

Memorandum On

**Research in the Department of Preventive Medicine and Industrial Health,
College of Medicine, University of Cincinnati.**

Introduction

The investigative work in the Department of Preventive Medicine and Industrial Health is carried on in two more or less distinct, but closely related, categories, namely, (1) that which is concerned with certain broad scientific disciplines which have application generally to medical research, namely, epidemiology and biometrics, and (2) that which relates to the hygienic problems of industry, including those of the community which stem from the operations of industry. Further to clarify these two categories of research, certain examples may be cited. Epidemiology, in the first category, has long been an important discipline in the investigation of hygienic problems of various populations, having to do with the incidence and distribution of diseases therein. The epidemiologist must now concern himself with various forms of chronic disease which now have greatly amplified importance in human health, within both the industrial and general population.

The role of biometry, in giving expression to hygienic facts, and in establishing the mathematical relationships toward their further investigation and elucidation, is achieving increasing significance within the Department. This has been recognized outside the Department to such an extent as to have brought forth the development and growth of a biometric (computing) center situated within the Department, but available to the entire Medical Center. This development, organized recently, and given adequate financial support through a large grant of funds by the U.S. Public Health Service, is actually the formal expression of an existing activity created by the biometric staff of the Department in its collaboration with investigators in other departments of the Medical Center.

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The epidemiologic and biometric work of the Department is housed in the ground floor of Cherry Hall, where the participating staff functions as the division of Preventive Medicine.

The other functional divisions of the Department (Industrial Medicine, Industrial Toxicology, Industrial Hygiene Technology, and Bibliographic Research), housed in the Kettering Laboratory, are engaged in a variety of research projects, some of which involve all of the divisions of the Laboratory, including Preventive Medicine, while others are initiated and carried out solely within some one of the divisions. As an example of a coordinated program of research, a project which was initiated in the division of Toxicology, as an investigation of the toxic manifestations of the absorption of beryllium by animals, has been extended into an environmental survey of the industrial operations in which beryllium is used, involving the extent and character of the contamination of the atmosphere of workrooms with finely divided beryllium as the result of these operations, as well as into the collection of information concerning the incidence of disease due to beryllium among the workers who engage in such operations, and the critical consideration of standards of industrial safety relating to the permissible concentrations of beryllium (and its compounds) in the atmosphere of work areas. This work calls into play every functional division of the Laboratory, including a continuing search of current literature for any and all pertinent information on beryllium.

The present activities of the Department, with respect to research, are listed below, according to the functional division of the Department in which each project was initiated. It should be recognized that very few of these projects have remained exclusively within the division in which they originated, and that none of them has been prosecuted without frequent consultation of the principal investigator with his associates in the divisions of the Laboratory.

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Division of Preventive Medicine

Epidemiology

A project on competing risks has been underway for some time and will continue in the future. This is a theoretical problem concerning the effects exerted by medical and hygienic practices on the disease patterns of populations. Specifically, one is concerned with the manner in which the decrease in the diseases of the early life of individuals affect the patterns of mortality in later years, especially as to deaths due to circulatory abnormalities and cancer. This is under continuous investigation by members of the staff.

A grant for a study of the effects of low therapeutic dosages of radiation upon subsequent malignancies has just been obtained jointly by this Division and the Department of Radiology.

The staff of the Division serve as consultants in a number of other current epidemiological investigations such as that concerned with mental disease in industry, and an examination of the needs of chronically ill individuals in this community which is being made by the Public Health Federation.

Preventive Medicine

The head of this Division has just returned from a foreign tour of investigation into the feasibility of medical training and facilities in certain underdeveloped countries.

Another member of the staff is studying the treatment and control of alcoholics by several methods. It is anticipated that guidelines leading to proper treatment and to the selection of appropriate facilities for individual patients will be developed.

Mathematical

Members of the biometrics staff have received a grant for the investigation of alternative biomathematical models which describe the deposition of inorganic substances in the tissues.

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Another project is being shared with members of the staff of Children's Hospital in investigating a model which permits the evaluation of new drugs used in the treatment of leukemia.

Experimental

A grant has been received to develop investigations in antibody responses to toxic exposure of animals and man. The reactions of man and experimental animals will be followed during and after the termination of definable types of exposure, both in degree and time, to high energy fuels, pesticides, and similar toxic materials now commonly encountered in modern communities, in industry, and in military situations.

Training

A training grant in epidemiology and biometry obtained last year has enabled the Department to train outstanding students in research and theoretical problems in medicine which require a special knowledge of mathematics and the ability to look at medical problems through the eyes of a computer. A number of students in this class are actually engaged in various phases of medical research.

