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SCIENCE AND EVERY-DAY PHILOSOPHY¹

By President WILLIAM E. WICKENDEN

CASE SCHOOL OF APPLIED SCIENCE

WE are gathered in this distinguished seat of learning to acclaim these new companions in research, who by their zeal, their intellectual integrity and their devotion to the ideals of science have shown themselves worthy to share in the pursuit of truth. Meanwhile John Does by the thousand stroll along, roll along on the streets of your fair city, scarcely aware of your existence and less aware of being in your debt. To them you are just a bunch of highbrows—a queer lot who get some freakish sort of kick out of peering down microscopes, messing around with ill-smelling chemicals, poring over statistics, peering at stars, carving up household pets and pests indiscriminately, rigging up mazes of wire and tubing, and juggling with the fourth dimension. The motives that stir your enthusiasms are mostly beyond their ken. Forty years and more ago a track laborer on the right-of-way of the Nickel Plate Railway in Cleveland saw a man

fussing with sets of mirrors in a way which struck his curiosity. The man didn't seem to be a surveyor or an inspector of permanent way. "What," he asked the trespasser, "are you up to here?" "Why, I am trying to measure the velocity of light." "Well, why should any one make such a fuss over a thing like that?" "Oh, because it is such corking good fun!" The trespasser was Michelson, and his fun lasted a lifetime. Corking good fun! How lightly the genius of optics summed up his ideals—the philosopher's thirst for truth, the artist's struggle for self-expression, the pioneer's wrestle with nature, the prospector's zest for discovery, the idealist's pursuit of supreme excellence—such corking good fun!

John Doe, as he rolls or strolls along the street, prides himself on being a great admirer of science. He is vaguely aware that science makes the water pure, keeps the sewers safe, keeps the current on tap in the wires, makes the telephone talk, tames the germs that pursue him, discovers medicines to kill

¹ Address at the Sigma Xi Initiation, Ohio State University, May 26, 1933.

them, puts the jazz on the air, and makes the family car reliable enough for the wife to run. He even reads of rocket ships to visit the moon, of frogs without fathers and of roosters made over into egg-laying hens. He wonders if it was Will Rogers who started all this fuss over comic rays and why Einstein can get folks so excited about his relatives.

John Doe isn't quite so cock-sure as he used to be that all this science is a good thing. This business of getting more bread with less sweat is all right in a way, but when it begins to destroy jobs, to produce more than folks can buy and to make your wife's relatives dependent on you for a living, it is getting a little too thick. Perhaps science is going too fast. That preacher over in England who wanted to call a halt on all this research stuff and on all new inventions for ten years wasn't so crazy after all. And then there are taxes—endless and back-breaking taxes. Didn't he just hear that it costs anywhere from 5 to 10 million dollars a year to run one of these universities, and the football team wasn't so hot at that? Better set some of these atom-busters and dog-carvers and guinea-pig tenders to working for a living and give the ordinary property owner a break.

No, John Doe is not much aware of being in your debt, and least of all perhaps for the ideas that control his habits of thought and life.

My purpose to-night is to discuss in simple outline some contributions which science has made to our every-day philosophy, to the idea patterns of the man in the street. To be modern means to believe in progress—that if life isn't getting better, at least it ought to be, that our children have a right to a better chance than we, that humanity will not inevitably repeat all its past errors, that civilization will consolidate and hold its gains. The Greeks, we are told, had a word for many of our supposedly advanced ideas, but I doubt if they had a word for progress. In ancient times it was believed that humanity was in a continuing or progressive state of decline or even decadence. The good days were in the legendary past. Each generation kept getting further away from the golden age. Religion looked backward wistfully to the happy garden where men were as gods. The longed-for Messiah was not to be an innovator, a discoverer, a creator—but a restorer of man's lost estate. It was a depressing doctrine, tinged with futility.

In the middle ages life was looked upon as a hard experience whose only reward was to be found in another world. Sainthood was to be the goal of striving, and there was little hope of a better state of life this side of the grave. Here and there a Roger Bacon caught gleams of progress, but they were mostly dim or fleeting. Truth was to be sought in the lore of the ancients. If you were curious about nature, you consulted Aristotle. The university was an elaborate de-

bating society. Invention was a tedious matter of casual trial and error. The arts were passed on from generation to generation without significant change, so that the tools which first broke the soil of Jamestown and Plymouth might have been at home on the latifundia of Rome.

The birth of natural science brought a new conception, the optimistic conception that man could be in large degree the master of his fate, the hope that he need not fear nature, but could enlist her in his service. The long struggle of civilization for more bread with less sweat was suddenly changed from a losing fight to a series of brilliant triumphs. Men began to invent tools deliberately. Man, whom Thomas Carlyle rather sneeringly called "the tool-using animal," began to acquire a new dignity, as the only being in the whole order of nature who is able to overcome his own limitations and make nature his partner and not his tyrant.

