

SCIENCE

FRIDAY, NOVEMBER 25, 1921.

EDUCATION IN RELATION TO PUBLIC HEALTH AND MEDICAL PRACTISE¹

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PERHAPS the most obvious thing that can be said in regard to education in relation to matters of health and medical practise is that such education is sadly needed. I may state the matter rather more strongly by saying that ignorance on these subjects is directly responsible in the United States alone for the loss of several hundred thousand lives each year, and an amount of sickness and suffering which we can express in no adequate measure. Ignorance of the laws of health, of the causes of disease, of how to avoid epidemics; ignorance of how to take care of children in the perilous period of infancy; ignorance of how to secure the proper medical aid in case of sickness and of how to take care of one's self or dependents when ill,—ignorance in one form or another is probably the most potent of all the allies of the angel of death.

The maintenance of life, whether in man or in lower animals, always implies an adequate adjustment of the organism to its environment. Since relatively few human beings die of old age, most death can be attributed to failure to make the proper adjustments. Among the things that our organism has to guard against are enemies of various sorts, lack of the proper quantity and quality of food, vicissitudes of climate, accidents and diseases, and it is obvious that the more we know of the various agencies that cause people to die, the more successful we shall be in avoiding or overcoming them. If one goes over the most common causes of death enumerated in the U. S. Mortality Statistics, he can not fail to be impressed

¹ Read before the Symposium on Science and the Public Health, held under the auspices of the Pacific Division of the American Association for the Advancement of Science, Berkeley, Calif., Aug. 4, 1921.

with the fact that the things that make people die are to a large extent avoidable. Of course we must all die some time. But knowledge has enabled man to cut down very materially the death rate from many causes in the past few decades and with greater diffusion of knowledge it is perfectly possible to make tremendous strides further in the same direction.

It is not sufficient that this knowledge be in the hands of the medical profession merely, much as humanity in general might gain and has gained by the application of this information to the prevention and cure of disease. The general public must be enlightened in regard to the preservation of health if the knowledge in the possession of the medical world can be applied in the most effective way. Imperfectly developed as medical science may be at the present time, there is a tremendous amount of sickness and death that could be avoided if the great mass of humanity could avail itself of the resources of medical knowledge and skill that are now available. As Dr. Benjamin Moore says in his book "*The Dawn of a Health Age*" in speaking of conditions in England,

At the present moment we possess sufficient knowledge of medical science to enable us to save at least three hundred thousand lives every year in this country alone, and the saving of these three hundred thousand valuable lives could all be effected without costing the nation a single penny, but rather at the same time many million pounds a year might be saved which under present conditions are absolutely wasted.

For this deplorable situation there are a number of causes, one of which is our commercialized system of private medical practice, but another is the widespread lack of information in regard to the preservation of health and the proper utilization of the medical aids within reach. But besides the drawbacks due merely to ignorance, there are others that are due to traditional modes of thought that have come down to us from the days of the primitive medicine man and which can not be properly appreciated except in the light of their historical development. We

may no longer believe in sorcery and magic but numerous individuals are still swayed by various attenuated superstitions which may determine their conduct when matters of life or death hinge upon the correctness of their judgment. Most of us set little store by charms and amulets, but many are prone to look upon medicines as effecting cures in a quite mysterious way. Much mysticism and superstition still linger in popular notions of medicine. Cures are not infrequently attributed to supernatural interference, and the functions of priest and medicine man that were originally performed by the same person are by no means yet completely dissociated. The old theory of demoniacal possession as the cause of disease and the old practise of exorcising the intruding spirits in order to effect a cure still survive, in a modified form to be sure, but with easily recognizable marks of their descent. As a scientific theory of disease, by the way, this primitive belief has a decided advantage over some of its modern outgrowths in its relative simplicity and rationality if we once grant the demonological premise upon which it was founded. And on account of the recent recrudescence of animism in several quarters I rather look forward to its being revived.

