

# Proceedings of the Iowa Academy of Science

---

Volume 45 | Annual Issue

Article 7

---

1938

## Science and Society (Academy Address)

Charles E. Friley  
*Iowa State College*

*Let us know how access to this document benefits you*

Copyright ©1938 Iowa Academy of Science, Inc.

Follow this and additional works at: <https://scholarworks.uni.edu/pias>

---

### Recommended Citation

Friley, Charles E. (1938) "Science and Society (Academy Address)," *Proceedings of the Iowa Academy of Science*, 45(1), 53-62.

Available at: <https://scholarworks.uni.edu/pias/vol45/iss1/7>

This General Interest Article is brought to you for free and open access by the Iowa Academy of Science at UNI ScholarWorks. It has been accepted for inclusion in Proceedings of the Iowa Academy of Science by an authorized editor of UNI ScholarWorks. For more information, please contact [scholarworks@uni.edu](mailto:scholarworks@uni.edu).

## SCIENCE AND SOCIETY

CHARLES E. FRILEY

Two quotations will serve as texts for this brief discourse on Science and Society:

The late Dr. Edwin E. Slosson — "In our civilization the mechanical forces have forged ahead of the moral and intellectual forces. Modern man is like the Arab fisherman who liberated from the bottle genii he did not know how to control."

Stuart Chase — "This is the last great adventure; the boldest, most exhilarating, most dangerous adventure that ever challenged the intelligence and spirit of mankind. From our brains have sprung a million wild horses, now running loose and almost certain sooner or later to run amuck. Where are the riders with the whirling rope; where are the light-hearted youth to mount, be thrown and rise to mount again?"

And to complete this ominous moving picture, the following accompaniment in the form of a dirge from the pen of the editor of a great metropolitan newspaper:

"It is possible to make a success of failure, but when a failure of success has been achieved the end is at hand. Man is disappearing beneath a flood of his own complications. The technologists have ruined the world and it remains only for them to take notice and act accordingly. They will assemble their families and depart for some region where a new start can be made. Their supremacy over nature puts otherwise uninhabitable regions at their disposal and they can separate themselves from the doomed people. They can make their own climate. They may take the upper reaches of the Amazon or the Antarctic plateau. There the culture of the machine which has passed sentence of death on the masses of the old time world can bloom.

"The children of the machine will have no use for any of the arts as now known. Their estheticism will be satisfied with the music of disintegrating atoms, the colors of synthetic sunsets, the movement of machines built not for utility but for art. The poet will be known by his engines, the realistic dramatist by his mathematical formulas, the artist by his arrangement of the sunrise, and the musician by his concerto for the electric dynamo."

Truly, a sad portrayal! To add to the thickening gloom the con-

temporary Pessimist, whose name is Legion, proclaims loudly that there is no apparent hope in the world situation; that the spirit of nationalism is still rampant and domineering; that the governments of the world are at the crossroads, and that political instability and national insecurity were never before so evident, all because governments do not know how to deal with the problems pressing from every side; and finally that we are headed straight for a relapse into chuckle-headed barbarism.

But science does not propose meekly to accept the entire blame for the woes that beset a weary and puzzled world without a vigorous counteroffense. Some people, seeing the old humanistic values crumble, turn angrily upon science in the attempt to check its further advance. This is not the right method. Science is essential to a lucid view of the world and to the very existence of a complex modern civilization. So humanism is necessary, for without a true appreciation of its values we do not know how to live or what to do with the power which science confers. If I were asked to define humanism, as here used, I would answer — “to have life and have it more abundantly.”

Without question ours is the age in which man's collective force and knowledge have reached their highest point. The great fabric of science and social organization into which we are born stands firm around us, independent as a whole of the action of any individual. Yet each of us is formed by it and carries it on; at the worst we may injure or retard its growth; at best we may add a little to the infinite sum from which our own powers arise.

