



“SCIENCE CONFRONTS TWO WORLDS”

E. H. Lindley

Chancellor, University of Kansas

Members of the Academy:

It is a great honor and privilege to be here. What I have to say will be somewhat of an anticlimax following this very charming introduction. I have had the fortune to be a student of science for a great many years, but I got a thrill tonight, one of the many that I have had in contact with science and scientists. When I walked into the banquet hall tonight through this group of representatives of science, I was thrilled with the reflection that not one of you or anybody of your profession could have found a livelihood in Oklahoma the year I was graduated from college. My short professional life has spanned the miracle of the advance of science in this wonderful state.

A body of scientists should take a great deal of satisfaction in the momentous chapter in the history of civilization which covers a little less than three centuries up to this hour, and which is characterized by the amazing advance of science.

Science is indeed very young in this old world. The old clock dial figure will remind us of the youthfulness of science. You will recall that according to that figure—assuming that we are living at 12:00 o'clock high noon now in the history of our race and that men have lived a quarter of a million years on the earth (certainly a conservative esti-

mate)—we set apart 240,000 instead of 250,000, allot them to the twelve hours up to this moment on the clock dial, allowing 20,000 for an hour. Nothing happens of which we have any recorded history until about half past eleven by that clock. And less than a minute ago (more exactly about thirty seconds ago) Bacon launched his "Novum Organum" on the tide of time. All of modern science has happened during these swift seconds. Yes, less than a clock tick ago steam began to work for man, and what a mighty revolution steam has wrought! Impressive, indeed, is the magnitude and spread of science.

However, if we are interested in the history of civilization, and remember that the Greeks long ago had science (they were the first people to use their minds freely), we ask ourselves what happened to science in the long interval between the golden days of Pericles and the day of Bacon. If time permitted it would be valuable to inquire why science languished during those intervening centuries.

Whatever caused that eclipse of science, it is a fact that in the advance of modern science there developed in the minds of a few scientists a conviction that science would ultimately occupy the whole field, banishing every other form of knowledge that has enriched practical experiences in the past. The period of exuberant hopefulness in science dates from the period immediately following Darwin, Spencer and Huxley. And again to remind ourselves how youthful science is, Huxley, when his genius began to be evident in England, could find no public post anywhere in that rich empire whereby he could support himself in scientific research. And Huxley died only yesterday, so to speak, a significant commentary on the infancy of science, and the slowness with which a great race adopted science which was to transform its life.

To repeat, the exuberant optimism of scientists dates from the post-Darwinian times. I recall very well seeing Alfred Russell Wallace, the discoverer of the theory of natural selection. I was a young man at the time, and I remember the impression it made upon me to shake hands with the man who, with Darwin and Huxley, formulated what seemed to us an ultimate and final theory of life, namely, the inevitable and irresistible law of progress, insuring that nature and human nature are to go on endlessly improving. Thus, science developed an optimism in reference to its own sphere and scope. The doctrine of evolution was inspired by the hopes and desires of the growing band of scientists, and that faith spread throughout the thinking world. So it was rather fashionable in those days, those immediate post-Darwinian days, for scientists to say that they had driven religion out and that art was, after all, chiefly a pastime of leisure hours. Science was destined to be king and emperor. These delusions of grandeur came as they came to theologians in an early period, and to philosophers in their adolescent period. They reflect the great hopes that grow out of success.

As a result of success Darwin, Huxley, Spencer and like scientists, developed a kind of megalomania. They failed to remember, however, that Napoleon after his great victories marched on to Moscow and beat a retreat. Not that I am predicting so great a retreat for science.

It is well, however, to remind ourselves that science originates in one world, but serves two worlds. The world of matter, as understood by science, is the world of nature, a world of description. The other world is the realm of values. These two worlds are quite separate. They can never quite penetrate each other. Thus, the world of fact, of phenomena, of the ordering of phenomena which is the business of science; and the world of worthfulness, the world of value, which is the concern of the arts and religion.

We were led in those Darwinian days, dominated by Newton's conception of time, space, and matter, to believe that the laws of nature were quite rigid and immutable, and that nature consisted finally and chiefly of time, space, and matter. And that was the basis of a very solid kind of security, and lawful to the core. Science had plucked the heart out of the mystery of the world.

