SCIENCE

FRIDAY, OCTOBER 23, 1914

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SCIENCE AND PRACTISE[1]

THE Society of Naturalists at this meeting celebrates its thirtieth anniversary, an occasion which in itself perhaps calls for no special felicitation, but one on which we should all rejoice on account of the safe passing of a crisis in its life. Not many years ago its very existence was threatened, and now the society finds itself securely established for a definite purpose. Conceived by its founders as a means to bring together workers in biology for the discussion of topics of common interest, it was confronted almost at the outset by a condition in which there appeared to be no such topics, so rapidly did the organization of more special societies from its midst take place. It seemed as if its career were to be that of the ephemerid, a sacrifice to its own fecundity. Ultimately, however, as a result of an experiment suggested by the late Professor Penhallow, when president of the society, a process of regeneration took place, not an exact restitution of all that had been lost by autotomy, but rather a sort of heteromorphic growth, which, while preserving the old shell, transformed the main functional activity of the organism to a new sphere, specialized but nevertheless having much common ground of interest. It is particularly appropriate that the society should have taken up the field of genetics as its own, for what has its career been but one long persistent effort in practical eugenics? Though its early experiences did seem to resemble a self-destroying schizogony, we now look upon

[1] Address of the president of the American Society of Naturalists, Philadelphia, 1913.

them as the more usual type of parenthood. Its offspring have become many and waxed strong. The eldest daughters have begun to reproduce their kind and just to-day the society rejoices in the advent of a new grandchild.[2] We can see long vistas of new physiological associations reaching out into the dim and distant future, and no one can predict where this propagation of societies will end. We view this with equanimity so long as the new organizations do not become too narrow in their interests and so long as they continue to recognize the mutual benefits of regular family reunions. From this year's gathering the society notes with regret the absence of some of its most fancied children.

Through its relationship to the affiliated societies the Society of Naturalists has now come to represent in a general way the interests of biological science. It is important that there should be some such body in existence even if it were solely for the maintenance of the proper relationship between our science and the public.

In these days of intense practical activity and social unrest it is difficult to overestimate the need for the application of science to every-day life and to the sudden exigencies of our social organization. I do not mean merely the application of science to industry or to physical health, but rather the more general relation of science to human aspirations and to human conduct.

Man to-day, while still retaining instincts which he shares with other animals, is distinguished from them by the vast modifications which accumulated experience has brought about. Social, moral and religious sanctions are so interwoven with instinctive impulses that it is all but impossible to distinguish between what is nature and what is nurture in our make-up. Yet this is the fundamental criterion for all action that seeks to improve mankind either through breeding a better race or through the modification of his behavior.

Human civilization has its many visible signs in the machinery it employs and in the objects it collects about it. These are the outward expressions of the mental and moral impulses that have actuated man and which we collectively call culture. Many definitions of this elusive spirit have been attempted, but I like best Matthew Arnold's characterization, that culture has its origin in the love of perfection, and involves two main elements—the passion for knowledge and the will to do good. It rests upon right thinking as well as upon right doing—I like this conception because it recognizes culture as creative, and not merely as passive appreciation.

> To give these forces [of culture] names from the two races of men who have supplied the most signal and splendid manifestation of them, we may call them respectively the forces of Hebraism and Hellenism. Hebraism and Hellenism—between these two points of influence moves our world. At one time it feels more powerfully the attraction of one of them, at another time of the other; and it ought to be, though it never is, evenly and happily balanced betwen them. . . . The governing idea of Hellenism is *spontaneity of consciousness;* that of Hebraism, *strictness of conscience.*[3]

Science, like literature, art and other instruments of culture, has fallen under both of these influences. Yet science in its last analysis is the very embodiment of the Hellenic spirit—the passion to know. Its great intellectual achievements are the fruition of this ideal. The application of these to the alleviation of human misery and the uplift of the world are manifestations of the spirit of Hebraism.

The commonest and the most distorted

[2] The American Society for Experimental Pathology.

