Notes on the

HISTORY of LABORATORY OF PHYSIOLOGICAL HYGIENE

University of Minnesota

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The Laboratory of Physiological Hygiene had its origin as a result of discussions between the late President Lotus D. Coffman, Dr. Harold S. Diehl, Dean of the Medical School, Mr. Frank McCormack, Director of Athletics, and Dr. Maurice B. Visscher, Head of the Department of Physiology. The first purpose was to establish a focus for research on the physiology of man as related to the conditions of his life and to provide better instruction in physiology for students of physical education.

Temporary headquarters were established in room 314 Millard Hall in the latter part of 1937. In the spring of 1938 operations were begun on a limited scale in room 307 Millard Hall and adjoining rooms. Basic equipment and space for controlled studies on human activity first became available in 1939 and 1940. In the Spring of 1941 the program of the Laboratory was largely adjusted to work related to military problems, chiefly on Army rations. In the Summer of 1942 the Laboratory was moved to the present location under the South Tower of the Stadium. The housing for subjects in the upper part of the Stadium was provided, on a temporary basis, in the Fall of 1944.

The Laboratory proper, exclusive of the space temporarily housing subjects, has a floor space of about 11000 square feet divided as follows: 6 offices, 5 chemistry and physical measurement laboratories, 4 special experiment rooms (with attached shower and toilet), metabolism room (with attached toilet), x-ray room (with attached dark room), subject dormitory (with attached shower and toilet), library, kitchen, dining room, shop, 2 toilets, 6 storerooms.

The human experiment rooms have air conditioning (2 separate systems) which can maintain any combination of temperatures from 32 to 130°F. and humidities from 10 to 98% at any time of the year. The shop, and laboratory, the secretarial office and the Director's office have radiator heat; all other rooms have a forced-draft hot air heating and ventilating system. The Laboratory receives steam, water and gas through regular University lines; the electricity supply is from an independent power line and transformers.

The University has title to all but a small fraction of the installations and equipment and it is expected that title to the latter will be acquired from the Office of Scientific Research and Development at the expiration of present contracts.

The subjects used in the Laboratory comprise students, soldiers, patients and conscientious objectors. The latter men are volunteers transferred under the authority of the Selective Service System. The first Civilian Public Service Unit, consisting of nine men, joined the Laboratory in April, 1943. The Unit was increased to twenty men in January, 1944, and to sixty five men in October, 1944. For some purposes student volunteers are used; in other cases, where the experiments are prolonged and involve discomfort the subjects are paid according to the time and nature of the work. Patients, from various hospitals or referred by their physicians, have been used generally for only brief observations but it is expected that after the war more prolonged studies on patients will be made.

The central theme of the Laboratory is the exact measurement of human function and the factors affecting human performance and behavior. Of necessity this broad area is circumscribed and limited in practice but so far as possible an attempt is made to explore and examine at least selected variables representative of the major areas of function which may enter or affect or predict performance. Biochemical, physiological and psychological observations are made in parallel. Special efforts are made to use and to perfect functional tests in the nature of standardized stresses. The approach is not dissimilar to that of the engineering testing laboratory and efforts are made to adhere to equally rigorous standards. Much emphasis is placed on muscular performance because of relative ease of standardization and the wide ramifications in total physiological adjustment related to physical activity. Different individuals differ widely in physical activity according to occupation and athletic inclination and these differences presumably have past, present and future influences on the physiology of the

individual. We are convinced of the importance of subjecting the problem of individual physiology to careful scrutiny in the non-diseased state as well as in the presence of disease.

In general, the variables considered here break down into two groups:

1) Dependent variables: blood chemistry, urine chemistry, digestion, excretion, circulation, vision, hearing, motor speed, coordination, endurance, strength, intellective functions, emotional state and so on.

2) Independent variables: temperature, exercise, training, sleep, posture, diet, oxygen supply and so on.

It would be possible to study the relations between dependent and independent variables one by one and this is the customary approach in most other laboratories. For example, we could study the effect of posture on peripheral circulation, or the effect of muscular exertion on the peripheral visual fields, or the effect of temperature on chloride excretion. While such limited researches are valuable and are also made here, it is clear that this method is often both uneconomical and limited in value when the real question happens to concern the total behavior and performance of the whole organism. This Laboratory operates in the belief that the whole is frequently not predictable, quantitatively, from the separate examination of the isolated parts.

It may be stated that the Laboratory is devoted to the study of the entities which are loosely termed "fitness", "health" and "fatigue". A major concern is to supply quantitative, objective criteria which may be applied to clarify these vague but obviously very important concepts. It is hoped that in the process there will emerge the beginnings of a real science of physiological hygiene. The goal toward which we should like to contribute is the utopian situation in which, from a study of a given individual now, it would be possible to predict both short time and long range physiological results from a given mode of life, personal habits, activity and diet.

There is at present in the United States no other laboratory or institute precisely comparable to the Laboratory of Physiological Hygiene, the nearest approximation being the Fatigue Laboratory at Harvard. Facilities for some studies of the physiology of human exercise have been installed at Indiana, Iowa, Northwestern, Stanford, Cornell and Wisconsin. A few laboratories are increasingly using multi-variable approaches to human performance problems; the Department of Physiology at Northwestern and the Department of Medicine at Cornell are notable in this regard. There are, of course, numerous laboratories devoted to one or another special aspects of quantitative human function; examples include: circulation--Cornell, Pennsylvania, Cincinnati; renal function--N.Y. University; metabolism--Cornell, Mayo Clinic; heat exchanges--Yale, Rochester; muscular performance--Iowa; vision--Columbia.

Governmental agencies are increasingly participating in research on human performance and the war has given a tremendous but possibly only temporary impetus in this field. Among the principal organizations are the U. S. Public Health Service, the Navy (at Bethesda, Md., and at Pensacola, Fla.), and the Army (at Fort Knox, Fort Monmouth, Wright Field, Randolph Field and at Lawrence, Mass.).

Just before the war there were very large developments abroad in the total approach to the quantitative study of human function and performance. Great institutes were established in Germany (Berlin, Dortmund, Hamburg), Russia (Moscow, Leningrad, Kharkov) and Japan (Tokyo) and started in Belgium (Liege). Grandiose schemes were promulgated in Italy and a journal was founded in France. In England national conferences wereheld and the official proposal for a great national institute was commended in the Times and the House of Lords.

It is not possible to predict what will happen after the war but it seems probable that realism will urge much greater expansion and effort along these lines. The ordinary university department is very seriously handicapped in attacking problems of human performance, "fitness" and "health" efficiently and realistically.

Special laboratories, departments or institutes are needed in which suitable facilities, experience, organization and viewpoints are combined. To what extent will the universities assume these responsibilities? In many ways it would be unfortunate, both for the nation and for the universities, if research of this nature would be left wholly or even largely to the bureaucratic development of the federal government. Federal subvention may be necessary but in any case it may be hoped that at least some of the universities will find it possible, in this as in other fields of science, to maintain leadership in knowledge by advancing research which is fundamental without limitation to the strictly academic, and practical without being commercial. We believe the Laboratory of Physiological Hygiene has unusual advantages which should allow significant developments in the future.