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THE HUMANIZING OF KNOWLEDGE[1]

I

ANY most familiar object will suddenly turn strange when we look it in the face. As we repeat some common word or regard keenly the features of an intimate friend they are no longer what we took them to be. Were it not for our almost unlimited capacity for taking things for granted we should realize that we are encompassed with countless mysteries which might oppress our hearts beyond endurance did not custom and incuriosity veil the depths of our careless ignorance. That I am "I" to myself and "you" to all of you, who are each of you "I" to yourself is on contemplation a perturbing circumstance. That the vibrations of my vocal cords should stir ideas in you is no easy matter to explain, and no one has yet been able to tell us why we and the earth so inerrantly attract one another. But these can hardly be called mysteries to most of our fellow men, who are so inured to personality, speech and weight that they are for them scarcely observed commonplaces.

Those to whom a commonplace appears to be most extraordinary are very rare, but they are very precious, since they and they alone have made our minds. It is they who have through hundreds of thousands of years gradually enriched human thought and widened the gap that separates man from his animal congeners. Without them the mind as we know it would never have come into existence. They are the creators of human intelligence. The mass of mankind must perforce wait for some specially wide-eyed individual to point out to them what they have hitherto accepted as a matter of

[1] Address before the American Association for the Advancement of Science, meeting in conjunction with the Pacific Division in Salt Lake City, June 23-24.

routine or failed altogether to notice. These mind-makers are the questioners and seers. We classify them roughly as poets, religious leaders, moralists, story-tellers, philosophers, theologians, artists, scientists, inventors. They all are discoverers and pointers-out. What eludes the attention of others catches theirs. They form the noble band of wonderers. Commonly unnoticed things excite a strange and compelling curiosity in them, and each new question sets them on a new quest. They see where others are blind, they hear where others are deaf. They point out profundities, complexities, involutions, analogies, differences and dependencies where everything had seemed as plain as a pike staff.

In short, poets, philosophers, religious geniuses, artists and scientists are all rare variants of the human species, who emerge here and there through the ages. Sometimes they make a wide appeal to their fellow men; often they stir their resentment or horror; most frequently they suffer neglect and contempt. A discovery to which no one listens is obviously of little or no importance. It is a mere private gratification which concerns only the discoverer himself. So the great question arises as to what determines the *success* of a new idea; what establishes its currency and gives it a social significance by securing its victory over ignorance and indifference or over older rival and conflicting beliefs?

To be accepted by the multitude of non-discoverers an idea must obviously be *attractive* to them in some way or other. And what are the kinds of attractiveness which promote the wide dissemination and the firm and prolonged acceptance of beliefs? This is a difficult question, and I do not flatter myself that I can answer it very satisfactorily. I take it that the new idea must seem "good," and mayhap noble, beautiful and useful, and that it must fit in pretty well with existing notions; or at least must not threaten violently to dislocate the accepted scheme of things. If it is ugly, wicked, discouraging, humiliating or seriously disturbing to the received plan of life it is likely to be shown the door. Ideas like kisses go by favor. The *truth* of the new idea proposed for acceptance plays an altogether secondary rôle. We rank the Good, True and Beautiful together but it is shocking to observe how little does the success of a new observation depend upon its scientific or historical credentials. In almost all we hear, read, say and come to believe, truth, in the scientific sense of the term, is a matter of almost complete indifference. It is irrelevant and may seem an impudent intruder and marplot. We often naïvely use the word "feel" for "believe," and even the word "believe" means to cling to something dear and precious, and good in our sight—to accept what we like to accept. And the wonder grows that there ever appeared in this world of ours a group of men like those here assembled so eccentric as to regard truth as the paramount issue.

If we make an exception of certain homely matters of fact which have underlain the development and practice of the industrial arts, mankind has until very recently been nurtured in the main on beliefs that were not submitted to any rigorous test of scientific or historical criticism, and which for the most part would not have been able to withstand careful scrutiny. But it would be a grave mistake to assume that what from a modern scientific standpoint are myths, poetic fancies and gross misapprehensions have not played an all-essential part in the building up of the human mind. Man's beliefs had inevitably in the first instance to be what suited him and what he naturally and easily grasped and clung to. For it is not the precise truth of an idea, as we have seen, that leads to its wide acceptance but its appeal; its congeniality to a being of the nature and setting of man. There had to be a vast widening of the primitive imagination and vocabulary, and innumerable guesses about real and imaginary things before a phenomenon so strange as modern science could emerge. Logical definition and speculation can operate quite as well—indeed better on unreal presuppositions than on experimentally verifiable ones.

