

Physiology and Public Health

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In recent years we have become increasingly aware of the establishment, in a growing number of institutions, of specific departments whose concern is the "application of physiological knowledge to the practice of hygiene." Most journals concerned with public health, whether of a general character or devoted to a particular branch provide a section dealing exclusively with the physiological aspect, and such journals as *Arbeitsphysiologie* deal wholly with specialised angles of the subject. Courses in public health now usually include instruction in a wide field often termed "applied physiology" but which may sometimes bear the more restrictive appellation of "industrial physiology." But the application of fundamental physiological knowledge to human activity in modern industry is only one of the spheres of public health where such knowledge is with advantage being introduced. Indeed, there is no reason to doubt that, not only in virtue of its achievements till now, but because of the very nature of the subject, physiology in hygiene will occupy in time a position at least as important as the preventive and medical aspects.

What is the scope and status of physiology as applied to public health and state hygiene? It is the purpose of this paper to review in outline the position held by physiology in this field at the present time, indicating some main principles which guide its application and postulating some future lines of development.

The subject of public health may conveniently be considered as comprising a number of practical entities such as child and maternal welfare, school hygiene, domestic and personal hygiene, occupational and industrial hygiene. In all these branches the application of physiology fulfils primarily the same role. By the employment of the conceptions, "laws," facts and methods of "pure" or "academic" physiology it aims to determine and lay down the conditions that are essential for the proper performance of human activities in a healthy, normal manner; those activities—the expressions of the individual's practice of the art of life—having been studied and the "healthy normal manner" itself having been established and defined. The fulfilment of this task necessitates that both the individual and his environment come under critical consideration. In effect, the science of physiology which takes as one of its fundamental and oldest standpoints the inter-relationship of

the external and internal environments of the body, is here employed only in a new setting, that setting being the social and humanistic one.

By establishing the optimum requirements (though frequently in practice it may only be possible to enforce the minimum) and by comparing the actual state of affairs with these scientifically proven desiderata, the application of physiology immediately points the way to reform in legislation, administration and practice. The physiological approach may therefore come into conflict with the prejudices and established ideas of polity and of custom, tradition and convention. So it points the way also to the need for enlightenment through education.

The practical implications of this application of physiology may be examined with advantage still closer. The fundamental requirements of human beings stated in broad terms do not constitute a large number. That human beings require adequate food, shelter, rest incidental to the exhibition of the phenomena of activity, growth and reproduction is elementary. However, when we examine these requirements in the light of present-day Western civilisation and take into consideration the variability of human beings, the variation in their activities, the range of conditions over different parts of the globe and the far-reaching changes produced by continual invention, the matter, realistically viewed, becomes considerably complex in actual practice. Moreover, in many particulars that influence the lives of human beings, the intimate factors involved are not always known with certainty and the physiologist has still to busy himself with unravelling these important details. The number of effective and hitherto unsuspected influences are steadily growing, and we have begun to take into consideration a variety of novel factors such as the ionic content and electric charge of the atmosphere, heavy water and radiations from space. The more the physicist and chemist discover about the inanimate world about us, the more there is for the biologist to worry about regarding the relationship of these discoveries to the life of living matter.

Having ascertained with some certainty the physiological implication of a particular set of circumstances, the application in practice means that the physiologist—till now amateur technologist and technician—joins hands with the engineer, the legislator, and the administrator,

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It is the purpose of appropriate legislation to place many matters fundamental to the preservation of the workers' health and welfare beyond the pale of voluntary action by employers. In this regard notable progress has been made, for industrial legislation does embody at the present time measures which, both in the scientific and the humanistic sense, may be called enlightened. The provisions that the law makes can usually, in the first instance, only be of a general nature. The specification of the detailed rationalisation from the welfare point of view, for every industry is clearly not easily realisable. Nevertheless, as one can see in the recent great consolidating British Factories Act (1937) definite provision is made for the further enunciation of regulations, both general and particular, at discretion of the authority.

Of various measures relating to industrial hygiene, a significant number find their justification to a great degree on a physiological basis. There may be mentioned provisions regarding heating, ventilation, lighting, safety and first-aid measures, removal of and protection against dust and fumes, rest pauses, duration of work, lifting of weights.

It is clear that the applications of physiology which are finally embodied in industrial legislation, though very important and not inconsiderable, represent only a portion of the contribution which industrial physiology makes in this branch of hygiene. In other fields, it may be mentioned that air-conditioning, a science of rapidly growing importance to industry (as well as outside it), has witnessed the fruitful collaboration of physiologists and engineers over a long period. A glance at the reports of the Industrial Health Research Board or of that department of the International Labour Office dealing with the subject will show the important place occupied by physiology in modern industrial practice.