[3] "Culture and Anarchy," pp. 110 and 113.

view of the value of science finds utterance in the glorification of its relation to mechanical invention and industry in general. I am not one of those who believe that science has been sullied by this alliance, but I do wish to emphasize the one-sidedness of this point of view. These improvements are applications of science. They have given us much comfort and ease, and they have suggested some of the most interesting fields for purely scientific study though, on the other hand, they have brought in their wake some of the most difficult problems with which society is confronted. However, it is not the material benefits that man now most needs. In these days when most perplexing questions are crowding upon us, it is not so much the results of science as it is the spirit of scientific inquiry and the application of scientific method that are indispensable. To have an array of investigators covering all fields of human knowledge is not sufficient. What is most needed is that the scientific spirit should permeate much further into the rank and file of humanity, that there should be a more general appreciation of the value of science beyond what it does for our bodily comfort.

It is not necessary to dwell at length upon what constitutes the spirit of science and what its methods are. Accuracy in observing and recording natural events is the very foundation of its existence; power of analysis, sense of proportion of values, and imagination are necessary for its highest achievements. The watchword of science is fair play and fearlessness in recognizing that the rules of the game are inexorable and that any infraction of them leads sooner or later to disaster. It is too much to expect the man in the street to possess scientific imagination and subtle analytic power, but it is not beyond reason to hope that there may be found in him ultimately a greater regard for accuracy and fair play in forming opinions to guide his conduct.

Modern life is, however, not satisfied with opinions—we have them to satiety. It demands action as well as words. This restless demand for action reveals undiscriminating and half-baked opinions, and it leads to one individual demanding that others make their own conduct conform to what he thinks is right.

We are just now in a period of exuberant Hebraism. At least at the present time the Hebraic ideal seems to be the dominant if not the only uplifting force opposing the most sordid materialism. But we need more light—we are in sad need of the genius of Hellenism in general affairs. It is the part of science to breathe this spirit, to provide the basis of action that is right and to discourage doing for the mere sake of doing. If, though, practical life has too much of Hebraism, the very best of science is too much without it. Scientific men must take greater part in the affairs of the world, not only in industry, but also in the idealistic movements of society. The unrelenting abomination of sham, hypocrisy and wilful ignorance which inheres in science means far more for mankind than the solution of particular problems. Who, for instance, would place the chief value of astronomy in its application to the art of navigation, to surveying, or to the prognostication of the weather, rather than in what it has done in widening man's horizon and giving right appreciation of the relation of himself and the earth to the universe? The sublime ideas of infinity of space and time and the beauty of the simple laws of planetary motion have had a value to mankind far transcending that of any so-called practical application of stellar science. The theory of evolution is in the eyes of the mul-

titude a totally unpractical idea. Yet it has done more to stir the foundations of society than the steam-engine or the telegraph.

The failure of scientific men to exert their full measure of influence in affairs rests largely upon their guilelessness and naiveté in dealing with men as well as upon their natural reluctance to express opinions on subjects about which they feel they know but little, especially since the problems involved are usually of far greater complexity than those encountered in their regular work. You will see that I am overcoming that reluctance this evening.

Society, maintaining itself upon an incomplete knowledge, which is always in process of growing, must necessarily at times receive rude shocks and make new adjustments. Just at present all its constants seem to have become independent variables. Old traditions have given way and doing is preferred to thinking. To be called a man of action is to receive the highest approbation of one's fellow-men. Yet there never was an age when there was greater need for sound thinking.

The pressing problems all involve in their last analysis the relation of the individual to society. In how far shall liberty of the individual be subordinated to that of the community? For better or for worse the doctrine of *laissez-faire* is in abeyance. It is the abuses of individual liberty that are uppermost in men's minds, and the defense of individual rights is in danger of being left completely in the hands of those who would use them for selfish ends. The spirit of social and moral progress is ground between the upper millstone of doctrinaire reform and the nether millstone of commercialism. Many good and wise men find themselves in a dilemma from which there seems to be no way out.

The more purely economic and administrative problems need perhaps cause no great misgiving. They are likely to keep themselves adjusted to the requirements of the nation even though sharp clashes of interest do arise, for here there are more exact measures of value and a sort of self-regulating mechanism which, while it may often get out of order, nevertheless will not fail entirely. It is for the social and moral questions that solutions seem most remote and the direction of travel most uncertain.