Clinical Division (Industrial Medicine)

An investigation of the applicability of the tolerable limits of exposure to beryllium is in the planning stage, as an extension of previous investigations of this metal and its compounds.

The "normal" metabolism of chromium, boron and nickel is being investigated. This involves the determination of the normal ranges of the concentration of these metals in blood and their excretion in the urine of various unexposed groups of industrial employees. The extent of the accumulation of cadmium and chromium in the human body from birth to death is also being investigated.

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Another investigation is concerned with the variations in the gamma-globulin fractions and enzymes in the blood, in chronic pulmonary disease.

The extent of the absorption and excretion of lead by various groups of persons in urban populations is being investigated, in parallel with determinations of lead in urban atmosphere (carried out by members of another division.)

Measurements of pulmonary diffusion are being made on a series of patients and volunteer subjects, by means of rebreathing carbon monoxide.

An investigation is being made, in collaboration with the Neurological Disease Research Center of the USPHS in Guam, of the concentrations of trace metals in the blood of patients living in an area in which neurological disease occurs in high incidence.

A continuing investigation of carcinoma of the urinary bladder is being prosecuted by the clinical followup of men formerly engaged in the manufacture of benzidine.

Physiological effects associated with the manufacture and use of certain chlorinated hydrocarbon insecticides, are being investigated in a 10 year retrospective survey of men in a manufacturing plant. A preliminary investigation is now under way.

Ocular irritation, in association with exposure to the exhausts of automobiles, is being investigated in a study of the effect of different fuel mixtures and their exhaust products, in collaboration with members of the staff of the Robert A. Taft Sanitary Engineering Center of the U.S. Public Health Service in Cincinnati.

An investigation of electrical impulses of the cornea, as an indication of irritation of the eye, is being made by a graduate fellow in industrial medicine. The electrical impulses picked up from the cornea of rabbits, are

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to be correlated with irritation of the human eye.

Dermatologic Investigations

The research activities have been concerned essentially with the role of environmental factors and the pathogenesis of contact dermatitis -- both of irritant and allergic origin. The factors which have been under study are: ambient temperature and humidity, exposure to common chemical materials (soaps, synthetic detergents, polar and nonpolar organic solvents), substances which are known to accelerate chemical carcinogenesis, and ultraviolet and infrared radiation. In the past year it has been observed that exposure to ultraviolet light of 3200A and shorter wave lengths, results in decreased reactivity of animal skin to at least one potent experimental sensitizer.

It has been observed, clinically, that wetting and drying of the skin appear to increase the incidence of contact eruptions during winter weather. This is especially true of the dermatoses found among machinists and housewives. Further studies have been planned to explore the effects of repeated immersion of the skin (hands, etc.) in water alone as well as in mixtures of common chemical irritants, on the structural, physiological and biochemical integrity of the skin. These will include experiments to demonstrate the changes in the epidermis and the cutaneous barrier, of repeated wetting and drying in relation to certain biochemical alterations and to impairment of the defenses of the skin against the penetration of foreign substances.

Psychiatric Investigations (Industrial Mental Health - A Joint Activity of the Department and the Department of Psychiatry)

Detailed data have been collected from the personnel records of 325 employees in industry, and from the medical records of 168 of these. The personnel and medical departments of the industrial organizations have classified them as: long term absentees, short term absentees, accident cases, cases presenting interpersonal difficulties or inefficiency, repeated visitors to the

medical dispensary, and the "normal" effective employees. The supervisors have been interviewed to obtain ratings of their performance at work. Each subgroup has been divided into "experimentals" and two types of controls. The 117 "experimentals" have been given psychological screening tests, and have been interviewed by a psychiatrist or caseworker. Diagnostic assessments have been formulated and recommendations made for help on problems, including suggestions to family physicians and referrals to community agencies, and psychiatric clinics. These procedures are being repeated 2-3 years after the initial study. Comparisons will be made of the data in the records, as to changes in the "experimentals" as compared to the two types of "controls." Economic estimates will be made as to the value of any changes in relation to the costs of intervention. Other correlations will be studied bearing on the mental health of the "experimentals."

Division of Industrial Hygiene Technology

Air Pollution

A survey of air pollution caused by the operations of a large steel mill is being carried out.

- (a) The soot fall is being measured at various locations in the city, in relation to the site of the plant, from time to time during a full year.
- (b) The concentration of benzopyrene in the air in the vicinity of various operations in the coke oven area, and at one representative site in the residential area of the city, are being determined.
- (c) The quantities of various materials discharged from selected stacks of the plant are being measured.