Among the wonderers and pointers-out the poet, who "fancy light from Fancy caught," whose "thought leapt out to wed with thought," has always been surest of a large audience. For songs, heroic tales and rhapsodies can be attuned to the heart's desire—they are magic

carpets on which we can voyage whither we will. Their truth is the deepest truth, that of vague human longings. When we are told that Kubla Khan a stately pleasure dome decreed, "where Alph the sacred river ran, through caverns measureless to man, down to a sunless sea," we do not feel obliged to consult a list of Tartar rulers, or locate the sources of the river Alph, or consider the geological formation of limestone caverns. Few will be disturbed by the question of what particular species of wood louse secreted the honey dew, or the probable number of bacteria occurring per cubic centimeter in fresh milk of Paradise. When the scientific rumor reaches the poet that Nature is so careful of the type, so careless of the single life, he will find many who will share his impulse to kneel down upon "the great world's altar stairs that slope thro' darkness up to God." The truth of human fears, disappointments and aspirations is indeed the supreme truth, being made as we are, and is likely to remain so. All other truth no matter how true is in comparison dust and chaff, except for the few who owing to their highly exceptional temperament crave proofs and precision, at least in some narrow segment of life's circle.

Religion shares with poetry and romance the appeal to man's natural and deep longings and spontaneous inclinations. Indeed, among the many definitions of religion none is perhaps better than that of Santayana, to whom it seems to be poetry sometimes mistaking itself for science. Religion has concerned itself, at least during historic times, with those terrors, awes, obligations and aspirations which rest on a belief in supernatural beings, good and bad. It has to do with our vivid fears in a world of sad mischance; with the hopes, restraints and sacred duties which might in some way offset life's incalculable tragedies. The poetic elements in religion are accompanied by more or less definitely formulated beliefs about man's origin and nature and the workings of the things about him. These convictions are commonly of ancient and untraceable genesis, although they may finally be very logically and precisely stated by a Saint Thomas or a Calvin and form a part of a closely concatenated philosophical system. One may not, however, take the same liberties with religious beliefs as he may with the fancies of the poet. The adherents of a particular religious creed are not free to pick and choose, and reject what comes to seem improbable. The "truth" once delivered stands, for it depends largely on the form of its original delivery. It is the word of the Most High or of some prophet inspired by him. At least this has seemed inevitable to a great majority of Christians and their leaders since the founding of their faith. Religion therefore makes a double appeal, that of poetry and of divinely certified truth about all the great concerns of life. It meets questions about our origin, duty and possible fates, without any call for painful critical thinking, suspension of judgment and dubious, ever-to-be-revised, theories and hypotheses.

II

These preliminary reflections have been necessary in order to introduce the scientist to himself. He is quite as prone as others to take himself for granted and not realize what an altogether astonishing and even grotesque mystery he and his doings constitute. He, like the poets, philosophers, theologians and artists, belongs to the small and precious group of persistent wonderers. He is a questioner, a discoverer, a pointer-out. He like them gives meaning to things that would otherwise pass unnoticed. But there is something inhuman in his methods and aims. He craves a meticulous precision of observation, measurement and statement quite alien to the other teachers of men. He exhibits an almost shocking insensibility to the cherished motives of belief. He does not ask whether what he looks for is right or wrong, beautiful or ugly, useful or futile, comforting or distressing. He only asks whether what he finds is an instance of something really happening. He persistently carries his analysis as far as he can and scrupulously sets down just what he has seen and the inferences he may make or suspect. Moreover he interests himself in what appears to the overwhelming mass of mankind as stupid trifles which promise neither pleasure nor profit. What difference can it possibly make whether

a caterpillar has four muscles or four thousand, as described by the indefatigable Lyonnet; whether the light from metallic arcs may contain wave lengths as short as a six hundred thousandth of a millimeter; whether the solutions of the violet salt of chromium sulphate are stable at room temperature; whether there are sixty or eighty thousand species of beetles. And in other fields, what does it profit a man to be able to point out the interpellations in the Book of Ecclesiastes, or discover the origin of the Edict of Milan or describe the marriage customs of the small and obscure tribe of the Todi. And yet there can be no doubt that these and similar questions and their answers constitute the great bulk of scientific knowledge that has been accumulated during the past three centuries. They are stowed away in monographic contributions, proceedings and transactions under innumerable rubrics which no single man of science no matter how broad his interests and comprehensive his knowledge could possibly recall. This esoteric treasury of knowledge, the very existence of which is unknown, or indifferent, even to the so-called educated classes, is like a vast safety deposit vault with its many boxes large and small. The keys are in many hands, but few there be that can open more than two or three of the boxes.

