. Adjustment to a change in environment can also be a problem. It is well known that when cattle are moved into a neighbouring pasture they may very well suffer brief gastrointestinal upsets. Of the two processes of adjustment and adaptation we can say that people adjust while populations adapt.

How do people adjust and adapt and what mechanisms are involved? Many of the biological processes are conditioned by enzyme sequences, and the trace substances form a normal part of many of the large enzyme molecules. It is known that substitution of one molecule, at a given valency, for another may occur and that this may also alter the pattern of the action of that enzyme. The lipid metabolism which led to the incorrect differential distribution of fats in muscle may be due to an altered enzyme sequence as a result of a molecular replacement. Definite relationships have been established between the intake of chromium, glucose tolerance, and diabetes. Cadmium has been shown to play a part in hypertension, and the relationship between hypertension and zinc is also being investigated.

### Wilson's disease

This allows us to speculate on some of the many illnesses that may be unrecognised evidence of such changes. Wilson's disease is a disease due to an autosomal recessive trait in which copper is deposited. This affects both monoamine oxidase and ceruloplasmin metabolism, but the interesting point is that very few people suffer from Wilson's

disease despite the wide use of copper saucepans, copper water pipes, and copper rich foods such as nuts and oysters. The reason may be that we are a genetically selected population who are resistant to copper with the exception of a few people who are biologically susceptible.

Sodium and chloride are under suspicion in relation to another autosomal recessive condition, cystic fibrosis, and investigation of trace element variations in the environment may give us a clue as to how this selectivity operates.

Copper and zinc have been shown to play a part in the development of taste acuity by altering the balance between the ions and the trace metals which control the diffusion of taste activity into sensory cells. Nutritional deprivation or chelation will reduce the body load of these metals and produce alterations of taste which can be corrected by restoring the trace elements to their normal levels.

Thus the trace elements can influence choice and discrimination, which may influence our free will decisions and have far reaching implications on the evolution of the species. This may sound very theoretical in the light of our own preoccupation with general practice, but we operate at the point where the first evidence of an imbalance may be detected.

## Intakes of trace substances and disease

A professor of geology at a Canadian University, Harry V. Warren, and a medical officer of health for a west country market town, Dr E. D. Allen-Price, both noticed that abnormal quantities of trace substances could enter food chains. Professor Warren used biogeometric methods to find new mineral deposits, while Allen-Price recorded localities where the incidence of illness of long-term origin was abnormally prevalent. Work is now being undertaken to correlate the mortality studies with the biogeometric studies of the environment.

The area covered by Dr Allen-Price's report is significant that in the three areas of the village there were three different cancer death rates, with the area of maximum mortality being the one served by a stream. A series of morbidity studies was instituted on a rather wider scale than just the village, and the analysis has shown that other factors are disturbed. There are more congenital abnormalities, an increase in cardiovascular disease and diseases of the C.N.S., and a small increase in diabetes and also in those conditions which the epidemiological evidence suggests might arise from long continued exposure to environmental factors which may be of considerable significance in later life. The work continues with measurement of possible radiation hazards. We know that metamorphic rock contains a high mineral content; where there is a high mineral content there is a possibility of radioactivity. In 1963 it was shown that there was radon present in the water and the local environment of one particular stream in quantities that should give us cause for further enquiry. So I see it as our future to equip ourselves to observe.

## Hippocrates as guide

Our practices are influenced by occupational, environmental, and social features and we should train ourselves so that we are able to investigate clusters, folk lore, or the bizarre situation that we recognise in practice. We acknowledge that these things occur but are tempted to pass on to the next business. General practice began with Hippocrates, and a fragment of one of his speeches sets the whole of my lecture in proper perspective.

" Whoever wishes to investigate medicine properly, they should proceed thus. In the first place, consider the seasons of the year and what effect each of them produces, for they are not all alike but differ much in themselves in regard to their changes. Then the wind, the hot and the cold are common broad outlets and then such as are peculiar to each locality. We must also consider abnormalities of the waters, for as they differ from one and other in taste and weight also do they differ much more in their other qualities.

In the same manner when one comes to a city to which he is a stranger he should consider its situation, how it lies to the wind and to the rising sun, for its influence is not the same whether it lies to the North or to the South, and these things one should consider most attentively. Concerning the waters which the inhabitants use, whether they be marshy or whether they be soft or hard and running, whether they are from elevated situations or saltish and unfit for cooking. And the ground, whether it be naked and deficient in water, or wooded and well watered, or whether it lies in a hollow and the mode in which the inhabitants live and partake of it."

A newcomer to a practice area might take that as the text for his appointment, but if each of us applied the same principle of objective study to the population within our medical care then we would take a great step forward.

## THE WORLD WE WANT OUR CHILDREN TO LIVE IN (SUMMARY)

**Professor R. W. Smithells**
*Department of Paediatrics and Child Health, University of Leeds*

I envisage the hostile environment as being one of earthquakes, floods, droughts, plagues, tidal waves and blizzards, but today we have been talking about the debit side of man's attempt to modify his environment to his own advantage. We have been talking about his ignorance, indifference and arrogance in many respects.

Evolution is progress either by mutation or by choice. Until humans arrived, progress was by mutation or apparently random changes which were occasionally for the better but more often for the worse. As evolution progressed, more and more of the changes were for the worse.

Man's progress has been largely by choice or deliberate decision, because man differs from other creatures in two ways. Firstly he is creative and can make things, and secondly he is a moral creature with a sense of right and wrong, and good and bad. He can choose between the two and can use his creations for good or for evil. The progress of man is erratic but by and large he moves a little further forward each time, very often solving one problem by creating others. An example is air pollution, which is the direct result of the industrial development which has contributed to our material prosperity.

Most of us are fairly grateful, but we must find out how to go on enjoying our prosperity without having to enjoy the pollution. When food becomes more readily available undernutrition or starvation disappears, but too many people overeat. You close your clinics for the undernourished and you create the ' weight-watchers ' instead.

In the developing countries where disease is rife, you can drain the malarial swamps and start immunisation campaigns, which result in far fewer child deaths, and then find that there is not enough food for them to eat. Similar considerations may apply to clinical problems. We know that by the active, aggressive surgical treatment of spina bifida, some children who would have been severely handicapped will survive with a lesser handicap. It is also true that some babies who would have died in the first weeks of life will, with treatment, survive with quite severe handicaps.

### Correcting mistakes

Man learns by his mistakes and he usually avoids making the same mistake twice or introduces a correcting factor to minimise the consequences. If we like a diet that induces tooth decay our correcting factor may be an increase in the fluoride content of