There can be little doubt that the influence of old traditional notions is no small factor in determining the attitude of many people towards problems of health in the educated and the un-educated classes alike. Many people who may be perfectly scientific when it comes to matters of building bridges or repairing engines, may rush when ill to some quack of whose qualifications they know nothing, or adopt procedures as stupid as wearing a charm or repeating some mummerly to ward off the evil eye.

We are losing our old-time naïve confidence in medicines and to a certain extent the medical profession. We know that doctors often disagree, that they continually make wrong diagnoses, that they have their fads in methods of treatment that spread like epidemics over the profession only to be abandoned after a short period of trial; people are dis-

turbed by the teachings of so-called schools with their different theories of the cause and cure of many diseases. And when they are ill they are puzzled to know where to go for relief. Smith recommends Dr. Jones; Brown advises an osteopath; someone else favors a Chinese herb doctor who is reputed to have made some wonderful cures; another suggests a favorite patent medicine; another urges the employment of an electric healer; still another extols the virtues of hydrotherapy; and Mrs. X. would have them go to a Christian Science healer to help overcome the illusion that there was anything the matter at all. Out of the thousands of things that have been prescribed and swallowed for various ailments a mere handful have stood the test of time and fuller experience. Almost any liberal-minded modern doctor will tell you this, but a large part of the public fails to appreciate how far the medical profession has advanced and still regards the doctor as chiefly a dispenser of dopes.

Not only is there much misconception of medical science and practise but there prevails a good deal of dissatisfaction and discouragement with medicine that is not devoid of substantial grounds. It can not be denied that our present commercialized medical practise prevents a large part of the public from obtaining the medical attention it needs and which, for the welfare of society in general, it should receive. As Dr. Cabot has remarked, the only persons who can afford adequate medical aid are the very poor (who are often taken care of for nothing) and the very rich. This circumstance doubtless leads many to become dissatisfied with medicine in general and renders them prone to be misled by the attacks of the enemies of medical science who seem to be growing in numbers in proportion as the science has advanced and its real service has become extended.

Among the large bewildered and dissatisfied class there are many who have gone from one doctor to another without ever falling into the right hands. There are many unfortunately for whom there is simply no help

available in the present condition of medical science. And there is a large class of persons with imaginary ills who continually haunt the offices of doctors in the vain effort to obtain relief. All these classes are apt to furnish recruits to the opponents of medical research and practise who, whether from a semi-religious fanaticism or from motives of financial gain, make themselves a constant menace to the health of the community.

A large proportion even of educated people have no proper orientation upon the present situation of the science of medicine. What is particularly hard for them properly to realize is the difficulty of the problems which the physician has to solve and the extent to which he is handicapped by the failure of science to afford adequate methods of diagnosis and cure. The physician is continually confronted with problems the only honest answer to which is "I don't know." But his patients are naturally disappointed with such a verdict, even when assured that the doctor will take the necessary steps to get at the root of the trouble. Frequently patients can not be made to consider the situation in an unbiased manner and have no proper appreciation of a truly scientific attitude on the part of the physician. The demand of such patients to be humbugged often leads the physician to adopt an attitude of pretense and assurance in order to cheer up his patients and keep his business.

The remedy for this situation—and conditions in this regard have improved in recent years—is more scientific training on the part of doctors on the one hand and enlightening the public as to what may reasonably be expected of medicine on the other. Well-trained and high-minded physicians who treat their patients with entire candor and frankness even at the risk of alienating many of them do much toward educating the public to take the right attitude in turn toward the medical profession. With improvements in the standards of medical education and the elimination of the poorly equipped practitioner who is, perforce, something of a pretender, the esteem with which the medical profession is

regarded will surely rise and many causes of dissatisfaction which now alienate people will tend to disappear.

It is important that the public be made to realize that although medical practise is very old, scientific medicine is still in its infancy. The public should know something of the great conquests which have been made in recent years in the struggle against disease. It should know something of the rôle of bacteria in causing diseases, how diseases are spread, and consequently how they may be checked. It should have some knowledge of the achievements of protective inoculation, serum therapy, the relation of knowledge of physiology and pathology in understanding and treating disease, and the general dependence of medical science and practise on the development of the fundamental sciences on which medicine rests. It should appreciate that most of these sciences have had their greatest development in relatively recent times, that the cause of public health is dependent upon their further advancement, that we are living in a period of great achievement and promise, and that we may save millions of human lives and endless suffering by the support and encouragement of scientific research.