Nevertheless the scientific investigator and the scholar has his own peculiar rewards. He finds a few like-minded persons to cooperate with him. Scientific research is not simply a solitary indulgence of infrequent and eccentric individuals. Little drops of knowledge coalesce into bigger drops, and odds and ends of detailed information gradually get shifted into patterns of great interest and beauty. For the world proves to be indefinitely investigable. Then there is much refreshingly human in the pursuit of knowledge. The investigator is the hero in a romance; he is keener than the sleuth of the detective tale and knows it. He has his territorial disputes, his ententes and his wars with his fellow scientists.

It is apparent however that the sustained and arduous scientific research which has gradually built up our fund of knowledge is a pursuit for the few. It is far from a seductive occupation for even creative minds of the poetic and religious type. It often requires years to ascertain facts and record observations that will in the end fill a small, abstruse and technical pamphlet. For research is mainly looking for things that are not there and attempting processes that will not occur. The layman has little notion of this. Experimental science is tireless fumbling and groping or, in its taxonomic aspects, the painful discrimination and comparison of detail. It is subject to innumerable disappointments in following trails that lead out into a boundless desert or up against barriers that it seems hopeless to try to scale. For the scientist does not make his own landscape as does the poet and even many philosophers, nor can he fly hither and thither at will, but he subjects himself to the tyranny of the natural phenomena or processes that he is observing, and, as Bacon says, he works "according to his stuff and is limited thereby."

The successs of modern scientific emulation lies very largely in its stubborn refusal to consider natural phenomena in terms of human impulse and mankind's native interests. During the Middle Ages the world was thought to be made for man. It was the vestibule to an eternal existence that awaited every human soul beyond the grave. As his transient sojourning place and scene of trial it had a moral and edifying quality which underlay a great part of the speculation about natural things. Around about the earth were the heavens, the ever perfect and incorruptible dwelling place of God and the angels and of the blessed who were found worthy to see His face. Those who began the reconstruction and further amplifying of knowledge, from the early seventeenth century onward, were on their guard against these older genial anthropomorphic and geocentric conceptions of Nature, and they also found various excuses for neglecting the sanctified interpretations prevailing in the universities. The preferences of the observer were to be ruled out. He was to be merely a careful and neutral spectator who must not allow himself to become so warmly implicated in his discoveries as to sacrifice a whit of his eager indifference. Of

course this proud isolation was subject to many compromises, conscious and unconscious. And from a philosophical standpoint the onlooker, as has often been pointed out, is always one of the essential elements in the observing and recording. The ideal was, however, and still is, to dehumanize scientific investigation so far as may be. And this method has approved itself by its exceeding fruitfulness.

III

The question here arises, how did this scientific ambition ever come to be a matter of public concern? How did this professedly idle curiosity, as Veblen ironically calls it, confined as it is to rare and eccentric intellects and affecting a superb indifference to human interests, ever come to influence the beliefs and daily lives of great masses of mankind? The indubitable and ever growing social significance of modern experimental science is the result chiefly of three historical tendencies.

1. In the first place the minute and scrupulous observations and calculations and careful inferences of the natural scientist have in a few cases formed themselves into such impressive generalizations as to catch the attention of laymen. Examples of such large reconstructions are the reduction of the celestial bodies to physical and chemical processes; a growing substitution of respect for so-called natural laws, and a corresponding decline of confidence in miracles and magic, the partial elimination of the diabolical in the theory and practice of medicine, and latterly the frank inclusion of man himself in the order of nature. This process of transforming a naturally unscientific creature into a scientific one has of course not gone very far, and the tendency has met with varied and insistent opposition with which we are all familiar.

2. In the second place the inventor and engineer have in the interest of practical utility seized upon certain details of scientific discovery and with the connivance of the business man, influenced by motives of pecuniary profit, succeeded in revolutionizing industry and intercommunication, thereby gravely altering the conditions, possibilities and problems of civilization. Scientific research originally carried on for its own sake has thus produced indirectly the most far-reaching effects on our daily life. Moreover the constant refinement of technology has led to the invention of scientific apparatus without which research could never have reached the point it has. A striking example of this is the perfecting of electrical apparatus which has recently rendered possible the discovery, bewildering in its implication, of the electrical nature of matter.

In the beginning mankind was in no position fundamentally and permanently to modify his environment in his own interests. He had to make such terms as he could with the uncontrolled order of nature. To-day through scientific knowledge and experiment he is constantly engaged in remaking the world to suit his convenience. He indeed often yields to the temptation to exploit his resources with a reckless abandon which raises many serious problems in regard to the future of the race. He substitutes mechanical devices for the human hand; he generates and distributes new forms of power, and has finally learned through synthetic chemistry to create an indefinite number of new substances. Achievements of this class are the most spectacular outcome of applied knowledge and have done more than anything else to secure the scientist a specious popular esteem. But the problem is becoming acute whether that esteem is of such a character that it will permit the overwhelming process of readjustment to be guided and controlled by those best qualified by natural competence and training to prevent varied catastrophe.