It is well known that the work of the ancient Greeks influenced the study of the natural sciences until the seventeenth century. They made many notable scientific observations and speculations, and they laid an excellent foundation for future advances. But their contribution to education was more in the fields of literature and philosophy than along scientific lines. Their tendency to speculate, rather than to observe, test, measure and record, was the fundamental weakness of Greek science. As a result they handed down to the medieval world an extensive “book-science” and many brilliant observations, such as the works of Aristotle and the Alexandrian mathematicians and astronomers, but little scientific knowledge that could be used in modern science.

In fact, the natural philosophy of the ancients for the most part disdained to be useful.

Archimedes, a great scientist, once expressed himself as half ashamed of his inventions, which were the wonder of the ancient

world. He spoke of them as trifles with which a mathematician might be suffered to relax his mind after intense application to the higher and really important aspects of his science.

Macaulay reminds us that Seneca, that self-satisfied old Roman, once exclaimed that the discovery of the principle of the arch was of no particular importance. It did not matter to the truly wise man, said Seneca, whether he has an arched roof over his head, or indeed any roof at all. He is bent only on perfecting his moral nature, and his great aim is not to investigate facts and their applications but to make himself independent of all material things.

The philosophy of the ancients prevailed until the sixteenth century, and during all these years the world and its phenomena remained largely an unmeasured mystery. Lacking accurate data, man speculated about nature and her laws, his thoughts ranging from philosophy to poetry and from both of these to religion. At length came Bacon and Descartes, whose philosophy called men to examine the world about them, reasoning from their external characteristics into their internal natures.

In his *Essay on Lord Bacon*, Macaulay gives an interesting comment on the ancient ideas of scientific study:

The ancient philosophers did not neglect natural science; but they did not cultivate it for the purpose of increasing the power and improving the condition of man. Seneca wrote largely on natural philosophy, and magnified the importance of that study. But why? Not because it tended to alleviate suffering, to multiply the conveniences of life, to extend the empire of man over the material world; but solely because it tended to raise the mind above low cares, to separate it from the body, to exercise its subtlety in the solution of very obscure questions. Thus natural philosophy was considered in the light merely of a mental exercise. It was made subsidiary to the art of disputation; and it consequently proved altogether barren of useful discoveries. . . .

The aim of Platonic philosophy was to raise us above vulgar wants. The aim of Baconian philosophy was to supply our vulgar wants. The former aim was noble; but the latter was attainable. . . . The philosophy of Plato began in words and ended in words, noble words indeed, words such as were to be expected from the finest of human intellects exercising boundless dominion over the finest of human languages. The philosophy of Bacon began in observations and ended in the arts.

The attitude of Christianity toward science throughout the middle ages was one of intolerance toward inquiry and reason, and emphasis on blind, emotional faith. As a result, the miraculous flourished during this long era. Mysticism, superstition, magic, good and evil spirits, astrology, the worship of saints and relics, — all these, pervading all ranks of society, stood seriously in the way of

real scientific thinking and discovery. It was a current view, for example, that comets were formed by the ascending of human sins from the earth, that they were then changed into some kind of gas, and ignited by the anger of God. This poisoned stuff then fell down on people's heads, causing all kinds of mischief, such as pestilence, plague, sudden death, war and earthquakes.

But with the rise of the universities, the revival of trade and industry and the awakening which came with the revival of the old learning, lost throughout the middle ages, the Church assumed a much more tolerant attitude toward inquiry and reason than had been the case for hundreds of years. As a result, the opening of the sixteenth century was the most stimulating time in the history of our civilization since the days of Athens, Alexandria, and ancient Rome.

Unfortunately, this growing tolerance of the Church changed abruptly to an attitude of suspicion and critical reaction as a result of the Protestant Revolts that swept Europe following Luther. This attitude reached its climax in the revival of such medieval institutions as the Spanish Inquisition, relentless in their opposition to all forms of independent inquiry.