In this age of militant reform the list of measures proposed for the regeneration of mankind and for which organized propaganda is made is a very formidable one. Effort is correspondingly scattered and really important movements are befogged in a cloud of petty and oft ill-advised attempts at correction. Reformers are good citizens with the best of intentions and are frequently the sole influence for good in a community. The evils which they combat are often very serious, so that one hesitates to do or say anything in opposition to their aims, or even to the means they employ to realize them. Yet there are weighty and by no means selfish considerations that may constrain one at times to raise a dissenting voice and draw attention to some of their misdirected efforts.

The chief characteristic of reform is the dominance of Hebraism over Hellenism—"the preference of doing to thinking." It is always ready to act, and to act with enthusiasm according to what it supposes to be light, though half the time remaining blind to the need of more knowledge and neglecting the means of obtaining it. There is neither breadth of view nor sense of the proportionate value of things.

Particularly misguided are those reforms that seek to enforce by legal enact-

ment various forms of abstinence, that empty sort of moral felicity the real virtue of which consists in the circumstance that it may be followed later by some properly regulated and supposedly innocuous indulgence. The prohibition movement is the best to consider here by way of example because it is one of great force and one that aims to combat a serious evil. Any argument that is valid against it will hold *a fortiori* against similar movements.

The misery caused by drink, with all its hygienic, economic and moral phases, appeals dramatically to man's sympathy and awakens the desire to do something to mitigate it. To accomplish this no means would seem simpler and more direct than the prohibition of the sale of liquor by law. The results of this method have not been satisfactory, however, except perhaps in small communities, because the habits of mankind involved are treated merely as so many physical obstacles to be thrust aside by a calculated amount of force. It is not reasonable to expect that a large minority—within a fraction of fifty per cent. in the state of Maine—will submit to the regulation of their personal habits by scarcely more numerous neighbors. Not having the moral support of a large enough proportion of the population, the laws are violated to a scandalous degree. Thus, while the intent of the prohibition laws constitutes an unjust infringement of individual rights, their failure to accomplish their purpose, which is inevitable, is responsible for evils far more fundamental and more insidious than the drink habit itself. This is realized by a great many thoughtful persons but, incredible as it may seem, opposition to the propaganda of prohibition is left largely to those pecuniarily interested in keeping the liquor traffic intact. There are certainly some most exasperating and disheartening aspects of the liquor situation in this country—so many, in fact, that worthy citizens sit in their clubs and drink, at the same time giving a long list of reasons why they vote "no license." Nevertheless a large proportion of these evil features could readily be eradicated if we had less of that hypocrisy and cynical contempt for the law that is engendered by the existence of so many laws not really in accordance with public opinion. The experience of other countries amply justifies this view.

The methods employed to obtain prohibition legislation are often more objectionable than the measures themselves. Public opinion is aroused by protracted campaigns led by paid agitators, where enthusiasm for the cause precludes all consideration for opposing views and the rights of the minority. The legislative chambers become invaded by a veritable lobby of political and moral intimidation, and the final passage of an act is made the occasion of scenes that belong to the time of the crusades rather than to the present. Even the halls of the national congress are not exempt from such spectacles,[4] and yet those who believe that important questions should be settled with full knowledge and in a fair and dispassionate spirit stand aside and leave the opposing ground to the brewery and the saloon. To tolerate such methods for accomplishing even the most worthy purpose constitutes the gravest kind of danger to our political and social organization. The pernicious habit once acquired will surely be used for baser ends. The art of exhortation is confined neither to the righteous nor to the wise, and much, if not all, of what is done by the revivalist method will inevitably be regretted in the light of reason and have to be undone—often with difficulty.

To attempt to stop drinking by legal

[4] December 11, 1913.

compulsion is to overlook that behind the tangible evils of drink there lies a weakness of human character. It is but the part of foresight to look to influences that strengthen self-control rather than to remove some particular temptation. The latter action substitutes the restraint from without for the far more ennobling and enduring restraint from within. Man is too much of an imitator not to have his individual character deeply modified by environmental influences. The force of a good and cheerful example will accomplish more than preaching and artificial restraint. All can not be saved, but it were better that some go to the wall than that all sicken in that stifling air of virtue by act of legislature.