3. A third less theatrical but none the less significant effect of the progress of natural science has been the influence which its ideals and methods, so successfully applied to the investigation of physical, chemical and biological processes, has had on the conception of man himself, his origin, history, habits and institutions. Anthropology, history in all its branches, philosophy, psychology, economics, and all other departments of research bearing on man's nature and conduct are undergoing changes of a momentous nature so revolutionary in their theoretical and practical implications that some recent writers go so far as to maintain that a great part of what has passed for social science

is obsolete or obsolescent; that it will pass away in the light of new scientific knowledge even as the scholastic philosophy was supplanted by experimental science. Man suddenly finds himself a bewildered actor in a new drama where he must learn his part all over again on pain of disastrous failure in his appointed rôle.

To summarize the preceding reflections: Modern scientific research, in spite of its professed aloofness and disregard of human feelings and motives, has succeeded in unfolding to our gaze so new a world in its origin, development, workings and possibilities of control in the interests of human welfare that practically all of the older poetic and religious ideas have to be fundamentally revised or reinterpreted. Scientific knowledge ingeniously applied and utilized by inventors and engineers has, with the assistance of business men and financiers, metamorphosed our environment and our relations with our fellow men. Lastly, our notions of our own nature are being so altered that should we discreetly apply our increasing knowledge of the workings of the mind and the feelings a far more successful technique might finally emerge for the regulation of the emotions than any that has hitherto been suggested. This is at least an exhilarating hope.

Now if all this be true we are forced to ask whether it is safe when our life has come to be so profoundly affected by and dependent on scientific knowledge to permit the great mass of mankind and their leaders and teachers to continue to operate on the basis of presuppositions and prejudices which owe their respectability and currency to their great age and uncritical character, but which fail to correspond with real things and actual operations as they are coming to be understood. For a great part of our beliefs about man's nature, the rightness and wrongness of his acts date from a time when far less was known of the universe and far different were the conditions and problems of life from those of to-day. Do we not urgently need a new type of wonderer and pointer-out whose curiosity shall be excited by this strange and perturbing emergency in which we find ourselves and who shall set himself to discover and indicate to his busy and timid fellow creatures a possible way out? Otherwise how is a race so indifferent and even hostile to scientific and historical knowledge of the preciser sort—so susceptible to beliefs that make other and more potent appeals than truth—to be reconciled to stronger drafts of medicinal information which their disease demands but their palates reject?

IV

It is this paramount question that I had in mind in preparing this address. I have not the time nor indeed the capacity to make its multiform and urgent necessity clear as I should wish. But many of you, I know, have already been thinking of the matter and will concede the necessity and urgency without further argument. Others will have experienced a vague anxiety and foreboding about the present state and prospects of scientific advance, and what has been said may help to clear their minds if they do not agree forthwith that the present crisis is of the precise nature and gravity that it seems to me to be.

Much has been written of the conflict of science and religion. But this is to narrow down the real problem, which is nothing less than the stupendous task of cultivating an appreciation of the nature and significance of precise thought and exact knowledge in a being by nature and nurture so careless of truth and given to modes of thinking repugnant to scientific intelligence. For even the more magnificent scientific discoveries, especially those of recent years, have not penetrated into our general education and are entirely disregarded in most discussions of social problems. And yet an imposing accumulation of critical information of wide bearing is at our disposal which could become an active factor in the readjustment of the troubled relations of man were it possible to overcome the obstacles to its general dissemination and acceptance.

A striking illustration of the present ineffective methods of popularizing cardinal scientific discoveries has recently been supplied by the revival of a strong and threatening opposition to the knowledge we now have of man's affinity and obvious relationships with the rest of the organic world. The idea of organic

evolution is perhaps the most momentous in its bearings of all the great generalizations which have come with increased knowledge of the globe's history and the history of its inhabitants. Those who will take the trouble to consider even in the most elementary manner the multifold and concurrent evidence of the successive appearance of vegetable and animal species on the earth and the reasons for including man among the primates, can not fail, unless they be utterly blinded by prejudice, freely to concede the animalhood of man. The matter has been set forth by skillful writers such as Huxley, Wallace, Haeckel, John Fiske, Drummond and many others in a manner so plain and convincing that it would seem that no one would have the slightest inclination to take issue with them on the general proposition. But to judge from the conscious and unconscious confusion that seems to prevail in the minds of many the matter is still very ill-understood by even intelligent laymen.