Unless the more educated part of the community have some vision of the development, present situation and promise of medical science, it is apt to be more strongly influenced by the shortcomings of present-day practise than by the wonderful achievements which medicine has actually won. But very recently in our own state, California, the educated public showed itself in danger of being misled into supporting legislation in the interests of quackery and even of fanatical opposition to medical research.

The public health is a public trust. If this trust is not discharged properly, the public will have to pay a fearful bill. The more informed the public becomes, the higher are the standards that will be demanded of those that practise the healing art, the more adequate will be the provisions for public hygiene and sanitation, the more satisfactory

will be the relations of doctor and patient, and the more generously will investigation be supported. Even among educated people there is sore need of education along these lines.

But greatly as many educated people need educating, there is a frightful amount of suffering and needless death among the more ignorant elements of the community and especially among our large immigrant population. The recent book of Mr. M. J. Davis on "Immigrant Health and the Community" reveals a general situation that is very bad. Our great immigrant tide lodges mainly in cities where the various nationalities are segregated in crowded districts where they live under unhygienic conditions. Their death rate as shown by the U. S. Mortality Statistics and the investigations of a number of life insurance companies is markedly in excess of that of the native-born. Their infant mortality is high. The studies of the U. S. Children's Bureau have shown that in many towns it is two or even three times that of the native Americans, and that it tends to decrease with greater length of residence in this country. While a certain amount of the enhanced mortality of the foreign-born is due to their low economic status, a larger part of it is due to ignorance in regard to the maintenance of health. Many immigrants do not know English when they arrive and never learn it afterward. The newspapers printed in foreign languages,—and there are over 1,200 of them in the United States,—are full of the advertisements of quacks, it being a noteworthy fact that while such advertisements have decreased in papers published in English they have greatly increased in papers published in foreign languages. The uninstructed foreigner who does not distinguish between the regular physician and the advertising quack is swindled out of his money and fails to get competent aid when he is ill. Many belong to Benefit Societies and receive for a small fee the perfunctory service of some lodge doctor. Numbers frequent free clinics and dispensaries where they are rushed through a cursory examination and given a

bottle of something to allay their more distressing symptoms. All along the line the immigrant gets service which is scamped if he is not actually swindled by charlatans and quacks. The barrier of language prevents him from receiving that enlightenment on the subject of quackery which has done so much toward guarding the English reading public from being defrauded. The same barrier keeps him from securing needed aid from his English-speaking neighbors and in consequence of his ignorance and isolation death exacts a heavy toll.

Nothing can demonstrate more forcibly the importance of widespread education in relation to public health and medical practise than the unfortunate situation of many of our foreign-born population. And we should pay much more attention than heretofore to the problem of protecting these people against the results of their own ignorance and the ravages of unscrupulous charlatans.

But we need a much wider campaign of education. Naturally one thinks of the schools which should at least give more generally than they do, the elementary instruction in physiology and hygiene which would prepare the students, in a measure, for understanding many problems with which they will later have to cope. The Federal Government is making a small beginning in the way of instructing people through various publications on matters of public health and especially in the care of infants. Boards of Health in many cities are carrying on the work of education and this work could be easily extended. Papers and magazines may do much for the cause as is evinced by the articles of Dr. Wiley and the attacks of *Collier's Weekly* on various medical frauds. Life insurance companies are finding it to their interest to disseminate information on the preservation of health among their policyholders and even supply nurses to attend them during illness. The various societies affording sickness and accident benefits to their members would probably find it advantageous to give instruction about keeping well and thus save themselves from paying money to members after they are sick. So also with the large

industrial firms which employ physicians and maintain hospitals for their employees. And the doctors themselves might consistently with their calling—for we should bear in mind that doctor means teacher—the doctors might do much more than they do in the way of educating the public on matters of health.

