



*I. I. Rabi and L. A. DuBridge*

I AM HAPPY TO BE ABLE to bring you the greetings of Columbia University, now beginning the third century of her life, and her thanks for your joining us in our Bicentennial Celebration on the theme, "Man's right to knowledge and the free use thereof."

In our United States we are born free, but we cannot be born wise. Man's right to knowledge is not the same as his right to the air he breathes. Knowledge has to be attained, it has to be learned, it has to be discovered. Even learning is a form of discovery. Therefore, man's right to knowledge can only mean his right to the opportunity to learn and to discover.

Man's right to knowledge then becomes an assertion of a right to education for all who have the ability to learn and the will to knowledge. Even more, since knowledge is always bounded by the unknown, we assert the right and even the duty to press forward the boundaries of knowledge. It is our faith that knowledge is a good to be sought even for its own sake alone, that new knowledge transforms the old, making it more beautiful, more meaningful, and more useful to mankind.

In our democratic society these propositions meet with wide acceptance. It was not always so. The struggle for universal elementary education was long and arduous and is not completely over even in our own day. As for higher education, the almost unique position

# MAN'S RIGHT TO KNOWLEDGE

**and the free use thereof"**

by I. I. RABI

which your own institution holds in this field shows how far we still have to go before higher education of the first quality is available to all who can profit thereby.

Our assertion of man's right to knowledge is then only a prelude to a large program. It is not a statement of existing fact, but an ideal which can be achieved only after generations of persistent and devoted effort. Even though our country leads the world in providing educational opportunity for our population, the greater part of the program still remains to be fulfilled.

We must not forget that in other parts of the world, notably in the Soviet Union, another and different educational effort of vast dimensions is being pressed forward. Their ideology does not carry the banner of "Man's Right to Knowledge." Individual rights are meaningless or abhorrent to that ideology. Their educational program is to train the citizen to the service of the state, to be a cog in a vast machine, to operate and think only in complete conformity to principles laid down from above.

Subversive as this effort may be to true education, it is not wholly unsuccessful in its appeal. There are people even in our own country who are attracted to this perversion of knowledge and education, this denial of intellectual and spiritual ends. This shallow but facile doctrine is very persuasive to those who look upon the individual as only a means to an end, although the end on close examination turns out to be ignoble and degrading.

These people, tired of thinking, incapable of learning, need the reassurance of a mass. They are more than

ready to surrender their individual wills to a leader, to be submerged in a herd where all one has to do is to keep step with the man ahead. Their drives come not from spiritual resources within, but from the pressure of the mass without. Their motivation is hate and envy. Always their great hatred is directed at freedom, at schools that are free to teach objectively, at libraries where the individual has freedom of access to all knowledge and all doctrines, but their greatest hatred is for the individual who undermines their security by daring to think differently.

The mechanism which maintains the domination of absolute conformity is terror. We have seen its effects in Russia, in Germany, Italy, Japan, and most recently in China. When fear is in the saddle, enthusiasm takes the place of thought, hypocrisy takes the place of genuine patriotism, cant takes the place of reasoned doctrine, and a noble record of achievement can become a source of calumny and suspicion.

Ultimately, and the signs are already visible even in our own country, this drive for conformity will be directed at science, the stronghold of reason and objectivity, and we must prepare for the attack.

Science is perhaps the most important of the driving forces which give our culture its pervasive power and aggressive virility. If our science is fettered by intimidation and outside control, as it is in the Soviet Union, the principles on which this country was founded will cease to have a living validity.

## The influence of science

Our science is a massive and beautiful intellectual structure which has been erected piece by piece over centuries of effort by devoted men from many lands. It cannot be successfully challenged except in its own terms, since it is solidly based on detailed experiment and exact observation. In response to its universal appeal, an increasing portion of the more gifted young people in every country of the world are attracted to study and to contributing to the growth of scientific knowledge. It is then no wonder that even the ancient cultures of the East, which have kept their own integrity for many centuries, are now being transformed in our own generation because they are unable to resist the influence of scientific thought.

Likewise, within the universities, science has through the last century played an increasingly important role. The university is no longer an institution which is chiefly concerned with the preservation and dissemination of knowledge. With the growth of science, the university is now equally concerned with the more dynamic activity of discovering new knowledge and educating young men and women to carry on this task in the future.

The modern university is therefore no longer an ivory

tower, with windows turned only toward the past; the present and the future are now equally our concern. When new materials are needed in industry, when new healing agents are needed in medicine or when new weapons are required for defense, or even when our political and economic arrangements require revision, people now look to the university for help, guidance, and inspiration.

Nevertheless, so great is the capacity of the human mind to hold two contradictory views at the same time, the university professor is still regarded as an unworldly person, out of contact with reality, unable to conduct the affairs of his university without the intervention of politicians.

## The tradition of science

Science is the greatest uncentralized, undirected cooperative effort of all time, not only among people of the same culture but also among peoples of the most diverse origins and customs. Furthermore, the traditions of science provide us with a set of values and an ethic which are rational and therefore accessible to all men. The universal respect in which science is held by people who differ extremely in other matters indicates that the scientific tradition can become a means to bring the nations of the world together for peace and cooperation.