Science not only taught man to believe in progress, but it taught him as well to believe that it could be achieved in cumulative effort. The ancients won their knowledge by placer mining; here a nugget, there another, washed out by a lone prospector. The modern man of research mines the hidden veins systematically and has learned to separate the finely dispersed gold from the baser bulk of human experience by experiment, analysis and verification. With the growth of systematic science, the dependence of mankind on rare and unpredictable genius began to decline. Science grows by accumulation. Its victories belong to the army of patient, often obscure investigators rather than to some rare Napoleon. Its ideal is that of removing the hazards of chance from the growth of knowledge and the advance of human well-being. What we have gained in the last two centuries has been due less to individual brilliance and inspiration than to the capacity which men have developed to work together in groups. It is this idea of progress through cumulative effort, progress by cooperation, progress which does not wait for some brilliant stroke, some lucky discovery, or the coming of some superman which is perhaps the chief contribution of science to social philosophy.

To natural science, with its ideal of cumulative and conserved progress, we may also credit the growth among men of a psychology of abundance, with its whole train of political and social consequences. Primitive man, with his instincts rooted in nomadic existence and branded by his incessant struggles against cold, hunger, pestilence, enemies and want in every form, would have thought the notion that mother earth could provide an abundance for billions of children utterly fantastic; like the old woman of the shoe, she already had so many she didn't know what to do. The ancients accepted slavery and aristocracy

naturally as the unescapable consequences of meager resources and scanty production. I can not think it a coincidence that the development of democratic ideals and institutions, of human hope in religion and social vision in ethics has come step by step with the growth of science and technology. These ideals are the political, economic and spiritual affirmation of the credo of human progress, based on a possible abundance for man in this world. How far we have moved from the faith of the ancients that stoicism in the face of want, of pestilence or war is the highest of virtues. Oriental and Occidental cultures find here their major plane of cleavage. Charles A. Beard, the historian, records his vivid impressions of the religions of India as natural expressions of the ideals of a people who have no hope of a square meal in this or any other world. If nature forbids the satisfaction of the most elemental of all wants, the longing for food, what greater boon can be sought than emancipation from all desire and from consciousness of one's self?

At opposite ends of the circle of fatalism lie the passivity of Asia and the dazzled optimism of the Victorian Age. Man's brilliant conquest of nature made the idea of progress seem an automatic principle. Social control over discovery, invention and industrial exploitation was unnecessary, in fact, almost profane. "Hands off! Let economic law take its course, and in time all would be well!" Would that human welfare were so simple, but we are finding that *laissez-faire* or rugged individualism break down in our larger crises where readjustments must be made at forced speed. The war made it tragically evident that progress is not inevitable.

If the war has brought to a climax changes in our social philosophy, the period since the war has brought sweeping changes in natural philosophy. Fifty years ago chemists and physicists were fairly confident that they had come upon the ultimate units in nature. These were atoms—minute, hard, indestructible, elastic, billiard balls of stuff, controlled by the same universal laws of gravitation which held the planets in their courses. Philosophers in ivory towers and simple men at their firesides began to build themselves pictures of the universe, not out of the figments of pure thought, but out of the very hard, solid atoms of the physicist and chemist. And quite a plausible picture it was that they built out of chance groupings of atoms.

Was it not Huxley, the great expounder of mechanism in nature who asserted that six monkeys, set to strum unintelligently on typewriters for untold millions of years, would be bound in time to produce all the books in the British Museum? In short, given time, every conceivable accident was bound to happen. And here was man, who had once dreamed of himself as the central figure in a drama of salvation

on which all existence turned, reduced to a casual incident, just a chance arrangement of little billiard balls amid millions of suns and planets whirling in inconceivable space.

Scarcely had ordinary men settled down on the atom as the indivisible unit of nature with a machine theory of the cosmos in imminent prospect, when experiments suddenly broke through this supposedly adamant foundation into a new and magical world. Roentgen caught an accidental glimpse of it in 1895 and the Curies broke into it with more evident design in 1898. With a crash the entire solid, billiard-ball model of the cosmos collapsed. Explorers found themselves threading their way through the ruins into a wonderland more strange than even Alice had discovered, where the hard stuff of matter dissolves into impalpable radiation and where energy, whatever that may be, is turning itself into atoms and molecules. Here are transformations that seem to defy all predictions: anomalies which seem to hint of some caprice in the chain of causes and effects. Is energy merely another aspect of blind matter? Is it something wholly apart from the realm of the spirit? What physicist would dare assert it? The scientist who a short generation ago was shunning the "den of the metaphysician" has now moved in and taken possession. A curious day this—when certain biologists speak confidently of growing men to order in the laboratory if the need arises (note the saving clause) and certain psychologists profess their belief that they could mold the new-born babe at will to any pattern of conditioned responses—yet one can scarcely find a materialistic physicist. How interesting it would be to call Huxley and Spencer back from the shades to behold this new wonder.

