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C. O. Bates

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INFLUENCE OF MODERN SCIENCE IN THE FORMATION OF
IDEALS.

PRESIDENTIAL ADDRESS.

BY C. O. BATES.

Gentlemen of the Academy:

Allow me to congratulate you on the completion of another year's successful and profitable work. Self-imposed scientific effort brings its own reward to every earnest soul in search of truth. The acquisition of new knowledge is both fascinating and stimulating. In proportion as we get knowledge at first hand, just in that proportion is the fascination and the stimulation increased, and our acquirements become a part of our being.

In 1819 Orested discovered that a wire carrying a current of electricity caused a magnetic needle to be deflected. This little and apparently insignificant force is, by a device for multiplication, running our elevators, propelling our street cars, and driving our machinery. The same force by a device for division is sending wireless messages across the ocean. Over two centuries ago Leeuwenhoek discovered an apparently insignificant class of microscopic organisms which on account of their rodlike shapes were termed bacteria. Today from a study of these organisms and their products, pestilences have been banished, disease conquered, and the average length of life increased by more than ten years. The miracle of the loaves and fishes was not more wonderful in some respects than the accomplishments of electro-magnetism, or of antitoxines.

Knowledge revealed through nature in this age is "as the rain that cometh down and the snow from Heaven, and returneth not thither, but watereth the earth, and maketh it to bring forth and bud that it may give seed to the sower and bread to the eater."

The scientific world moves apace; evidences of unrelaxing energy are apparent on every hand. A great discovery today does not astonish the world as it did a few generations ago. The discovery of the principle of the Leyden Jar in 1745 made a more profound impression in Europe and America than a similar discovery would make today.

This occasion gives me opportunity, not only to call attention to the magnificent work that has been done by the members of this body in discovering, collecting, and publishing scientific knowledge, sufficient each year to make a valuable volume, but also to speak of some things that are greater: namely, the indirect effects of scientific work upon the moral fibre and character of a progressive and prosperous people.

The old-time humanities developed an aristocratic class with a refined and selfish culture, and at the same time developed an ignorant class of slaves. A spirit of caste was developed and society became stratified as the various geological formations in the earth's crusts. It is the function of both science and religion to break up and pulverize these lines of stratification. Modern science answers the question of the ancient humanities as to who my neighbor is, by relieving suffering, prolonging life, by controlling and banishing disease, by uplifting humanity into one common brotherhood. It is the mission of science to help fill the hearts and minds of all with lofty and noble and true ideals. Science deepens reverence, banishes superstition, and exalts the truth. Science gives new standards of evidence; gives larger conceptions of duty and obligation, and enables us to make progress from a general knowledge of disconnected events to a special knowledge of phenomena connected by an invisible yet omnipresent law.

But it is said that the study of science has caused the distinction between that which is sacred and that which is secular to disappear; that parents, magistrates, judges, and ministers of the Gospel are not respected and honored as they formerly were; that religious creeds are losing their distinguishing characteristics; that the distinction between the pure and applied science is passing away; that the humanities are beginning to assume the garb of the utilities. It may be true that a mere taste of such a knowledge, by tearing down preconceived ideas, causes a lawless state of mind, but a deeper insight into scientific truth gives more reverence for law and order. Whatever of evil there is on account of this condition is to be remedied by more science. "A little knowledge is a dangerous thing."

Not until several decades yet to come can the fruit of scientific work be properly judged, but it is not difficult at present to discern the tendency of the times, and to observe the shaping of the great ideals for the education of future generations.

The methods of science have pervaded every department of human thought and enterprise. The so-called humanities of today have taken the methods of experimentation, testing, investigating, etc., rather than depend entirely upon tradition, dogma, and authority. Sociology is a science as to its methods and principles. Research in history is as scientific in its methods and plans as research in chemistry. Scientific investigations have modified and enlarged our knowledge of sacred history. It is destined to bring about the idea that every bush is a burning bush and that all ground is holy ground. "The hour cometh when ye shall neither in this mountain nor yet in Jerusalem worship the Father." "In every place incense shall be offered unto my name, and a pure offering: for my name shall be great among the heathen, sayeth the Lord of Hosts."

No scientific theory provoked so much discussion or brought about such a sharp conflict with theology as the theory of evolution. The warfare, however, is over, and every one is an evolutionist in a sense, but there are as many kinds of evolutionists as there are minds to conceive the theory. And the great Truth that stands out prominent as the result is the principle of unity, and to this principle it may be added that dogmatic theology and dogmatic science are equally objectionable.

The search for truth for truth's sake is always commendable, and commands the respect and the approval of an earnest and thoughtful people. We know but little about the matter. The ancients knew much less than we. The line of progress seems to lie in a better understanding of matter and its properties. In proportion as we comprehend and gain mastery over matter and the latent and vital energies that are associated with it, just in that proportion are we able to bring blessings to humanity and to understand God's revelations through nature. "Each new discovery," says John Fiske, "but places man upon a higher pinnacle than ever and lights the future with the radiant color of hope."

As knowledge increases, the domain of the natural world becomes enlarged and more real, while the domain of the supernatural world vanishes, and disappears as a myth. Reasoning from effect to cause has explained many strange phenomena, and at the same time disturbed the settled belief of many minds. The

belief in the law of the conservation of matter and of the conservation of energy in the physical world leads us direct to the future world, and makes it both natural and easy to accept the belief in the immortality of the soul.

Many bright minds of scientific bent and aptitude have appeared in the centuries gone by, but it seems that they were born out of season. Six hundred years ago the world was not ready for the great mind of Roger Bacon, when he taught that "Without experiment nothing can be adequately known. An argument proves theoretically, but does not give the certitude necessary to remove all doubt, nor will the mind repose in clear view of truth, unless it find it by way of experiment." "The strongest arguments prove nothing," said he, "so long as the conclusions are not verified by experience. Experimental science is the queen of sciences, and the goal of all speculation."