A survey of air pollution caused by the operation of an electrometallurgical plant (metal silicides) is being made.

- (a) The dust-fall at a number of sites surrounding the plant is being determined periodically throughout one year.

- (b) The relationship of the dust-fall to the emissions from the stacks of the plant is to be determined.

A comprehensive investigation of the lead in the air of Cincinnati is near completion.

- (a) The air of Cincinnati is being sampled periodically at 4 representative permanent sites and at one mobile station, and these findings are being correlated, so far as possible, with analytical data obtained in an investigation of the lead content of the blood and excreta of representative residents of the city. (This is an investigation participated in by members of the Clinical staff of the Laboratory, as referred to previously.)

Industrial Hygiene

The metabolism of inhaled lead is being investigated in human subjects who are exposed to air containing 0.13 mg. of lead, as the lead sesquioxide, per cubic meter, to determine the ultimate extent and the fate of the lead absorbed under these conditions. The function of the division is to maintain the physical condition of these experiments and to analyse the biological materials that result from the experimental design. Determinations are being made of the occurrence and the concentration of Cd, Ni, Pb, Cr and B in necropsy from deceased persons free of industrial exposure to these metals. The selection of cases and the collection of the tissues are under the direction of physicians in the Clinical Division of the Department.

An analytical method for determining thallium in body tissues is being developed. A method for the determination of thallium in the urine has been devised and is in current use.

Division of Toxicology and Forensic Pathology

Toxicology and mode of action of certain organic-metallic compounds

The alkyl lead compound, tetramethyl lead, has been under investigation

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for some time, and is now nearing completion. This has been paralleled by additional work on tetraethyl lead, to establish the nature and significance of subtle differences in the metabolism of the two compounds.

Toxicology of various pesticides

A series of insecticides has been investigated over the period of the past twenty years. These involve prolonged observations on animals subjected to exposure under varying conditions, in order to determine the limits of safety for their various usages, in so far as this can be translated qualitatively into human experience. (Quantitative information concerning man can be obtained only on the basis of human experience in industry or elsewhere or through observations on human subjects in the laboratory.) Experimental methods are being examined critically in an effort to improve their qualitative relevance to human experience, with special consideration for their mechanisms of action. Six insecticidal products are under investigation at this time.

Toxicology of certain chlorinated hydrocarbon solvents.

Several representatives of the varied series of compounds are being investigated in a preliminary manner.

The metabolism of an organic mercurial compound

A radioactive compound is employed, and is being followed in its distribution in the tissues and excreta of animals, by means of measurements of radiation rather than by chemical analysis.

Investigation of mechanisms of industrial carcinogenesis.

This work, under way for many years, with special reference to cancer of the skin, is continuing and is concerned productively with the phenomena of chemical acceleration of carcinogenesis, under the sponsorship of several industrial organizations.

Invest

An antioxidant for various foods, and a preservative for flour are being investigated in relation to public safety. These investigations must comply with certain requirements of the U.S. Food and Drug Administration, but they must also meet the critique of the staff of the Department as to their relevance and adequacy.

Miscellaneous toxicologic investigations

A series of complex fluorides, and a number of industrial chemicals about which preliminary information is required, are being examined for their immediate toxicological characteristics.

Division of Bibliographic Research

A reference file of the current literature on the physiology and toxicology of substances of significance to environmental health is being maintained as background information for departmental personnel, graduate students and other

investigators.

An annotated bibliography of the occurrence, physiology and toxicology of lead and its compounds has been assembled over the years. It includes publications on this subject from the earliest times. References are recorded; abstracts have been prepared since 1948, and copies are distributed periodically to the members of the staff.

An annotated bibliography on the occurrence, physiology and toxicology of fluorine and its compounds has also been assembled. It includes publications on this subject from the earliest times. A compilation of about 3700 abstracts, published in 1938-1950 in book form, was sponsored by a group of industrial organizations. This work is now being continued under a grant from the National Institutes of Health. Supplements will be published at two- to three-year intervals; a separate, selected bibliography, to be of assistance to those

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interested in the fluoridation of drinking water, will be published yearly.

An annotated bibliography on the production, care and use of laboratory animals is being assembled, with the financial support of a grant from the National Institutes of Health (1953-1962). A compilation of about 1500 abstracts was published in December, 1960, by the Federation of American Societies for Experimental Biology, as Supplement No. 6 of Federation Proceedings; a supplement will be published in the January-February, 1963, issue.