And what shall we say of the overturn in our notions of time and space, of eternity and the infinite, of the ideal, the relative and the absolute. John Doe may think of modern mathematics as the fringe of insanity, but there is scarcely an idea in his head which it has not revolutionized. He has lost much of his sense of certainty, and gained in his respect for probability. The only inexorable certainty he can hold to is the certainty of ever-continuing change. If you can not live adventurously, you are only an onlooker in life's game. Max Planck, one of our major prophets, says: "Science does not mean contemplative rest in possession of sure knowledge." If John Doe wants contemplative rest, even on the vegetative level of intellectual existence, he will have to go back to the thirteenth century for it.

Volumes could be written on the revolution in sidewalk philosophy which has grown out of the generic concepts of organism and evolutionary development. John Doe's casual speech, without his being aware of it, is saturated with ideas based on genetic transmis-

sion, embryonic development, differentiation of structure and function, modification by environment, the influence of survival values, and progress through successive stages of conception, gestation, infancy, maturity and senescence. He not only applies these ideas to individuals; you may catch him any day applying them in a sweeping manner to communities, states, nations, races and whole civilizations. John Doe does not hesitate to ascribe personality traits to nations as well as to individuals. The Scotch are close, the Irish garrulous, the Dutch stubborn, the French polite, but not always sincere, the Germans plodding when at peace but savage in war. The individual as well is not merely the product of certain hereditary influences, he is the product of an intellectual and social climate as well. Whether a given person is a monk, a robber baron, a crusader, an explorer, a pirate, a poet, a pioneer, a missionary, an inventor or a research worker is not wholly a matter of chromosomes and early nurture, it is also a matter of the century—or even the decade—in which he lives.

Perhaps no phase of modern behavior is more characteristic than that of specialization. Here the parenthood of science is clear and unmistakable. Specialization among the ancients was primarily a differentiation of skill. The oldest recorded craft appears to be that of metal worker. Before priest, lawgiver, healer or soldier was Tubal-Cain—"the instructor of every artificer in brass and iron," only six generations from Adam. Specialization of function is also a fairly old idea. Plato elaborated it in his "Republic," but no one can imagine Plato or Aristotle proposing a society based on specialization of knowledge. Even as late as the sixteenth century, Francis Bacon, who by profession was Lord Chancellor of England, was able to claim all knowledge as his sphere. Science, on the other hand, owes much of its fertility to the principle of the division of labor. Effective science did not begin until men made the winning of knowledge their distinctive business or profession. Knowledge multiplied amazingly when an army of specialists began to break it up into ever smaller and smaller fragments in order to pursue it the more intensively.

Philosophy in all ages has sought for unity of knowledge, science for diversity. The contrast between the specialism of science and the generalism of philosophy is the theme of a structurally perfect epigram—that science is a means of learning more and more about less and less until one knows everything about nothing; while philosophy is a way of learning less and less about more and more until one knows nothing about everything. In the contest between these two principles the battle has gone heavily of late in favor of science. Every branch of learning has craved a share in the prestige of science. History,

economics, sociology, politics, psychology, linguistics, education and even theology deserted the camp of the philosophers almost in a body, to seek admission to the ranks of science. Of late it has seemed that it is not the arms, the uniform, the equipment nor the tactics which distinguish the soldiers of science. One only needs to utter the right password to enter the lines and that word is "objectivity." Verily, we use the word science to mean so many things nowadays that we no longer have any word to mean science. Trust John Doe to destroy all distinctions of meaning from any word which acquires prestige values.

The age of specialization leads inevitably to the age of the expert. The ideal man of a pioneer society was the self-reliant, self-sufficient individualist. In the society which framed the American Declaration of Independence, and later the Federal Constitution there was little to mark one man off from another except native intelligence, natural energy, property ownership and personal cultivation. Ten in eleven were living on the soil, with all the highly localized interests of a rural society. Men who expect as a matter of course to be farmer, carpenter, mason, blacksmith and, on occasion, physician, magistrate and legislator as well, find it easy to admire the versatile amateur and to look with disfavor on the specialist, even to suspect him of being a sharper, bent on using his superior knowledge to do the common man out of his rights. The fathers, or at least those who followed Thomas Jefferson, had a profound faith in the collective wisdom of common men. Democracy was expected to transcend in some way the limitations of the individuals who composed it. Patriarchal societies from Old Testament days down have held in special reverence the sort of wisdom which distills out of common experience. This was assumed to accumulate with age and to invest the old with special sagacity in counsel.