Almost daily some new "crusade" is chronicled. Some are directed against real evils, others are trivial and still others vicious. These reform movements, so far as they seek to regulate the private life of individuals, show weaknesses of the same kind as those just cited and probably none of them has the justification that the drink evil affords. More sound thought and less hasty action is needed. Let there be less running to the legislature for laws that make new crimes of venial offences, and laws that extend the definition of serious crimes to include lesser transgressions. Undue severity of punishment, instead of stopping crime and immorality, merely brings the law into discredit. "If we inquire into the cause of all human corruptions," wrote Montesquieu in "The Spirit of Laws," "we shall find that they proceed from the impunity of criminals, and not from the moderation of punishments. Let us follow nature, who has given shame to man for his scourge; and let the heaviest part of the punishment be the infamy attending it."[5] If this be true for major crimes, and the Romans at least found that it was, how much more does it hold for those very natural offences against good behavior that moral zealots seek to punish with severe penalties. But, I fear, such wisdom is a long way off from general recognition in this country, for, as Mr. Bryce pertinently remarks, "For crotchet-mongers as well as for intriguers there is no such paradise as the lobby of a state legislature." Lest this seem far away from science, remember that the method of science is based on experience. Shall we throw all past experience to the winds in our mad dash for the millennium?

The youngest reform movement, as yet but scarcely born, the one which all biologists must be watching with parental solicitude, is eugenics. But this youngster, too, needs protection from its overzealous friends. Already the enthusiasts are demanding legislation, unmindful of how little information we really have to base it on, and oblivious of the vast complications of a problem which touches the very vitals of our social and our animal organization. For the present the practical application of eugenics to man would best be left to that minority of thoughtful and rather unimpulsive persons who are willing to experiment upon themselves and their descendants. On the other hand, we need not look upon the widest extension of this practise with any misgiving. The eugenic sanction, even if it does require the subordination of the impulse of the moment to future expectations, is far less artificial than many of the restraints imposed by our present social conventions.[6] In considering the motives that may impel mankind in the future to more general practise of eugenics, it does not seem likely that young men and wo-

[5] *Op. cit.*, Vol. 1, p. 96. Nugent's translation.

[6] Havelock Ellis, "The Task of Social Hygiene."

men will be carried away to any extent by a higher sense of duty toward remote posterity. The ideal will be realized rather through the due appreciation of a fragment of ancient wisdom: "The father of the righteous shall greatly rejoice; and he that begetteth a wise child shall have joy of him"—Hellenic sense from a Hebraic source.

Holding the view that many of the tendencies of the time may best be combated by more general use of the methods of science, and by less worship of material results, it is pertinent to inquire how to make the scientific attitude of mind more prevalent. Here the immediate problem is not one of eugenics. Even for the present generation and the one following it we hope to do something through individual training.

Our own time has witnessed the extensive introduction of science teaching into the schools and there are now no important institutions of collegiate rank in this country where science is not at least on an equality with the humanities. As a consequence of this we should expect more satisfactory results than have been obtained. The fault is that in our science teaching too much stress is laid upon the mere imparting of information, in response to the demand that subjects must be presented in an attractive and entertaining way, and in disregard of the fact that the chief value of science lies in its methods and its spirit. We do not make enough of methods and thoroughness. School and college science is much too desultory; there is no practise in that power of sustained thought that is so necessary to the drawing of right conclusions. In the schools there are possibly difficulties in the way of concentration of studies, but it is by no means so in the colleges, and such concentration is at present hindered only by the time-worn notion that culture consists in knowing a little about everything. Specialization has been forced upon us by an unprecedented activity in all branches of learning. Not to plan our curriculum in accordance with this condition is futile. If we want men who can direct their attention to the solution of the large problems of life we must give our youths practise in concentration of thought—some rigorous schooling in the methods of reasoning by which problems are solved. One who has had such training, no matter in what subject, will have no difficulty in picking up any information he may need, but the man who has scattered his efforts will ever flounder hopelessly and will find his appetite for sound learning dulled by his persistent nibbling.

