CHEMICAL ANALYSIS

FRANCIS R. HOLDEN, Ph.D.(Chem.)
SAN FRANCISCO

CONTINUING the story of the dynamics of industrial hygiene, chemistry also contributes skills and technics for the detection and control of occupational disease. This story is one of teamwork between physicians, engineers and scientists, the combination which has been so effective in extending man's life span and in controlling disease. The development, manufacture and use of chemotherapeutic agents such as the sulfonamide drugs were the product of teamwork.

It will be recalled that Dr. Hasterlik's examination of his patient was thorough and complete. The case history and the physical and clinical examinations of the patient showed a lung condition compatible with beryllium poisoning. Dr. Hasterlik, therefore, called on Dr. Lauer and Mr. Adley for assistance.

Dr. Lauer's study of the medical department records and Mr. Adley's preliminary survey of the industrial environment confirmed the possibility of an occupational relationship of the patient's condition.

At this point the problem moved from the qualitative to the quantitative stage. The importance of the quantitative aspect of toxicological problems was recently demonstrated by Dr. Don Irish, of the Dow Chemical Company, Midland, Mich. Dr. Irish pointed out that the usual definition of a toxic substance is that it acts as a poison. In turn a poison is defined as an agent which when introduced into an organism may produce an injurious effect.

Dr. Irish then demonstrated the inadequacy of the definition as follows: Assume that we introduce four different chemical compounds, one each, into four guinea pigs. Animal A will receive compound 1; animal B will receive compound 2; animal C will receive compound 3, and animal D will receive compound 4.

When the results are checked it will be found that animals A and B have died, while animals C and D are in excellent health. On the basis of the ordinary definition of toxicity, compounds 1 and 2 are toxic substances while 3 and 4 are not. This experiment can be performed in the manner described using the following chemicals: Compound 1 is table salt; compound 2 is sodium bicarbonate; compound 3 is arsenic and compound 4 is strychnine. There are no tricks in this experiment, and it can be performed with the results described. The answer to this apparent anomaly lies in the amounts of the substances employed. Large amounts of table salt and sodium bicarbonate are required to cause death. Conversely, only minute quantities of arsenic and strychnine may be given if health is to remain unimpaired.

Read before the Section on Preventive and Industrial Medicine and Public Health at the Ninety-Ninth Annual Session of the American Medical Association, San Francisco, June 29, 1950.