Recently a serious misunderstanding has resulted from the report that men of science are giving up "Darwinism," that "Darwinism is dead." This has puzzled those who supposed that evolution was a well substantiated assumption, and has filled with a somewhat malicious joy those who have always denounced the notion as wicked and opposed to Scripture. To the public, Darwinism means evolution, man's monkey origin, as the matter is popularly but inexactly phrased. But to the paleontologist and biologist Darwinism does not mean the theory of man's animal descent, which was formulated long before the publication of the *Origin of Species,* but is confined to the ingenious theories which Darwin so patiently worked out to account for the facts of evolution. The statement that Darwinism is dead does not mean that the evidence for the evolutionary hypothesis has in any way been weakened or that any really competent man of science doubts our animal derivation. It only means that Darwin's explanations of how one species may have been derived from another have proved, as a result of increasing knowledge, to be mistaken or wholly inadequate. It means that we can not any longer assign the importance he did to sexual and natural selection and the hereditary transmissibility of acquired characters. But the confessed failure so far of biologists to clear up the process of evolution, or experimentally create a new species from an existing one, does not affect the facts derived from many converging sources which lead to the unavoidable conclusion that man has a genealogical relation to the higher animals.

It is the extraordinarily illuminating discovery of man's animalhood rather than evolution in general that troubles the routine mind. Many are willing to admit that it looks as if life had developed on the earth slowly, in successive stages; this they can regard as a merely curious fact and of no great moment if only man can be defended as an honorable exception. The fact that we have an animal body may also be conceded, but surely man must have a soul and a mind altogether distinctive and unique from the very beginning, bestowed upon him by the Creator and setting him off an immeasurable distance from any mere animal. But whatever may be the religious and poetic significance of this compromise it is becoming less and less tenable as a scientific and historic truth. The *facts* indicate that man's *mind* is quite as clearly of animal extraction as his *body.* Those older observations which are classed under paleontology, zoology, comparative anatomy, bio-chemistry, physiology and embryology, which reveal innumerable conformities and affinities between man and the higher mammals in structure, function and development from the egg, are now being paralleled by observations, classed under comparative psychology, functional psychology, anthropology, prehistoric archeology and intellectual history, which show that man's mind like his body is akin in its nature and fundamental operations to that of the higher animals.

The historical and comparative methods of approaching the study of the human body are largely responsible, as you are all aware, for our present rapidly growing understanding of it. The historical and comparative study of psychological phenomena—of what we call reasoning, emotions, impulses, the will—promise to be quite as clarifying and revolutionary when they can be freely applied. They will

alter the whole conception of the various old divisions of philosophy—logic, epistomology, psychology, ethics—and tend to put these hitherto rather unreal and half mythical disciplines on a firmer foundation of observable facts. To cite a single example of this hopeful tendency, John Dewey has recently issued a book called "Human Nature and Conduct" in which he frankly reverses the usual procedure of writers on ethics. He first takes up the nature and workings of the human animal and then attempts to deduce the general rules that would seem appropriate to a creature like man. Now, the moralists in the past have in general neglected man's nature, of which with their mistaken presuppositions they could at best know but little, and have devoted their attention to accepted standards of conduct, ancient and dubious in origin, which they sought to justify by subtle theories and ingenious applications. This was, of course, to do little more than to rationalize the prevailing morals and mores. Hence the general barrenness of ethics as commonly understood.

Those who follow the recent developments in philosophical speculation can not fail to see how deeply they are influenced by the methods and discoveries of natural science. Indeed this old distinction between "natural" science and our knowledge of man himself is an artificial and misleading one. Man is an integral part of the natural order; he and his environment are constantly interacting. Such well-tried old terms as the will, consciousness, selfishness, the instincts, etc., when reinspected in the light of our ancestral background and embryological beginnings, all look very different from what they once did. The soul is no longer the pale little creature, *Hospes comesque corporis,* as described in Emperor Hadrian's famous lines. Nor is the human body, made up as it appears to be, exclusively of electrical charges, so lumpish a thing as it seemed. Mind and matter can no longer be divorced but must be studied as different phases of a single vital and incredibly complicated situation. Mind, as a recent writer has well put it, is no longer to be viewed as "primary but eventual." It is in the making, and a historical consideration of human intelligence, taking into account its animal and prehistoric substrata, its development in historic times and the profound effect of childhood on adult thought and feeling, reveals all sorts of previously neglected elements in the estimate of mind itself and of its untold future possibilities.