This leads to the general question of the value of discipline, a feature of training sadly lacking in our American life. We indulge our children at home, we demand no mark of respect from them, we give way in deference to all their whims, and we are pleased to see them entertained rather than instructed and trained in our schools; and on top of all of this unwise and unfitting early training it is sought to reform the world by laws that require the most self-denying conduct. Are we not trying to "teach the old dogs new tricks" —an impossibility known to the world long before the study of animal behavior became a science? Could not infinitely more be accomplished by a rigorous early training? Good habits acquired in early life would surely obviate the ground for much of that clamor for compulsion at a period of life when compulsion comes hard.

If our educational system and our family training do not altogether measure up to their opportunities in bringing more of the scientific spirit into life, what shall we say of the relations of our agents of

publicity to the problem? If the masses are not reached in the schools they may be reached through the newspaper, but at present the relation of science to the press is in a lamentable state. Especially in this country, where we pride ourselves on the freedom, the enterprise and the versatility of the daily newspaper, the relation is particularly unsatisfying to scientific men, and altogether ineffective as a means of properly interesting and informing the public on scientific progress. Probably the fault lies on both sides. The press, in catering to the popular taste for the sensational and in disregarding the very foundation of scientific inquiry, which is accuracy, utterly fails to reflect the purpose and the results of scientific activity. On the other hand, men of science hold themselves aloof, and do not appreciate their opportunity to exert a useful influence. It may be that the latter is the real root of the evil. In any case, it is at this end of the line that we ourselves may best try to help out. It is true that the limited experience which members of our profession have had in the matter of newspaper publicity does not lend much encouragement to the hope of a satisfactory outcome. Some of the most influential dailies avowedly have the desire to promote the true interests of science in relation to the public welfare; they have the confidence of some scientific men, and often have direct access to the sources of discovery, but what one of us can be satisfied with the form in which new discoveries are reported? We can not, of course, expect statements of our work to command the attention of the public if couched in the language of the *Jahresbericht*. Explanatory matter must be given, but beyond the demand of a diseased taste for the sensational, is there any necessity for the form in which science is now presented in the newspapers? Must a discovery, in order to attract notice, necessarily be heralded in flaring headlines as the greatest of the day and be accompanied by a full-page portrait of the discoverer? Yet that is the kind of science given to the newspaper-reading public to quench its thirst for knowledge.

Each year there are held in this country, not to speak of the world at large, numerous scientific congresses, at which much is communicated that is of the utmost importance to civilization. We should expect to find the proceedings adequately and decently reported in the newspapers. That this expectation is vain, is, however, obvious. To relate a little experience of my own will serve to answer why it is so. A few minutes before being called upon to speak at a medical congress not long ago, I was approached by a reporter who asked for an account of my paper. My remonstrance that he could soon hear what was to be said to the assembly, evoked the reply that he hadn't time for that and, besides, he wouldn't be able to understand if he had. Immediately after the meeting another reporter came up and asked me to explain the papers that had been read, and particularly what was meant by the terms "tissue," "cell" and "heart-beat," confessing frankly that he hadn't understood a word of what had been said.

Clearly there is no reason to find fault with either of these men for their ignorance. They may have been quite competent in their regular work. They certainly had the virtues of frankness and of knowing their own limitations. It would be unreasonable to blame a reporter of sporting or police news for a lack of knowledge of radio-activity or experimental embryology, but what should we say of otherwise resourceful newspapers that send such men to report scientific news for a knowledge-craving and credu-

lous public? That such subjects can be sensibly and accurately reported in the daily press is proved by the splendid record of the London *Times,* as shown, for instance, in its admirable reports of the last International Medical Congress. These reports have almost the accuracy that one would expect to find in official proceedings of the meetings. It is clear that the meetings were reported by experts, not only possessed of requisite knowledge, but also highly skilled in the art of writing. Here is an example worthy of emulation, and a splendid opportunity for some of our best papers to serve the public interest.