In this day of thermonuclear bombs many here will find my statements optimistic to the point of naiveté. When civilized mankind is cowering before the shadow of extinction, the blessings of science and technology are hardly obvious. But we must ask ourselves from where does this threat come? Surely not from some malevolent spirit alien to ourselves. It comes from other men like ourselves who must also feel this threat, and therefore there is hope that this menace can be overcome by wisdom and insight and by the very knowledge which produced the menace in the first place. We surely cannot give up our science to live the mean, benighted, fear-and-disease-ridden lives of our remote ancestors. Our powers for good and evil have always been the two sides of the same coin. There is no turning back on the path which humanity has taken. The solution, if any, of the problems of mankind lies in deeper understanding, more penetrating insights, greater capacities, more science and not less.

This path was recognized by the President of the United States in his stirring address before the United Nations Assembly in December of last year, when he called upon the nations to form a pool of uranium, plutonium, and other fissionable material to be used for the common good under the United Nations. This proposal, as the President made clear, is only the first step on the road which we have to travel if our civilization is to survive. No one should have any illusion that this

path will be an easy one. The history of the past decade is enough evidence to the contrary. Nevertheless, it is the direction which we must pursue with firmness and sincerity. If our new weapons are ever brought to the test of war, the result can only be universal disaster.

Up to the present day the Soviet Union, blind to the interests of her own safety and deaf to the anguished cries of humanity, has blocked our every effort to achieve a peaceful and harmonious world. Fruitless as our efforts have been so far, we must not be discouraged. We must not permit ourselves to be thrown back to a policy which depends solely on a Maginot Line of secrecy backed by atomic and thermonuclear retaliation. While building up the offensive and defensive strength of our country, we must continue to retain the initiative in offering to the peoples of the world positive proposals, imbued with moral purpose, to relieve the fears and tensions of our time. This, President Eisenhower, who is schooled in war but a lover of peace, will not cease from doing.

## Expensive research

As our science becomes more highly developed, scientific research becomes increasingly expensive, not only in medicine but also in the physical and biological sciences. This development, inevitable in any case, was greatly accelerated in recent years by the invention of important and necessary, but expensive instruments such as the large cyclotrons, the electron microscope, fast calculating machines, and by the recognition of the tremendous power and utility of electronic instruments in general for many fields of research.

These developments which have so greatly advanced scientific techniques and which have led to discoveries of the first importance, have nevertheless placed serious problems before university administrations in finding funds to support these expensive undertakings. At present, the larger fraction of the support for scientific research comes either from the Federal Government or from special foundations. This kind of support, although very stimulating and timely, brings with it a whole series of problems which are both novel and perplexing. But, no matter how difficult the problems, scientific research in the university must proceed with full vigor. If private support fails, we must continue to seek public funds with all the problems which they entail.

It would be a great loss amounting to a national disaster if the universities were to lose their leadership in basic science to specialized research institutes. The universities would become schools where the results of others were taught, but where the teachers themselves played but a minor role in this creative activity. The importance, the standing, and the vigor of our intellectual life in the university would immediately sink. The

professors would become, so to speak, retailers of the work of others, reporters of events rather than the active pioneers at the forefront of knowledge.

Such an atmosphere can hardly inspire the young and vigorous minds of the future generation of scientists. Bold and imaginative thinking cannot be communicated at second hand.

There is a most important practical national interest in maintaining scientific research in the university at full vigor. This point was not well understood before the war, but has now become very clear, and accounts to a large extent for the great interest of various departments of the Federal Government in the support of University research.

A professor actively pursuing his researches, surrounded by his students, in the laboratories of the universities produces not only new and valuable knowledge but also new scientists, able, skilled, and imbued with his enthusiasm. University research is always young and vigorous. Although the professor ages with time, the students remain timelessly young. The university is a producer of men as well as ideas, of inspiration as well as new knowledge and discovery.

Moreover, university scientists are uncommitted scientists. In a time of national emergency, as during the last war, students and professors could, with little or no delay, turn from their researches to the problems of the national emergency. In our universities we have, so to speak, a standing army of thousands of capable scientists who are equally useful in peace and war.

## The university and government

The value of this mobile standing army was fully demonstrated in the last war; the development of the atomic bomb was only one of a long list of great accomplishments which greatly shortened the war and saved the world from even greater misery. The cordial relations and mutual respect between our university scientists and our defense forces which were developed during the war remain unbroken to this day, and are one of the important elements in our national defense.

This cooperation between the university and government does not, by any means, represent a militarization of our scientists or of our universities. It is, rather, a symbol of maturity in our science and our universities, a symbol of the assumption of a public responsibility which was always present but not fully recognized until this decade. It is to be hoped that these lessons from our war effort will not be forgotten by the universities, by Congress, and by the Administration.