But within our lifetime a revolution has taken place in the world of nature as described by science. Einstein comes, and he says that time and space and matter are not ultimates at all, and he talks about potentialities and the quantum theory. Science is only a sketch or blueprint of certain aspects of nature, and in the lifetime of many people now living we have seen the transformation of the world of physics into a most plastic universe. Just a few decades ago the poets were adjured to learn from the scientists. Just now the scientists are saying they will have to learn something from the poets. No poet is more daring than the scientist, with his electrons and quantum theory and the like, and his vision of a dynamic world.

After all, science cannot undertake to explain anything. It must restrict itself to the description of phenomena and the order of phenomena. So there are marked restrictions of the field of science by the very men who have been, in these recent years, most creative in the sciences. I venture, therefore, to call attention to that revolutionary change and to ask what it means and what is the relation of science, or the world of description, to that other world, the world of values.

A very momentous thing happened in the latter part of the 19th century and the beginning of the 20th, growing out of the invention of the steam engine and the organization of industry and the resulting industrial revolution. Two or perhaps three great forces combined to produce what we called the machine age. One of these was industrialism, another capitalism. For the first time in human history, capital in sufficient quantities became fluid.

The first inventions were made by men who were not trained scientists, but very soon after the beginnings of the marching age, science was leaved upon, and thenceforth science made vast contributions to the advance of the industrial revolution. Fortunately, two things happened together, the development of machine industry at a time when science was becoming very resourceful.

We have today a critical period due to the combination of forces that in intent and in their particular essence are certainly not vicious, but in combination under certain conditions become a menace to our civilization, namely, the combination of science in the service of capitalism, neither of which is sufficiently saturated or dominated by the higher controls which we call values, or high social purposes.

Science itself, from the standpoint of the physicists, is neither moral nor immoral; it is amoral. The airplane will carry a bomb that will kill women and children just as readily as it will carry serum to somebody in Alaska. Science is not moral. Science has indeed harnessed great powers—great powers, however, in advance of control. So we are like "children playing with dynamite bombs." Science which might have brought us peace in 1914, made war indefinitely more destructive. Of course, the men who developed science from the beginning, scientists living in the two worlds, never dreamed of nor desired a result like that. To them science was to be the savior of the world and their own benevolent instincts were imbued with the idea that science was doing something holy and of inevitable benefit, rather than a detriment to society.

About forty years ago we emerged, for the first time in long centuries, into a period of plenty. We erected machines and organized corporate

activities in the realms of finance, commerce, and industry in the spirit of freedom, dedicated to the doctrine of private initiative, the freedom of the individual to do the best he could in the production of things. Meanwhile, we have been forced to question that the theory of profit has stimulated industry and commerce, and which, in my judgment, must be present until human nature has greatly improved. Profit may be necessary, but men are becoming critical of the assumption that "profit is the life blood of business." They are beginning to question whether it is the life blood of business or whether it is merely the red corpuscles of the life blood of business. There is another kind of corpuscle in the blood that plays a very important part in the blood stream and in the human body. They are the white corpuscles which perform a controlling and protective office, and they are often prophylactic. Without them the red corpuscles would play havoc with the human body. Profit inspires business, and perhaps must always be there to furnish incentive. The white corpuscles must be there in sufficient number in the form of regulatory activities in order that profit shall not be detrimental to the ultimate welfare of human beings.

And so the plot thickens. Machine industry began as mass performance. It was supported by science, which is impersonal and abstract. Sixty years ago Ralph Waldo Emerson saw that tendency, and said "Machines are in the saddle and they ride mankind." In the beginning of the Boer War, England made the discovery that only about ten per cent of the men were fit for military duty. Machines were grinding up the bulwarks of the empire. And so the crisis we face today is partly made what it is by that trend of machine industry which replaces a person by a "hand" who is merely the appendage of a machine.

A little while ago a friend who happens to be a painter of working men, a man who has the view that modern machine conditions have not entirely destroyed the individuality of men who work at machines, found certain machine workers and painted them to illustrate the dignity of labor. Modern machine had not destroyed the personality of at least all the men. On one occasion the artist went up to the Wayside Inn, made famous by Longfellow. Henry Ford, the owner of the Wayside Inn, was there. The artist took his portraits with him. He hoped to see Mr. Ford and interest him in this kind of art. Mr. Ford invited him in to the old-fashioned dances. Then Mr. and Mrs. Ford came in to see my friend's pictures. He looked at them, and said, "These are very interesting, but does this sort of thing pay? My question always, and I think it is legitimate," said Mr. Ford, "is whether or not it will pay." Then my artist friend made a reply in which he said, "Does it pay? Do the old-fashioned dances pay? Does the Wayside Inn pay?"—And he might have added, "Does the Model T pay?"

