REPORT UPON THE ACTIVITIES OF INDUSTRIAL HYGIENE WITH THE EXCEPTION OF THE INDUSTRIAL CLINIC FROM 1918 TO 1922.

In the spring of 1918 Harvard University received gifts, largely from New England manufacturers, in order to develop the subject of health in industry. The subscribers to this fund understood that the University would employ the money for research and publicity work of such types as seemed desirable, and for the training of industrial physicians and others directly connected with health work in industry. The work accomplished through this fund since 1918 is as follows:

A. Specific Problems.

1. Ludlow Investigation.

The Laboratory of Applied Physiology has collaborated with the clinical section of the Division of Industrial Hygiene, under the direction of Dr. Wade Wright, in the investigation of conditions in the Ludlow mills. The Ludlow Associates are large producers of jute products and were anxious to ascertain whether working with jute resulted in harm to their employees. The manufacturing processes subjected the workman to dust which, in the main, consisted of fine particles of jute, but which also contained a certain amount of dirt accumulated when the jute was baled in India. The survey of this establishment required the work of Dr. C. K. Drinker and Mr. H. M. Thomson, who measured dust concentrations using such apparatus as was available at the time (1919); Dr. Wade Wright, who made physical examinations on a number of the employees who had been

nose and throat condition of the same group of employees; and Dr. George Holmes of the Massachusetts General Hospital, who made X-ray photographs of the chest of the individuals selected for study. The entire investigation required about a month's time and resulted in establishing that prolonged work in jute does result in certain chronic fibrous changes in the lungs, apparently not of very serious character. The Ludlow Associates were advised on the basis of these findings, in order to be assured of their position, to install better ventilation in certain parts of the mills and so reduce the dust to as great an extent as possible.

Publications of the investigation for the Ludlow Associates has been withheld until the fall of 1922, when a second survey of the mills will be made following improvements which the Company has effected, and the findings of this Survey will be contrasted with those of the earlier ones to be issued.

2. Lead Investigation.

In the spring of 1921, the Laboratory of Applied Physiology received a sum of $51,000 from the American Institute of Lead Manufacturers to be divided into three $17,000 parts and used for a period of three years in investigating lead poisoning. It was the desire of the Lead Institute that the attack upon this problem should follow whatever lines the University believed profitable and that the investigators should feel free to go over work previously done. In order to accomplish this new task it became necessary to remodel the laboratories to some extent and to appoint

additional personnel. The investigation was placed in charge of Dr. J. C. Aub, and he was made Assistant Professor of Applied Physiology. Dr. Aub secured Dr. L. T. Fairhall, Dr. J. A. Key, Mrs. Marion D. Frankfurter, Miss Annie S. Minot, Miss Dorothea Smith, and Dr. J. W. S. Brady as assistants.

The first necessity in the whole problem of lead poisoning resides in absolutely accurate methods for lead detection. Dr. Fairhall and Miss Minot have spent the past year in reviewing and testing out published methods for lead determination in animal tissues, and Dr. Fairhall has devised and has published a method far superior to any as yet available. This method, while useful for refined laboratory work, is too difficult for ordinary clinical purposes, and Dr. Fairhall is now developing a shorter and simpler method for use in ordinary hospital and industrial practice.

Miss Minot has been making studies on the distribution of lead in chronically poisoned animals and has become particularly interested in the fact that lead is stored in the bones - not in the marrow but in the hard bone. Her results upon the subject are extraordinarily interesting and have become so positive that the laboratory is now in a position to search for human autopsy material in order to get confirmation. Apparently lead is invariably in some part locked up in the bones and may remain there for long periods of time. The subject for inquiry in this investigation is naturally the means by which this lead may be liberated from the bones and so cause poisoning.

Dr. J. W. S. Brady has been studying the elimination of lead through the bile and the effects of potassium iodide upon this elimination. His work has not shown that potassium iodide is of service in this

service in this particular.

Dr. J. A. Key has been making extensive morphological studies upon the blood-cells in lead poisoning and has gained valuable knowledge upon the causation and value of stippling.

Dr. Aub and Miss Smith have been interested in the cause of anemia in lead poisoning, and have discovered that the lead ion is apparently capable of very peculiar effects upon the membranes of the red cells. Their results are of importance not only in explaining anemia in lead workers but in disclosing the actual physiology of the red blood-cells.

The single publication to date on the lead work is:

Lead Studies: I. The Estimation of Minute Amounts of Lead in Biological Material. L. T. Fairhall. Jour. Ind. Hyg., 1922, 4.

Projected publications covering experiments now in progress are as follows:

Lead Studies: II. The Ionic Concentrations of Lead in Body Tissues. L. T. Fairhall.

Lead Studies: III. The Clinical Detection of Lead in Chronic Lead Poisoning. L. T. Fairhall.

Effects of Lead on Red Blood-Cells. J. C. Aub and D. Smith.

Excretion of Lead. J. C. Aub, J. W. S. Brady, and M. D. Frankfurter.

The Pathology of Acute Lead Poisoning and the Probable Explanation of Stippling in Red Blood-Cells. J. A. Key.

The Distribution of Lead in the Poisoned Animal. A. S. Minot.