All of these agencies I have mentioned and more besides have to do with instructing the public and all of them could well do more. This task which as we have seen is of such vital importance for human welfare would be greatly facilitated if the medical profession stood in more helpful relations to its patrons. As it is, a large part of the time of well-trained medical men is simply wasted in a kind of desultory practise from which their patients secure no permanent benefit. For this the patients may be quite as much at fault as the doctor. Thorough diagnosis with its tests for blood, urine and sputum, its bacteriological examinations and perhaps its X-ray pictures and other procedures is coming to be beyond the resources of any one physician however well qualified. And all these things are expensive. Adequate medical aid is simply out of the reach of people in ordinary financial circumstances, and the experiences with doctors which they can afford are so frequently unsatisfactory that they lead to discouragement and cause many to put up with ills that are the source of much unhappiness. Humanity comes very far short of getting out of the medical profession the aid which it is capable of furnishing and which it could probably furnish without any greater expenditure of time and effort than now goes into the hurried examination of multitudes of patients and the scribbling of prescriptions for the relief of their symptoms. Just how the business of relieving the ills of the body should be organized I do not presume to state, but until it is done more effectively than it is at the present time the relations of the medical profession to the public will be subjected to more or less strain. This strain is increasing, and it may be productive of much harm in a number of ways. It will not be removed, I fancy, until some system is evolved whereby the rank and file of suffering human-

ity who have no relish for becoming charity patients can obtain the medical attention they require at prices that are not prohibitive. There is a growing sentiment, both in the medical profession and out of it, in favor of working out a solution of this problem, and we are perhaps justified in looking forward to a more effective and satisfactory regime in the years to come.

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THE RELATION OF THE TECHNICAL SCHOOL TO INDUSTRIAL RESEARCH¹

RESEARCH is earnest, purposeful, persistent, intelligently directed effort to gain new knowledge of a selected subject. The spirit of research is devotion to truth and insistent longing for better understanding.

Industrial research is research done for industry. It may be:

1. In fundamental sciences, or
2. In applications of sciences.

It is difficult to set limits for the second class, distinguishing research from experimental development of processes, methods or equipment.

In the main, the environment of an industrial establishment is not congenial to fundamental research in the sciences. Furthermore, the connection between fundamental research and the business of a given establishment commonly is so attenuated that it is difficult for boards of directors to see justification for expenditure of stockholders' money for such research. Fundamental research, having less immediate connection with commercial profits, there is much less incentive for its control or for secrecy with respect to its results, in the interest of one establishment or group. Hence, fundamental research is especially suitable for those technical schools which can afford research departments. Then, too, such research lies close to the recorded knowledge

¹ A paper presented to the Conference on Engineering and Industry in connection with the inauguration of President John Martin Thomas, Pennsylvania State College, October 13, 1921.

and the theory with which the student has been familiarizing himself in his courses of study. It is a rare undergraduate, however, who will be competent for more than an assistant's part in research.

Industrial research in technology, or applied science, demands practical experience in the industry as a preparation for successful work. Indeed, it can not be done without knowledge of the particular industry. It often requires equipment or facilities of a kind or magnitude which can not be provided in technical schools. Only for limited problems, or under special arrangements, therefore, will this class of research properly be undertaken within a school. Students and faculty members may, however, participate in such research within an industrial plant under suitable conditions. Such direct connections with industry are stimulating to both teachers and students, and help to create a spirit of mutual appreciation between industries and schools.

The fields of research in which industry is concerned must not be too narrowly conceived by the schools. These fields are not limited to physics and chemistry, but include all the mathematical, physical and biological sciences, economics, and, not least, though mentioned last, those branches of inquiry which relate to men and women in industry, comprised in the term "personnel." To advance such studies, there has been established by the joint efforts of National Research Council and Engineering Foundation, the Personnel Research Federation. It has for its purpose the correlation of research activities pertaining to personnel in industry, commerce, education and government wherever researches are conducted in the spirit and with the methods of science. Its membership includes selected national organizations representing scientists, engineers, educators and the American Federation of Labor. The membership is now being widened to include other organizations of kindred interest. It has been learned that there are approximately 250 organizations in the United States giving