Three hundred years ago Dr. Wm. Gilbert wrote the following: "To you alone true philosophers, ingenuous minds, who not only in books, but in things themselves look for knowledge, have I dedicated a new style philosophising. But if any of you see fit not to agree with the opinions expressed, let them note the great multitude of experiments and discoveries, for it is these that cause all philosophy to flourish. We have dug them up and demonstrated them with much pains and sleepless nights, and great money expense."

The world had not then emerged from the dark ages long enough to appreciate and use the work of Dr. Gilbert on magnetism and electricity. They had to lie unheeded nearly two hundred years when Farady put them to practical use. Contrast this state of affairs with the glorious achievements of science during the nineteenth century.

It is this style of study that our education must assume if it is to progress. It is necessary to present high ideals to the youth of our land in order to insure progress into a higher and better state of civilization. Mere animal drudgery is being swept away by the scientific applications of the forces of nature, and more intellectual callings are taking their place. Many artisans are losing their occupations on account of such changes. The scale of human labor is being diminished at the lower end while additions are being made higher up.

A large per cent of the so-called laboring class now find employment in many lines that were wholly unknown a century ago—telegraphy, stenography, and a thousand forms of mechanical

manipulation. The tendency of the age from this point of view is upward, helpful, and hopeful; and the science of this age is seen to be humanizing and elevating in its effects.

Such progress is not without some unavoidable evil effects. We always travel to permanent good through transitory ills. We are at present, as we always are, in a transitory period, with a golden age back of us, and a golden age in front of us; but the golden age of the future is a very different one from the golden age of the past. Likewise the tendency toward the combination of the forces in society and social life produces similar evils. A small business is absorbed by a large business; the large business is absorbed by a larger business; and the larger business is absorbed by the largest—namely the government. Each change brings about a greater per cent of efficiency while a large number of people are thrown out of employment, and as a consequence we have troubles of a serious character. These, however, have been evanescent in the past. We have gone through many such crises and we have many yet to pass through. Our hope lies in the universal scientific education.

The history of achievements and advancements in science has been for the most part a history of the work of the leaders in their respective fields of work. They have by their indomitable zeal breathed the breath of life into the institutions where they have labored. Henry put life into the Smithsonian institution, Washington, D. C.; Agassiz did the same thing for the museum of Harvard. So does every teacher and worker in scientific investigations, however humble he may appear to be, impress the minds and hearts of those with whom he associates, and help to establish their ideals.

The tide of popular appreciation of scientific accomplishments was never so high as at the present time. This appreciation does not partake of the spectacular phase of science work as it formerly did, nor of the bread and butter phase of the subject, but it is a widespread and deep feeling that our present state of civilization is superior to that of the past, and that this superiority is largely due to our advancement in science. It is not so much Edison, the wizard, or Marconi, the magician, as it is the exhibition of organized and trained common sense of Tyndall, Huxley, Pasteur, and Koch, and others that guides and governs the great mass of our intelligent people.

The cultural value of science is different from that of the humanities if it may be said to have a direct cultural value at all.

Its mission is rather to prepare the way for a higher and better culture, to expose that which is artificial, and to emphasize that which is real. Science is the forerunner of the greater Christian life yet to come. It is "The voice of one crying in the wilderness. Prepare ye the way of the Lord, make his paths straight."

We cannot expect immediate results in the influence of science studies in the formation and development of our higher ideals because much of the subject-matter lies outside the range of our ordinary experience. Molecules, atoms, and electrons do not belong to the same order of magnitude in which we live. They are as far removed from us on the one side, as the stars in the Heavens on the other side.

There is perhaps no phase of educational work so effective in multiplying, extending, and enlarging our mental concepts, as the study of the relative orders of magnitudes, together with the range and scope of properties in each. It requires an extension and penetration of the imagination that cannot be surpassed. The largest body we know anything about is the galaxy of stars above us. An infinitely smaller body would be an ordinary object we deal with in mechanics—a body that is familiar to us in our every day experience. Take another step downward infinite in distance and we come to the microscopic world where every man working with his highly magnifying lenses is a Columbus discovering new worlds. Take a third step downward infinite in distance below microscopic organisms and we come to another class of bodies definite, distinct, and as real as any bodies that we know of. These bodies are called molecules and atoms. It requires a new and different language for each order of magnitude. It is necessary to make a great deal of correction for parallax in order to get a true conception of the various bodies in scientific work.

Such wealth and variety of knowledge, together with the increased power of accumulating more knowledge, all of which leads to one great First Cause, is good material for building a noble character which shall endure unto the end. A character that will take into consideration the whole man, physical, intellectual, and moral. Righteousness and conscience are facts to be dealt with just as much as wood and stone.

"The thermometer is not so sensitive to heat, the barometer to weight, the photographer's plate to light, as is the soul to the ten thousand influences of its fellow men."

"Great is man's skill in handling engines of force; marvelous, man's control of winds and rivers; wondrous, the mastery of en-

gines and ideas. But the man himself is greater than the tools he invents, and man stands forth clothed with power to control and influence his fellows, in that he can sweeten their bitterness, allay their conflicts, bear their burdens, surround them with the atmosphere of hope and sympathy. Just in proportion as men have capacity, talent, and genius, are they to be guardians, teachers, and nurses for men, bearing themselves tenderly and sympathetically toward ignorance, poverty and weakness."

"Each Christian youth is to be a man-maker and man-mender. He is to help and not hurt men. This is to walk in love. This is to overcome evil with good. This is to be not a printed but a living gospel. This is to be a master of the art of right living and a teacher of the science of character building."