Up to the present we have been concerned mainly with the utilisation of physiological knowledge for the arrangement of conditions in industry for the physiological operation of the work cycle. There are, however, occupations the nature of which preclude altogether or to a great extent any interference with, or modification of, the environment. Instances of such occupations are deep-sea diving, high altitude flying and work in atmospheres heavily charged with poisonous gases and fumes as for example decontamination by anti-gas squads. In such cases we resort to the stratagem of providing a physiological microclimate. Thus for ascents to high altitudes various types of respirators and special suits

have been designed with due regard to the intimate processes of the haemo-respiratory system. And, similarly, the provision of air for divers and for men in submarines requires a precise knowledge of the physiological processes involved. Science vouchsafes that the bomber can ascend to great heights to let loose his gas bombs, and that the decontaminator can thereafter appear to attempt to clear away the poisonous fumes liberated. A telling but sad reflection.

In some cases it is possible to discover individuals who can bear the severe conditions of a particular occupation more successfully than others. Such individuals are enabled to do this by virtue of the possession of the appropriate physiological compensatory and adaptive mechanisms. This may be peculiar to the individual, perhaps hereditary, but most usually it is the result of training or of previous exposure to like conditions. Selection of individuals can only be made with a knowledge of the essential bodily processes necessary for adaptation to the new conditions, and it is important to know also the pathological results that may follow the failure of adaptation. Selection tests have been devised for a variety of hazardous occupations and amongst these may be mentioned the tests for pilots (Schneider, 1918), and for mine workers (Dreosti, 1935a, b).

Apart from specialised tests of this kind, tests for general fitness are invariable in the selection of applicants for such public services as the police, the army, the air-force and navy. They are a feature also of the examination that individuals have to undergo (or should undergo) as candidates for employment in occupations where a high standard of physical health is a *sine qua non*. It is on the basis of such tests, carried out on individuals in the above-mentioned circumstances, and also on persons applying for insurance, together with data relating to school-children that a nation as a whole can be rated as being A1, B2, C3 and so on. However discouraging findings have been to nations who consider themselves as "great," it is important to realise that proper attention to factors that lower the general rating is in the main a relatively simple matter provided that the individual, the school, the head of the family and, in many cases the State, exercise their proper influence. Ignorance on the part of the individual is the door at which a good deal of the blame can be laid. However, economic circumstances are usually the main factor bringing about improper attention. The school has begun to exercise in this respect one of its most important functions, namely,

the correction of ills which home conditions have done little to mitigate and indeed may have engendered. Examples where the State has exercised a directive influence are not wanting on the Continent, and in South Africa we have the admirable achievement of the Special Service Battalions in improving the physique, stamina, and state of nutrition of many individuals who would ordinarily have been rejected and remained at a very low grading. The school milk-schemes in Great Britain are also a notable example.

Without going into any detail whatever concerning a subject which has become a very large one, it can be pointed out that physiological considerations play a fundamental role in vocational guidance, using this term in its widest sense. Here, as in all the applications of physiology, it must always be borne in mind that the latter can hardly be considered apart from a great number of other questions which are invariably involved, those relating for instance to the psychological, the sociological, the economic and the medical.

Training is a process that often calls for the attention of physiologists in occupational hygiene. Fitting subjects to new tasks involve problems concerning adaptative responses and their limitations. A knowledge of these allows the physiologist to decide, in relation to the individual on the one hand and the task and environment on the other, the nature and duration of the training required. Gradual acclimatisation of individuals to such conditions as high altitudes or hot environments (Dreosti, 1935b)

are examples of specialised training planned on a physiological basis. Training in athletics and sport is another very important department of this subject. With a proper understanding of what is involved, it is probable that "conditioning" of the body can go very far. Artificial methods, it is conceivable, may yet be discovered which will extend man's limits of adaptability considerably. Let us hope, particularly as regards industrial occupations, that these are always to be made for man and not *vice versa*. Otherwise we may well reflect on the possible biological breeding of workers for particular activities after the manner of the nightmare Utopia of the Brave New World.

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Rectal Incontinence;

Some Anatomical and Surgical Aspects.

JACK PENN.

The possibility of inflicting rectal incontinence is the bugbear of surgical procedures in the ano-rectal region. The problem as to what may be cut away with impunity and the significance of the sphincters has confronted most of us during our surgical internships. They certainly have troubled the author repeatedly; and as other practitioners may have had the same difficulties, it is the object of this paper to supply the solution to some of the ano-rectal problems.

There is no claim to priority in any of the methods mentioned; the facts having been culled from various proctologists, tempered by personal experience.

In order to keep the subject on a purely surgical basis the nervous control of continence has not been discussed.

The accompanying diagrams will show better than words the anatomy of clinical importance relative to this subject. The musculature is shown from three aspects:—

- A ... As viewed from below;
 B ... In sagittal section;
 C ... As viewed from above the rectum.

A. Fig. 1 shows the pelvic diaphragm as viewed from below. It consists of the component parts of the levator ani. Particular attention must be paid to that portion known as the pubo-rectalis