It was into this atmosphere of suspicion, distrust and hatred that the modern ideas and methods of scientific investigation were born. We are indebted to the English philosopher, lawyer and statesman, Francis Bacon, more than to anyone else, for the proper formulation and statement of this new scientific method. This he did in his *Novum Organum*, published in 1620, so named because he regarded it as a great improvement over the deductive *Organon* of Aristotle, which had dominated all thinking during the later middle ages. Bacon showed in this work the inadequacy of the argumentative method; he analysed and formulated the inductive method of reasoning, of which his study as to the nature of heat is a good example:

Heat is an expansive bridled motion, struggling in the small particles of bodies.

He further pointed out that knowledge is a process, and not an end in itself; and finally he indicated the immense and fruitful field of science to which the method might be applied.

Macaulay emphasizes the importance of Bacon's work in the following summary:

Bacon was not the inventor of the inductive method. He was not even the person who first analyzed the inductive method correctly, though he

undoubtedly analyzed it more minutely than any who preceded him. He was not the person who first showed that new truth could be discovered by the inductive method alone. But he was the person who first tuned the minds of speculative men, long occupied in verbal disputes, to the discovery of new and useful truth; and by so doing he at once gave to the inductive method an importance and dignity which had never before belonged to it. He was the person who first called the public attention to an inexhaustible mine of wealth which had been utterly neglected, and which was accessible only by this new road.

It was not by providing philosophers with rules for performing the inductive process well, but by furnishing them with a motive for doing it well, that he conferred so vast a benefit on society.

You are fully acquainted with the work of the remarkable group of scientists of the sixteenth and seventeenth centuries, who adopted Bacon's methods and who did so much for modern science, in spite of tremendous hardships and unceasing opposition. In this connection it is interesting to note that during the seventeenth century and a large part of the eighteenth as well, the extreme conservatism of the universities, their continued control by their theological faculties, and their devotion to theological controversy, served to make them such inhospitable places for the new scientific method that practically all the leading scientists were to be found outside the universities, with the possible exception of Cambridge in England. Fortunately, by the close of the eighteenth century the universities had been sufficiently modernized that scientific workers began to find in them a more friendly attitude toward scientific teaching and research. The nineteenth century saw the universities recognized as homes of scientific progress and instruction.

The eighteenth century witnessed vast and far-reaching political, industrial and social changes, in Europe and America, which tremendously broadened the intellectual and political horizon of the working classes; which completely altered the home; which provided more leisure for young people; and which greatly strengthened the position and influence of the common man. The Industrial Revolution completely altered the face of the earlier educational problem. As national ambitions expanded there developed a widespread dissatisfaction with the existing colleges, because they were aristocratic in tendency, because they devoted themselves so exclusively to the needs of a class, and because they failed to answer the needs of the State in the matter of higher education.

In America, shortly after the opening of the nineteenth century, there developed an increasing interest in colleges that would represent the State. It was argued that these institutions were im-

portant instrumentalities for moulding the future, that the kind of education given in them must ultimately influence the welfare of the State, and that higher education could not be regarded as a private matter. Thus began the development of the system of great state universities and colleges, whose activities during the past century have been directed increasingly toward the goal of rendering the maximum service to all the people of their respective states.

Similarly, leaders of thought and opinion in the early days of the American nation saw the benefits which would result if the people generally could be instructed in the application of the sciences to the common purposes of life. In his plans for the "Public Academy" in Philadelphia, Benjamin Franklin suggested the value of field work in agriculture, believing that the sciences could best be learned by practising them. John Adams believed that the state should make provision for education in applied science; and Thomas Jefferson proposed a school of Technical philosophy, as a division of the University of Virginia, to be maintained wholly at public expense, where various artisan could learn as much of the sciences as might be necessary to enable them to pursue their work intelligently.