That incident illustrates the conflict between two great civilizations. These two civilizations were in conflict in the days of Pericles. They have always been in conflict. One of them triumphs now, and then another. We may call them the civilization of power and the civilization of culture. The former looks upon nature as a dead and mechanical affair, a reservoir of energy to be exploited and used by man. The civilization of power has created forty slaves per man in the form of horsepower, an enormous advance in the utilization of nature to satisfy the needs of man.

The civilization of culture looks on the world with a very different eye. Nature is to be the home of a person. The world is to be loved, enjoyed, and used for the enrichment of his personal life. He is to be a citizen at home in this world. The conflict of these two civilizations

appeared that night when Henry Ford asked his question and the artist answered that question.

The civilization of power is, of course, indispensable. We cannot retreat from the machine. Ghandi proposes to do it in India. That might be possible in India, but surely we cannot go back.

The other civilization, that of culture, we instantly recognize as the only one which makes human life tolerable and aspiring. It acknowledges the value of science in its proper sphere. But it denies that science can never include the aesthetic and moral values which distinguish man from his sub-human heredities.

I repeat, that night in the Wayside Inn there was the collision of these two world views. The civilization of power develops a possessive attitude. "This is mine and I took it from nature, and it is all mine because I got to it first." Hence the tragic waste of natural resources. This couldn't have been possible if the civilization of culture had been dominant. The civilization of power had been too strong.

John Galsworthy has written a great epic story of a family in his Forsyte Saga. And if you want to read a history of civilization of power as it operates in England, read that story of a family, patriotic and honest in business according to the traditions of that time, but to whom the supreme end of life was the possession of things; not, indeed, merely the possession of things, but the possession of persons. And the great crisis in the life of Soames Forsyte, the hero, was when he treated his beautiful wife as a possession or thing, resulting in the revolt of that lovely person. And again, the story reveals the conflict between the possessive instinct and the higher capacities which culture has released, namely, the creative instinct. The freedom of human activity, the freedom of individuals was made possible by the civilization of culture. Only indirectly has the civilization of power ever contributed in any way to the freedom of individuals; on the contrary, it has been in many cases a Frankenstein that has turned upon itself and prevented the enlargement of life.

Now what, according to the civilization of culture, are the finalities, the great values of life? There are many words and definitions, yet you will agree that beauty is one of them, love is another. And lastly, the moral imperative is something that has an ultimate appeal to us all as human beings. All these belong in the realm of values.

The conception of "the economic man" grew out of the industrial revolution. No man quite like that has existed. Rather, the economic man plus his responsiveness to beauty and to love and to faith and dependence on powers greater than himself which would enlarge his life, and above everything else, his sense of duty. Santayana says that art is merely adequate industry. Art and beauty always appear when *work* is carried out to the satisfaction of all human demands. And Lee, speaking of the place of beauty in work, said, "Someone is going to loom up in America and do a factory that will rank with Homer's Iliad, Shakespeare's Hamlet, and the sixtieth chapter of Isaiah. Someone that is creative with money will yet prove that a business man can be as good as an artist, and like that artist he can sketch in the colors of the new world around us. The factory that this man will do will touch us like a religion or a great work of art. It will be filled all day long as we go by with the whirl of wheels. In the end, the whirl of wheels shall be as the chant of great people."

Art is the handmaid of utility. It is reflected in the axe of the master woodsman. It is the poetry of motion in the rowing of sailors. It is radiant in the mother who moves about her household duties with love in her heart and skill in her fingertips. The uprising demand for

art and beauty is revealed in the strides made in musical appreciation and the teaching of music in our schools, in the development of art collections, and the like, and above all, in the enormous development of industrial art. Any manufacturer who leaves art out of account today does so at his own risk. The titanic struggle in the automobile industry today is not primarily a struggle of engineers, as important as their work is, but it is a contest of artist-designers appealing to the comfort and pleasure of the public. Look at a ten-cent store today as compared with what it was ten years ago. You find in a ten-cent store forms of classical beauty not to be possessed by any but the rich a few years ago, but now embodied in commodities which are within reach of all. Business found that ordinary man responded to beauty. And in competition, men who were loyal to beauty in production were those who won the largest measure of success.

In the immediate post-Darwin period, there was a belief that man was merely a clever animal. We have come to see in the light of modern contributions of art, philosophy, and ethics, that he is something more than a clever animal. He has a capacity for spiritual contacts. That is where religion comes in. I am not here to preach a sermon. We have mentioned the ages when theology was modified by the searchings of science. Men became apologetic about their religious beliefs, and some thought everything was a matter of blind chance. They wondered why there should be a God. They were apologetic for any religious faith.