Now that the new deal has begun to emerge, it seems that science, with its emphasis on specialization and on knowledge acquired by persistent inquiry, has been undermining a lot of traditional thinking about natural self-sufficiency, collective intelligence and automatic wisdom. Government has been the last sector to capitulate to the specialist. A few years ago John Purroy Mitchell was chosen mayor of New York in a great wave of reform. At once he surrounded himself with the best experts on the various phases of city administration and gave the city an unexampled taste of efficient government. When the next election came, the voters pitched him out, lock, stock and barrel. "Who wants to be governed by a bunch of ——— experts," shouted John Does by the thousand. "We want to be run by folks like ourselves." But now that the brain trust seems firmly seated in the second line of responsibility at Washington, the

old idea that any honest man is good enough to govern seems to be on its last legs.

In the proposed measure to invest the trade associations with quasi-official responsibilities one sees the emergence of a functional type of government, which may in time overshadow the old principle of geographical representation which reflected the localized interests of a rural society. Let the men of science who have labored obscurely in government bureaus take courage. The day of the expert shows signs of dawn.

The total effect of scientific inquiry on the man in the street has been to heighten his sense of individual insignificance. How far away and long ago the voice of the shepherd-psalmist:

When I consider thy heavens, the work of thy fingers, the moon and the stars which thou hast ordained, what is man that thou art mindful of him and the son of man that thou visitest him? For thou hast made him but little lower than God and crownest him with glory and honor.

When the astronomer of to-day gets through with man, he can think of himself only as an animated mite, lost in limitless space on a speck of cosmic dust.

With this growing sense of individual insignificance has come a decline of interest in personal salvation and personal immortality. But as the concern to save one's own soul has lessened, the desire for social salvation and for a share in the immortality of the human life stream has grown apace. Humanity is still crying, "What shall I do to be saved?" The world scene beyond our own borders serves only to heighten the sense of revolutionary tension—Russia in a fever of social transformation, Italy scorning individual freedom for the discipline of the state, Germany groping for the pillars like a blind Samson, Japan expanding by the sword, China in chaos, halting between republicanism and communism, India in revolt against not only the rule but also the civilization of the western world, and everywhere a creeping paralysis in economic life.

Where may society look for salvation? Dynasties have crumbled and democracy fumbles its way by trial and error. Dictatorship, whether of an individual or a class, is fraught with terrible risks. Crises bring an instinctive craving for a leader, for some Moses to guide mankind through the wilderness. Men begin to despair of thinking and working their way through their problems; they long to have the seas rolled back, manna sent and water brought forth from rocks. They crave the pillar of cloud and of fire. Send us, they pray, some superman who can solve our problems by sheer insight.

The seer's vision may penetrate the very depths of the human heart, but the ills of society are too

impersonal and too complex. May I suggest that, grave as our need of personal leadership is, our need of knowledge is even graver. How can there be lack of knowledge, in the face of the mastery of nature we have won in the last century? Perhaps the triumphs of physical science and our faith in the social gains from its application have made us overconfident. Have we not built up a social structure far beyond the limits of our social intelligence? Have not the materials and members of a simpler society proved unequal to the stresses of a technological era? Why should we seek some political genius or some spiritual prophet to solve a crisis whose problems are essentially those of social architecture and engineering?

The sure and permanent gains mankind has made in the last three centuries have come through patient and cumulative investigation. This ideal of progress through understanding, progress through cumulative effort, progress by cooperation, progress which does not wait for some brilliant stroke, some lucky discovery, some prophet's insight or the leadership of some superman, has been the chief gift of science to social philosophy.

Our knowledge of men and of social institutions stands to-day where our knowledge of material nature stood two centuries back. We may be compelled to retrace our steps for a time to a simpler organization of society. We may, for a time, need to forego some of the material benefits which science and technology are amply able to provide. If we are to enjoy these gains with any security, it is urgent beyond all else that our knowledge of the human and social sciences be brought abreast of our material development.

Since the end of the American frontier, school, college and university have been our guarantee of an open door of individual opportunity. This door must be kept open if democracy is to survive. The university is now our frontier, but it has an even more significant mission. As individual leadership grows more inadequate for our social problems, we must depend more on institutional leadership. The university must lead the state. It is our only seat of open-minded, disinterested, cooperative effort. In it are enshrined the ideals of inquiry and of understanding. Before all else, it stands for the leadership of intelligence, rather than blind emotion. Science has been called a false Messiah, whereas it is no Messiah at all. It does not promise to lead men back through the darkness to a golden age that is lost; instead it offers them light, light that all may share, that they may walk by sight and not by faith alone, into the future unafraid.

If in this hour of crisis we weaken the university and let her light grow dim, we do so at the peril of our civilization.