In our own day, science, aided by the admirable organization of industry, and the growing consciousness of a common humanity, have knit together the social fabric more closely than ever before. A glance backward will reveal the fact that all great consolidations and advances of mankind have rested necessarily on some elements of justice and well-being. Principles of humanity, and not of tyranny or exploitation, bound together the Hellenic World, the Roman Empire at its widest, the Catholic Church, the communities of Buddha and Confucius in the East. And now, of all agencies of consolidation, science is showing its supreme fitness, and its kinship with the idea of a common humanity. It would be a fascinating trail to follow in the ancient world the extension of scientific knowledge and note its coincidence with the growth of a more humane spirit in religion, in poetry and in law. The agreement would be close and more than a mere coincidence. But on the dim trail of the past the evidence is of necessity slighter and less conclusive: in the modern world the case is clear. Side by side with the growth of science has come a steady deepening of human sympathy and its extension to all weak and suffering things. The seventeenth century, which saw modern science adolescent, ended judicial torture and religious barbarities in England. The eighteenth, which carried science still further, saw France abandon tor-

ture, and England and France begin to free their slaves and protect their women and children by law. The nineteenth century, which completed the triumph of science in the intellectual sphere, humanized the law and began the systematic improvement of the condition of the poor, and the systematic national training of the young. The twentieth century is characterized by further definite progress particularly in two aspects of human development: the advance of material culture, and of social justice; even though the latter may seem distressingly imperfect and inadequate as yet.

It is through the honest exercise of his intelligence that mankind has achieved these notable advances, both material and social. The gentle arts of sophistry and self-deception cannot be introduced into a mechanical device. A machine is impervious to the helpful influence of fine interpretations and high, consecrated sentiments. Likewise, the subtle misrepresentations, the eloquent appeals to prejudice, the plausible formulas, the bland casuistry, which in other fields of thought have such fine scope, are rudely excluded from the field of mechanics. The machine is shockingly indifferent to conventional distinctions. There is no orthodoxy or heterodoxy in mechanics; there is an utter disregard of the sacred rights of sincere but mistaken opinions, of the susceptibilities of the non-conformist conscience. If one desires to obtain a given mechanical result, he must strictly and absolutely, with no saving phrases or polite reservations, conform to facts as they are; otherwise, the machine will not work.

The advance of social justice has been brought about by exactly the same methods of intelligence that have created the steam-engine and the dynamo. The connection of the moral progress which marks the modern age with its scientific achievements is not accidental. Both changes are effects of the same causes. The abolition of the horrors of feudalism, of the ferocities and inhumanities of theocratic and absolutist despotisms, are the result of the same critical attitude of human reason to which is due the abolition of the Ptolemaic system of astronomy, the creation theory of biology, the phlogistic theory of chemistry, and the degeneration theory of anthropology.

The human spirit has many sides and cannot be ruled by any single rule; nor can it be restrained from making new discoveries in the great adventure of its evolution. It insists that the same scientific procedure can and must be applied to human life as has been applied with such success to lifeless matter and to plants and animals — scientific survey, study and analysis, followed by in-

creasing practical control. It realizes that human desires and aspirations are the motive power of life, but insists that no long-range or comprehensive aim of humanity can ever be achieved except with the aid of the dispassionate methods, the systematic planning and the experimental testing which can be provided only by the methods of science.

Man today has an opportunity unprecedented in history to master his world. But he will attain this control only as he disciplines himself into learning the technique. He has a further opportunity; that of mastering his civilization. It is his own fault if he cannot master himself.

A new point of view has developed, in accordance with which it is believed that the modern scientist or technologist should be less a technician and more a man of broad, fundamental training, less an expert electrician, mechanic or miner and more a man thoroughly grounded in the basic sciences, with especial ability to face the new problems of a rapidly changing industrial civilization.

Incidentally, the recent advances in the social sciences did not come until their leaders had grasped from the technical fields the necessity for accurate thinking and for careful evaluation of forces in the moral, social and economic problems of the nation.

In the last half-century the fields of science and technology have increased rapidly, and the problems of the worker in these fields have become correspondingly more difficult. He must plan longer spans, higher and more complex structures, more efficient prime movers, the transmission of power over greater distances, and the control of waterways for safety and irrigation; he must cope with the pressing economic problems of industry and agriculture, where an improvement in equipment, in financing, in the efficiency of a process, or the prevention of waste, may mean the difference between life and death for a great enterprise upon which multitudes depend for their living.