V

The chief aim of education for us who really grasp the value of a scientific attitude and appreciate the inherent obstacles which oppose themselves to its successful cultivation in the human species should be the inculcation of the profoundest of truths, namely, that science is one. It is nothing more or less than the most accurate and best authenticated information that we possess, subject to constant rectification and amplification, of man's nature and history, and of the nature and history of the world in which he finds himself. It is just the most reliable knowledge we have. It is not history, philosophy, psychology, ethics, politics, economics; it is not astronomy, physics, chemistry, geology, botany, biology—these are merely historical divisions of labor, which are now being profitably transgressed as we learn more of the essential interweaving and mutual dependence of all things. Those consecrated divisions may still have a declining significance in research, but I can not but think that they are one of the chief barriers to the cultivation of a really scientific frame of mind in the young and the public at large. They are aspects of a single supreme theme, Man and his World. *Once it was well to dehumanize science; now it must be rehumanized.*

The prevailing misapprehension of the evolutionary or historical conception of life and its unity should not be permitted to afflict the coming generation. But the precautions necessary to prevent this, demand our most careful thought and planning. The problem is nothing less than so revising our education that a new type of mind will be cultivated appropriate to our present knowledge and circumstances. Education is, however, controlled to a large extent by those who still adhere to many ancient conceptions which appear to them to be based on the best wisdom of the past, to be tested by time and substantiated by a consensus of human experience. These they do not wish

to see disturbed. No two persons might agree as to exactly what these approved findings are, but so long as a notion is familiar it is assumed that it will not do any particular harm. Now, new knowledge, if taken seriously, is very likely to prove an indictment of those very ideas which are dearest to the ill-informed. So in order to avoid inconvenient discussion the doctrine has become popular that so-called 'controversial" matters should be carefully excluded from both the schools and colleges. This means, when stated in a bald form, that instruction which might stir religious prejudice, no matter how unintelligent, business, political or racial prejudice, or violate the proprieties, must be avoided. College presidents, school superintendents, text-book writers and their publishers are at present almost helpless in this situation. Teaching must be made as little disturbing as possible, when its chief function should be to stimulate thought and furnish new and reconstructive ideas. The plight of the directors of education is indeed pitiable. College presidents have to sit up late at night reconciling the noble doctrine of freedom of teaching with the practical necessity of dodging controversial questions—for at all costs nothing must happen to arouse the resentment of timid parents and donors. Like Milton, the college head can not endure the humiliating imputation that his teachers are under the wardship of an overweening fist; and yet he is constantly haunted by the nightmare of the fist which will refuse to write any more checks to the order of the institution if an instructor is carelessly charged with Bolshevism or with teachings tending to immorality, sedition or irreligion. And what is perhaps still worse the religious, moral or patriotic critics rarely take the trouble to find out what an instructor or text-book writer whom they attack really has said or believes. This scandalous state of affairs is too little understood. Those best informed about it are for various reasons disinclined to tell all they know. Those who plan out courses of study and write books for the schools are not free but must often make very humiliating terms with unintelligence.

Fifty years ago Matthew Arnold described education as "the getting to know on all matters which concern us the best which has been thought and said in the world; and through this knowledge turning a stream of fresh and free thought upon our stock notions and habits." This ideal would be accepted by most educators, but how very far are we from realizing it in practice. Teachers and text-book writers can not proceed directly toward this goal as they conceive it. They must hedge and suppress, compromise and extenuate, lest the authentic things now known which it concerns boys and girls to learn should unluckily start them thinking. For this might rouse the apprehension of some defender of the social and moral order, some professional patriot or some adherent of the Mosaic authorship of the Pentateuch. The politicians in the Kentucky legislature think themselves competent to decide whether the state should grant funds to any institution in which man's animal extraction is taught; the politicians in the New York legislature have provided that no one shall teach in the schools of the state who is known at any time to have expressed any distrust of our institutions.

Now nothing could be more diametrically opposed to the cultivation of a scientific frame of mind. Education should be largely devoted to the issues upon which the young as they grow up should be in a position to form an opinion. They should understand that scientific advance has greatly altered, and promises still further to alter, our environment, and our notions of ourselves and, consequently, the expediency of existing institutions of moral, social and industrial standards. We should have a dynamic education to fit a dynamic world. The world should not be presented to students as happily standardized but urgently demanding readjustment. How are they to be more intelligent than their predecessors if they are trained to an utterly unscientific confidence in ancient notions, let us say of race, heredity and sex, now being so fundamentally revised.