Now they would lead us back to religion, saying that we were partners in the world. I say science has caused religion to be very self-critical, and very often not confident of its destiny. But I think that is changing. We are coming to see that just as the magician today conjures up things that no eye can ever see, so we are conscious of our relations not only to something beyond ourselves, but our relations between what we call our lower nature and what we call our higher nature. That is the heart of living religion. A consciousness that there is a better self that has a chance to triumph, and that we are under obligation to make the most of ourselves in this transformation. This overcoming, the renunciation of a minor good for a large good, not merely a contemplative belief that there is merely a larger good that we may choose, but the deep conviction that we *must* do so.

William James said that all the great objectives in history to which human nature has given itself have been inspired by what he calls religious enthusiasm—enthusiasm for the conviction that man is under obligation to seek a larger good at the cost of a lesser good.

Let us recall what happened in England at the time of that great world conference when a strange little man came from India clad chiefly in a blanket and eye-glasses. He didn't have any property. When he got off the boat at the French port, the customs officers asked him what he had, and he pointed to a few utensils and a goat, and said, "These are my earthly goods." You remember that when he went to live on the East Side, the people having seen the pictures of him planned to have some fun at the expense of this queer little man. But something happened. After these cockneys came into sight of this man something radiated from his eyes, face, and whole being that overcame them all. They forgot their derision and mockery and were awed in the presence of a great man. In that great conference his voice was among the most powerful. He had nothing in his hands. He had never raised corn or built a city. He had no possessions, and yet I think it is agreed that the words of Ghandi were the most influential uttered in that conference. After all, as Emerson said, all men are finally commanded by the saint who is obedient to the law of duty. This law of duty says we must make the

most of ourselves. We shall find our best selves not only in service to self, but in service to others.

These are some glimpses in the world of values as I see it, the world in which science is servant, but never master. With right organization, the civilization of power, and civilization of culture will make possible what Bertrand Russell called the good life, a life inspired by love or good-will and directed by knowledge.

History shows that good will fails without knowledge. In the middle ages when people were dying with black plague, they fled to churches and cathedrals and prayed for escape from the plague, and thereby spread the contagion. Plenty of good will, but lack of knowledge. On the other hand, in the World War science was destructive. It furnished abundant knowledge, but there was the opposite of good will. Science's great function is to be at the service of those who cherish and exemplify the great values of life.

A great thinker has declared that of the seventeen men who were officially responsible for the war of 1917, practically none desired the war, but it got beyond their control. If our knowledge of social and political science, and of higher controls, had been as adequate as our knowledge of physics and chemistry, the war would not have happened.

I have ventured to speak in a halting way of these two worlds that science serves. Science, growing out of one of these worlds, contributes to the civilization of power and also to the civilization of culture. The motivation of socially minded scientists leads the way to the good life, to the humanization of industry, the security of democracy.

One of the things that has inspired the human being at work and has advanced the values of the world of culture has, of course, been the pursuit of truth. This scientific spirit is a contribution to the world of values. The man who says to himself, "I don't know when this truth may be of value, and I may suffer in the promulgation of it, but the truth is my goddess, and I will be loyal to it to death."

I close with this from Tycho Brahe, a poem by Alfred Noyes. The king was interested in the work of the great astronomer, and built a great observatory in recognition of his scientific achievements. Friends said to the king, "Why are you wasting money on this man?" Then a new king, his son, came to the throne. He was a flippant man. He and his retinue went down to question Brahe, and Brahe said, "I have located seven hundred planets, and if I have time I will map a thousand, and then two thousand. Some day it may do somebody some good, and meanwhile. I have mapped the planets, and that is worth doing." Then he added:—

"In the time to come,
Said Tycho Brahe, "Perhaps a hundred years,
Perhaps a thousand, when our own poor names
Are quite forgotten, and our kingdom's dust,
On one sure certain day, the torch bearers
Will, at some point of contact, see a light
Moving upon this Chaos.
Though our eyes
Be shut forever in an iron sleep,
Their eyes shall see the kingdom of the law,
Our undiscovered cosmos.
They shall see it—
A new creation rising from the deep,
Beautiful whole.
We are like men that hear
Disjointed notes of some supernal choir,
Year after year we patiently record
All we can gather. In that far off time
A people that we have not known shall hear them
Moving like music to a single end."