We read the newspapers and furthermore we believe what we read more than we are willing to admit, though we damn them and sneer at them at the same time. But it is wrong to say that conditions are hopeless and incapable of betterment. Improvement in the relations between science and the press can be effected through closer contact and understanding. Scientific men must emerge occasionally from the sanctum and endeavor to make their aims and their work understood. The press for its part must in reporting science give up catering to the public demand for the sensational, and allow itself to be inoculated by the germs of accuracy and honesty that give life to the scientific spirit. The scientific man must not be pictured as an alchemist in medieval surroundings, searching for the elixir of life or the philosopher's stone. He is both human and modern, and the public will learn to appreciate him sooner as a man than as a magician. The habit set by reporting science in the spirit of science would ultimately spread to the more usual fields of newspaper activity and lead to more accuracy and less desire simply to make a good story in reporting news. This and a more rational conception of what science stands for and what its methods are will give to the average man the power to view his own problems with sanity and clearness and discredit a large measure of the cant that now gains many followers.

In giving expression to belief in the signal importance of the scientific spirit for practical life we come inevitably to those questions which every one has asked and no one has answered. Whither is it all leading, and how is it going to satisfy our human yearnings? It has been often said, and correctly, that we, the philosopher-scientists of to-day, have but traveled as did the poet-astronomer eight hundred years ago.

> And many a Knot unravell'd by the road;
> But not the Master-Knot of Human Fate.

But need this observation in its modern application be interpreted as a wail of pessimism? I think not. Though modern science has not pretended and does not now pretend to have unraveled the master-knot, though its philosophy even shows that we can not hope to attain that goal, the unraveling of knots by the road has shown no tendency to stop and new ones are ever appearing, no matter how far we go. Every knot unraveled effects some change in the relation of man to his environment, and sooner or later calls for some act of re-adjustment on his part. In this respect the modern relation of science to practise seems to differ fundamentally from that which obtained during the period of Hindu and of Greek ascendency, and this circumstance leaves ground for hope that the civilization based upon it may long endure and escape the fate of its forerunners so well described in Huxley's words:[7]

> The Vedas and the Homeric epos set before us a world of rich and vigorous life, full of joyous fighting men
>
> "That ever with a frolic welcome took
> The thunder and the sunshine. . . ."

[7] "Evolution and Ethics."

and who were ready to brave the very Gods themselves when their blood was up. A few centuries pass away, and under the influence of civilization the descendants of these men are "sicklied o'er with the pale cast of thought"—frank pessimists or, at best, make-believe optimists. The courage of the warlike stock may be as hardly tried as before, perhaps more hardly, but the enemy is self. The hero has become a monk. The man of action is replaced by the quietist, whose highest aspiration is to be the passive instrument of the Divine Reason. By the Tiber, as by the Ganges, ethical man admits that the cosmos is too strong for him; and, destroying every bond which ties him to it by ascetic discipline, he seeks salvation in absolute renunciation.

In our present culture the passion to know and the finding of new knowledge calls forth the desire to act even though the two impulses are not always found in the same individual. The very technique of modern science requires action; ideas are followed by experiments and experiments give new ideas. Discoveries lead to inventions which revolutionize social and economic conditions. On the other hand, practical instruments have suggested some of the grandest ideas of science, as when the problem of the economy of the steam engine led to the discovery of the law of the conservation of energy; and who will set any limit to the flow of ideas set free by present social and industrial conditions? Thought and action are in an infinite alternate succession. Because of this, because of the relation of present science to every phase of life—physical, intellectual, economic, social, ethical—I believe that the love of right thinking will not endanger our will to act.

Nor is there grave danger in the determinism of science, which has proved to be such an effective weapon in the pursuit of knowledge. Present methods of investigation become impossible if not based upon the postulate of the "uniformity of nature," but, at the same time, the motive to carry out our inquiries, the passion for knowing, takes us ever to new and untrodden fields, broader and of ever increasing interest. This enormous unknown region, which renders the prediction of the remote future but idle fancy, and hems our ability to predict our own conduct even in commonplace affairs, leads us to ascribe to ourselves freedom to act as we will, and to place upon individuals a proper share of praise and blame for their acts. This feeling, which is instinctive, will not generally give way unless the time should come when all of the events of nature can be foretold with precision.