VI

Supposing it be conceded that one at least of the objects of a general education is to help the young to become acquainted with the best that is now known or guessed about mankind

and the world; that it concerns them to know this, and that it should be so presented that it will, by encouraging them to busy their minds with our stock notions and habits, best prepare them to lead more intelligent lives and deal more wisely than their predecessors with old and new problems. Would it not be a most important contribution to reorder and restate this knowledge and suggest its implications? Might not this be profitably done with entire disregard of the timidities of educators and the apprehensions of those who now support education? No doubt things would have to be said which have hitherto been regarded as dangerous or inappropriate for the young to know. Issues of a distinctly controversial nature would constantly be arising. So such a task should not be left to any single individual. College faculties and teachers' associations are in no position to run counter to respectable tradition, and few there be that have any disposition to do so. As I have thought over the matter I see no large and influential association so well fitted as yourselves through a peculiarly competent and broad-minded committee, to undertake the task of *humanizing science,* and setting a new standard of education. That it will be easy even with your resources to choose the very best persons for such a committee, or that its work will have any immediate effect on general education is probably too much to expect. There are, however, minds of the requisite temper, training and literary tact. They must be hunted out and brought together in an effective conspiracy to promote the diffusion of the best knowledge we have of man and his world. They should have been researchers at some period of their lives, and should continue to be researchers in another sense. Their efforts would not longer be confined to increasing knowledge in detail but in seeking to discover a new synthesis of what is already known or in the way to get known. They should be reassorters, selecters, combiners and illuminators. They should have a passion for diffusing, by divesting knowledge so far as possible of its abstract and professional character. At present there is a woeful ignorance even among persons who pass for intelligent, earnest and well read, in regard to highly important matters that are perfectly susceptible of clear general statement. The members of the proposed committee should combine a knowledge of the exigencies of scientific research with a philosophic outlook, human sympathy, and a species of missionary ardor. Each of them should have professional familiarity with some special field of knowledge, but this should have come to seem to him but a subordinate feature of the magnificent scientific landscape.

Such a committee should be freed from educational restraints and from all suspicion of having to consider the feelings and preferences of donors and financial supporters. The more open-minded teachers and managers of education, as well as text-book writers and their publishers, would welcome a tribunal of high standing and unimpeachable independence, whose opinion and decisions might be sought from time to time to offset the complaints of importunate critics, who are now a constant nuisance and occasionally a great danger. There is at present a growing discontent with our education which appears even among the hitherto docile student bodies. The trouble lies not so much in our sometimes inept and now and then tyrannical form of administration; nor is it to be met by devising new ways of teaching old things. We must look to the very core of the instruction given; to what is being taught and to what is not. There is a recognized failure to make connections between the work in school and college on the one hand and the obligations and amenities of later life on the other. The whole substance and content of our general education needs a thorough overhauling. Something should be found to replace the effete and disintegrating old arts course. A good and sound idea underlies it, but its aims and methods and assumed results will not stand inspection in the light of modern knowledge and modern conditions of life. The elective system was but a confession that the tree of knowledge had put forth so many and such thick branches that the trunk was no longer visible. The stately proportions of knowledge are now lost in its ramifications. This difficulty can only be met by a novel synthesis—groping and tentative at first, but which will at least recognize and

proclaim an essential need and suggest at least one way of meeting it.

At present there is no proper interplay between the so-called natural and social sciences; and each of these grand divisions of human knowledge, which belong so intimately together, dealing as they do with man and his world, are artificially separated by old boundary lines, defended against invaders and smugglers by jealous vested interests. This is an inevitable outcome of transplanting into our educational system the technical divisions of scientific research. It seems to me that our various scientific courses rarely produce either of the main results to be expected from them. They neither engender in the student a discriminating and exacting tendency of mind—that combination of open-mindedness and caution which should be the finest fruit of successful scientific training; nor do they foster such a lively understanding of the workings of nature that the fascination of ever discovering new wonders will endure through life and mitigate sorrow, boredom and disappointment. Of course, judged by this standard, the failure of education is no less conspicuous in the fields of literature, history, language and philosophy.

We need some new organized effort to bring together in an imaginative and novel manner the prevailing and sometimes conflicting knowledge of the material world, its fundamental nature as it is coming to be understood in the light of the astonishing new theories of matter itself; the general story of life, with some attention to the great classes of living creatures; the discoveries in regard to man's nature and functioning and the history of his achievements and perplexities.

To give a single instance of the way in which this might be done I will explain that a good many years ago I became bored with what passes for history and began to consider those things in the past that interested me. These proved to be such evidences as we have of how the beliefs we now accept about man and his world grew up and developed. I found myself a trespasser roaming about in the preserves of the philosopher, theologian, anthropologist, comparative psychologist, prehistoric archeologist and of the historians both of literature and science—to mention only a few of my divagations. Now this has proved very amusing and instructive to me, and I have found many hundreds of young men and women to follow me in my wanderings. When we got through we had discovered a new world, and man's past and the possibilities of his future were no longer what we had taken them to be. What I have done others can do in better and more ingenious ways; and the history of man's achievements and growing understanding of himself and his world could be made a branch of study beginning early and running through all the years of school and college. For, as Francis Bacon said, the history of the world without the story of man's education is like a figure of the mighty giant Polyphemus with his single great eye left out.

