Minerals in the Body

Upsetting the Balance

By Dr. Masironi
Cardiovascular Diseases Unit, WHO

CARDIOVASCULAR diseases, rare at the turn of the century, are now the leading cause of death in the highly industrialized countries, where they account for roughly 50 per cent of all deaths. Death rates from coronary heart disease (CHD), in particular, have been steadily increasing over the past few decades. However, in population groups relatively unexposed to industrial civilization, this disease is practically non-existent. The developing countries occupy an intermediate position, but cardiovascular mortality rates are increasing there too.

Attempts to explain these geographical differences and alarming trends on the basis of dietary habits, blood fat levels, diminishing physical activity, genetic factors, smoking, psychosocial stress and other causes have not yet yielded consistent results. While the cause and pathogenesis of CHD are still not completely known, we know that a number of predisposing factors play a role.

Death rates from CHD are correlated with indices of living standards and technological development, in other words the "better" the living the more deaths there are from heart disease.

Recent investigations may shed some light on the relationship of cardiovascular diseases to technological advancement. One field of investigation concerns the so-called "trace elements", that is to say, minerals present in very small quantities in the body tissues. If any of these minerals exert an action on the heart and blood circulation, as they do on many other functions of the body, then it would be logical to expect that any disruption of their natural balance by industrial or other artificial manipulations of the environment would also have adverse effects.

What is a trace element? In the earth crust, ocean, air i.e. in all our geochemical environment there are more than 90 elements. Only 11 of these occur in the human body in substantial amounts—oxygen, carbon, hydrogen, nitrogen, calcium, phosphorus, potassium, sulphur, sodium, chlorine, magnesium—and are therefore called "bulk" or "major" elements. Their biological actions are known. Many others occur only in very minute amounts (less than 0.1 percent of body weight) and are therefore called "trace" elements. Seven or eight of these—cobalt, copper, iodine, iron, manganese, molybdenum, zinc and, possibly, selenium—are essential to human life since they are involved with growth, respiration, thyroid function and other physiological functions. For other elements, the biological usefulness is not yet known, and several may be considered merely as contaminants. It is possible that some of the trace elements indeed play important roles also in the function of heart and the circulation of the blood. Some of them might, for example, control the contractility of the heart cells, be essential for the elasticity of the vessel walls, blood pressure regulatory centres, metabolism of fats and sugars, etc. On the other hand, it is also possible that the contaminants may act as poisons, i.e. they may interfere with the beneficial elements or may alter the proper functioning of organs.

Adjustment to environment

Man, after many thousands of years, has become adjusted to natural environment and universal balance. This relationship to the environment starts from the rocks, which are the primary source of minerals. The minerals enter from the rock into the soil, the water, into plants, animals and man. The natural balance of a few decades ago has now perhaps somewhere been disrupted by man himself. In the technologically advanced, coronary-prone countries, man-made alterations of the environment through industrial pollution of soil, water and air, through various agricultural practices, such as irrigation and use of fertilizers, through the use of food additives and food processing, through water treatment, such as softening and distribution of water in metal or plastic pipes for domestic use—may have brought about changes in the natural mineral balance and, consequently, subtle, detrimental effects on cardiovascular function. These are only hypotheses, but there is some evidence that this may well be true.

The whole story started in 1957 when a Japanese investigator observed that areas in Japan where the river water was more acid were more subject to apoplexy than the areas where the water was less acid.

Following this observation, studies in the United States showed that the states that were served by soft water (low in calcium and magnesium salts) had higher morality rates from cardiovascular diseases than the states served by hard water. Other studies showed the same relationship in the United Kingdom, Finland, Canada, Sweden, and, to a lesser extent, in the Netherlands and Ireland. Areas where the water—not only the tap water at home, but also in the wells, reservoirs, and the rivers—was softer, always had a higher incidence and mortality from one or another type of cardiovascular disease. Other diseases and other causes of death did not show such a relationship.

If this relationship were observed only in one country, it might have been only a casual statistical association, not related as cause and effect. However, since it was found in several countries, it is more than a matter of chance. Something in the water, or associat-