It is not my wish to indulge in the pastime of prophecy. The tendencies of the time, though in reality but ripples, may often seem like mountainous waves about to engulf all. We may consider ourselves fortunate if we can see over the crest of the nearest wave and apply our strength and skill to stem its force. The present danger is not a wave of individualism and anarchy; it is rather a perversion of moral and intellectual ideals that seeks to confine spontaneity and individuality within a pale of external restraint, to minister to all wants, to regulate all joys—in other words, to *standardize* human character, by smoothing out to monotonous level those ups and downs of life that make us what we are.

Thinking and doing are for the time out of balance. Science has the power to restore and maintain the balance by breathing more of its spirit into practical life, and if an instrument to guide this work is needed—if it is right for men of science to have a confession of faith—I know of none more inspiring than the words that Huxley used in defining his own life purpose:

> To promote the increase of natural knowledge and to forward the application of scientific methods of investigation to all the problems of

life to the best of my ability, in the conviction which has grown with my growth and strengthened with my strength, that there is no alleviation for the sufferings of mankind except veracity of thought and of action, and the resolute facing of the world as it is when the garment of make-believe by which pious hands have hidden its uglier features is stripped off.

ROSS G. HARRISON

PUBLIC HEALTH EDUCATION, WITH SPECIAL REFERENCE TO THE SCHOOL FOR HEALTH OFFICERS OF HARVARD UNIVERSITY AND THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY[1]

FROM time immemorial the world has recognized three great professions—the ministry, law, medicine. They stand, respectively, for love, order and health—the great trinity upon which human happiness is founded. During the nineteenth century another profession arose, different from the other three in that it concerns itself with things external, but nevertheless of vast importance to the well being of the race—the profession of engineering. With many parts, heterogeneous, amorphous, the world has not always recognized it as a united whole; but gradually it has become crystallized around the central idea that "engineering is the application of the great forces of nature for the use and convenience of man." Thus our professional triangle has become four square and our modern civilization may be said to rest upon the four learned professions—the ministry, law, medicine, engineering.

Between these corner posts of education the framing of our social structure is intimate and complex. Beams stretch from one post to the other, and there are braces and cross-braces; combinations of sciences, sub-professions and vocations. As civilization becomes more complex the network thickens until we can scarcely recognize the boundaries of our callings and even our avocations become mixed with our vocations.

[1] Address delivered at the New York State Conference of Sanitary Officers at Saratoga, N. Y., Sept. 15, 1914.

Every once in a while some particular need of the race comes prominently to the front, and as the need becomes filled and men educate themselves for it we say a new profession has come—meaning a new species, not a genus.

At the present time the great need of the world is *peace*. The new science of engineering has built one of its structures too high and it has toppled over. Over-developed armaments have thrown the nations into a sea of blood, from which only the other three professions can rescue them, those which stand for love, order and health. But it is not civil engineering which has wrecked Europe, it is military engineering—the application of the great forces of nature not for the use and convenience of man but for the destruction of man. This is not what is meant when we speak of the new fourth great profession.

Although engineering has failed to blot out war, it has done much to blot out the other great scourges of the race—famine and pestilence. The development of transportation on land and sea has brought the wheat fields of the smiling prairie to the parched desert, and has widened the market gardens of the city. Agricultural engineering has multiplied the fruits of the soil. The development of cold storage has widened our markets in time as well as distance. Future famines from natural causes will occur only when engineering fails to do its work.

In combating pestilence the profession of engineering has combined with that of medicine. When disease comes from without it requires the aid of a profession which deals with things external, and as disease always acts within it requires the aid of a profession which deals with things internal. It is idle to discuss whether the doctor or the engineer plays the greater part in preventing disease. Where so much has been accomplished by both, where the work to be done is so great, there are tasks enough and rewards enough for both professions. In fact we must include the professions of ministry and law because social service and legal force are potent weapons in the campaign for health. Let us recognize as our first principle that the leaders in this cam-