This rapid progress has made the problem of curriculum development more difficult. In the effort to prepare the student for the many duties which may confront him in his chosen field, we have increased the number of technical subjects and correspondingly decreased the number and scope of the general studies. It is becoming clearer, however, that high proficiency in science and technology must be developed on intellectual foundations of a broad and searching nature, in which the humanities, especially the social and historical studies, play an appreciable part. I am convinced that the next important advance in education will be the development of

Human Engineering, through which the advances in science may be applied most effectively in raising the social structure to a higher level.

Some progress has already been made in this new direction. During the celebrations at Harvard in 1936 a movement was approved to coördinate the world's knowledge and thus translate it into moral force. Recently a distinguished group of British scientists recommended the creation of a democratic world association of science. To a recent statement by the President of the University of Chicago, that science is a failure in the educational process, Dr. Edwin Grant Conklin replied, during the Indianapolis meeting of the AAAS:

Those who have never experienced the discipline, the ennobling effects of scientific studies fear that science will destroy our civilization, and are calling upon educators to repent and to return to the good old subjects of classical learning. It was not science that caused the decay of former civilizations, nor was it in the power of classic art, literature and philosophy to save those civilizations. Certainly there are no other studies than science that distinguish so sharply truth from error, evidence from opinion, reason from emotion; none that teach a greater reverence for truth or inspire more laborious and persistent search for it. Great is philosophy, for it is an attempt at a synthesis of all knowledge, but if it is true philosophy it must be built upon science which is tested knowledge.

In its practical aspects the ethics of science includes everything that concerns human welfare and social relations; it includes eugenics and all possible means of improving human heredity; it is concerned with the best means of attaining and maintaining an optimum population; it includes all those agencies, such as experimental biology and medicine, endocrinology, nutrition and child study, which promise to improve bodies and minds. It includes the many scientific aspects of economics, politics and government; it is concerned especially with education of a kind that establishes habits of rational thinking, generous feeling and courageous doing.

These changing aspects of science were emphasized in a recent editorial in the *Washington Post*, which said, in part:

There is a growing awareness in the world that the successful search for truth does not assure the advance of civilization. If the findings of science should lead only to economic changes, without any comparable development of social, cultural and spiritual qualities, the ultimate result might be only disillusionment and chaos. If science is to fulfill its most important mission, it must give sober attention to the effects of its discoveries and to the general trend of world events, as well as to the pursuit of abstruse learning.

In these circumstances the scientist and the scholar acquire a moral responsibility for the labor of their heads and hands. It is not enough for the world's leading thinkers to provide the tools of progress. A much bigger task is to teach mankind to use those tools. And since that responsibility

has been so grossly neglected in recent years, the current movement toward greater diffusion of light, understanding and consequent good will assumes a place of commanding importance.

### *Conclusion*

If we go back into history, we find it was the men who built the old Roman roads and bridges who made it possible for Greek culture and civilization and the new Christianity to break through all barriers and flood the distant clouded regions with messages of hope and light. Even today, if we cut deep enough into any of our problems we will find a spiritual content. For instance, we talk about our American tariff in terms of finance or commerce or political economy; but if we penetrate deep enough — whether it be low tariff or high tariff — it turns out that its advocates are interested chiefly in the American standard of living; and the American standard of living simply means that the men and women of this country shall not be so handicapped by economic and industrial conditions that they cannot develop their own personalities, that they demand a margin of leisure in which to enjoy the things of real value in the world in which they live. The initial phrases of the nation's greatest document — the Declaration of Independence — contain words that can never be misunderstood: that we have "certain inalienable rights — the right to life, to liberty and to the pursuit of happiness." Such rights are spiritual rather than material; and they are so essential to our conception of government and to our self-realization — indeed, our self-preservation — that we must regard all the activities of science and technology as instruments with which to guarantee them, to hold them inviolate, and to perpetuate them.

IOWA STATE COLLEGE,  
AMES, IOWA.