An Association for the Advancement of Science representing theoretical knowledge and some of its multiform practical applications, should not confine itself merely to forwarding the progress of research; coordinating, systematizing and applying the discoveries made. It must assume the further responsibility, in the juncture in which mankind now finds itself, of cultivating and spreading an appreciation of our best knowledge of man and his world among those now indifferent or actively hostile to it. We have every reason to dread unintelligence, but are as yet altogether too considerate of the unintelligent; for we know that they usually have the whip hand. How shall we escape from this unworthy bondage?

I am aware that the new organization at Washington under the auspices of this association, Science Service, is already doing what it can to spread the knowledge of new discoveries and keep the public *au courant* of scientific advance. I know that the admirably edited periodicals, SCIENCE and THE SCIENTIFIC MONTHLY, are performing the same service for those sufficiently prepared to read them with interest and understanding. But excellent as is this beginning we must prepare to go much farther by making scientific knowledge in the broadest sense an integral part of education from beginning to end. We must so identify it with the experience of the child and the youth that no longer will a deeper import lurk in

the legends told us in our infant years than in "the truth we live to learn."

JAMES HARVEY ROBINSON
NEW SCHOOL FOR SOCIAL RESEARCH

THE FOOD RESEARCH INSTITUTE OF STANFORD UNIVERSITY

THE Food Research Institute of Stanford University was founded in February, 1921, by the Carnegie Corporation of New York in conjunction with the trustees of Leland Stanford Junior University, California. It is organized for the purpose of intensive scientific study of the problems of the production, distribution, and consumption of food. The institute grew out of a suggestion offered by Mr. Herbert Hoover, and its location at Stanford University was due partly to the fact that this university possesses, in the Hoover War Library, a large and unique collection of documentary material relating to the food problems and other economic aspects of the Great War. The Carnegie Corporation guarantees stated funds for the work for a period of ten years. Stanford University provides quarters and facilities and has appointed the directors of the institute to positions on the Stanford faculty.

The control of its policies and the active direction of the work of the institute are entrusted to three joint directors. The plan of the founders called for the selection of an expert in agriculture and food manufacture, an expert in economics and food distribution, and an expert in the physiology and chemistry of nutrition. In accordance with this plan, the following directors were appointed in April, 1921: Carl L. Alsberg, M.D., Joseph S. Davis, Ph.D., and Alonzo E. Taylor, M.D. At the same time an advisory committee was appointed comprising the presidents of Carnegie Corporation and Stanford University, *ex officio,* and the following additional members: Hon. Herbert Hoover, secretary of commerce; Dr. James C. Merriam, president of the Carnegie Institution of Washington; Mr. Julius Barnes, formerly president of the U. S. Grain Corporation; Dr. William M. Jardine, president of the Kansas State Agricultural College; Mr. J. R. Howard, president of the American Farm Bureau Federation; and Mr. George Roeding, formerly of the California Horticultural Commission.

The founding of the Food Research Institute is an outgrowth of war experience. During the late war, possibly for the first time in history, food production and distribution, nutrition and dietetics had to be considered by governments as national and even international problems. In determining policies required to meet the emergency, food administrators sought certain scientific information, from agriculturists, economists, physiologists, and physicians. Many valuable data were readily furnished. On the other hand, much of the desired information was not in existence, not because, given time, it would have been difficult to obtain, but because no one before the war had asked these questions or attempted to reach an adequate answer. Nutrition and dietetics had been studied mainly as individual problems, not as mass problems. The food supply had seldom been examined with adequate reference to its international aspects and to the particular commodities entering into it. Marketing problems had received mainly local investigation. There had been little coordination of studies in several important fields, and serious gaps were numerous. In many instances, therefore, the lack of essential information led to action more or less in the dark.

The founders of the Food Research Institute were convinced that the scientific study of such problems, from a broad national and international viewpoint, was important in peace no less than in war. While recognizing the essential services which research work in federal and state agricultural departments and colleges had rendered and will continue to render, they considered that a non-governmental organization with university affiliations could have advantages in attacking certain kinds of problems without the limitations which apply to these agencies.

The institute proposes, therefore, to investigate significant food problems from the standpoint of their bearing upon national economy and well-being, to deal with them as mass problems, and to emphasize the commodity and