The value of the standing army of scientists is greatest when they come from an atmosphere of freedom and independence where no avenue is closed to questioning, where a bold new idea is a value in itself; in short, an

atmosphere of the utmost academic freedom. Any attempt to undermine the independence of university research through government control is an attempt to destroy the very qualities which make the scientist of value, to the country and to civilization.

This far I have dealt chiefly with the first part of our theme, "Man's right to knowledge." I will now turn to the even more challenging second part of our bicentennial theme, "Man's right to knowledge and the free use thereof." Clearly, the right to free use of knowledge cannot be as absolute as man's right to knowledge. In the first place, there are stringent but necessary laws regulating many uses of knowledge. They range from the Biblical commandment, "Thou shalt not kill," to the well-enforced traffic regulations of your Pasadena, California. Nevertheless, we do not feel that these laws violate our free use of knowledge, because we know these laws to be wise.

## Knowledge and wisdom

The free use of knowledge is acceptable only when guided by wisdom. Knowledge without wisdom can be dangerous and perverse, but wisdom without knowledge is meaningless, since a man who is wise but ignorant can only be silent.

Wisdom is inseparable from knowledge; it is knowledge plus a quality which is within the individual human being. Without it knowledge is dry, almost unfit for human consumption, and dangerous in application. Its absence is clearly noticeable; the learned fool and educated bore have been figures since the beginnings of recorded history. Wisdom adds flavor, order and measure to knowledge. Wisdom makes itself most manifest in the application of knowledge to human benefit.

In its highest aspect, especially when applied to national affairs, the highest wisdom must be joined to the broadest knowledge. With knowledge as extensive as it has become in modern times, wisdom can hardly be achieved except through a communion of many minds. Indeed, it has always been so since Socrates sought wisdom by questioning his fellow men.

I would like to devote the remaining minutes of my discourse to wisdom and education.

Our colleges and universities are well organized to dispense knowledge thoroughly and efficiently, but since they tend to become a collection of schools and departments rather than a community of scholars, the saving grace of wisdom is too often omitted. Wisdom is by its nature an inter-disciplinary quality, and not the product of a collection of specialists. There can be no course in wisdom.

We do, indeed, try to mold the student toward a certain ideal of the educated man of the twentieth century, but it is too often a broad education administered by

specialists. The approximate counterpart to this ideal, embodied in a living man, is a rare being on any campus except here at Caltech.

In fact, in most universities, the student is the only really active connecting link between the different departments of the university. In a certain paradoxical and limited sense the students are the only broadly educated body in the university community. It might be equally as instructive and useful to have the faculty examined by the students from time to time, as to have the students examined by the faculty, according to immemorial custom.

Our American colleges and universities, since they are fairly recent foundations, have not settled into complacency. They are always ready to experiment with the curriculum to achieve desired ends. The ultimate end of education is knowledge embedded in wisdom. Our experimental methods have taught us how to impart the most diverse forms of knowledge, but the quality of wisdom has been more elusive.

Harking back to a past which now looks so bright in retrospect, to a knowledge and wisdom which now looks simple and clear, many educators all over the land have raised a banner with the inscription "Back to the humanities." This slogan has never been well defined. It does not mean a study of Latin, Greek and Hebrew writings in their original tongues; in practice it has usually come to mean less real, solid science, and more of everything else. I do not believe that this path will lead to wisdom or salvation in this generation any more than it did in previous generations when the humanities were in flower.

## Knowledge and change

Every generation of mankind has to remake its culture, its values, and its goals. Changing circumstances make older habits and customs valueless or obsolete. New knowledge exposes the limitations and the contingent nature of older philosophies and former guides to action. When change is slow, the new is gradually assimilated, and only after a number of generations is it noticeable that a great change has been brought about.

We do not live in such a period of history. In this century, enormous changes in the circumstances of our lives and in our knowledge have occurred, not in every generation but in every decade. It is therefore not at all surprising that our intellectual, our social and political processes have largely failed to keep abreast with contemporary problems. It is not surprising that we became confused in the choice of our goals and the paths we must take to reach them.

Our modern university, which takes all knowledge as its province, is the only instrumentality we possess which has the capacity of bringing order out of this chaos.

Moreover, society has laid this obligation upon us since it is our task to teach the youth of our country, to give them the knowledge and guidance which will enable them to meet the problems of their generation. We must not only transmit to them the wisdom of the past, but we must arm them for the future.

This task cannot be adequately performed unless the teachers become clearer in their individual minds, and as a university community, about our values and our goals in our own times. We cannot achieve this goal unless we make a conscious effort toward the ideal of a university as a place where learned men of different disciplines really communicate with one another to achieve wisdom.

Here we come to the problems raised by science.

## Understanding science

The least assimilated portion of modern knowledge, and yet the part which is most responsible for our changing world, is our science. Nevertheless, in this period of history, in this most scientific of all ages, the cultivation and understanding of science has become a specialized function of professionals in which neither the educated public nor the general university community plays an active role. In fact, with many otherwise estimable people, ignorance of scientific thought has become a matter of pride rather than regret.

How can one hope to attain wisdom, the wisdom which is meaningful in our own time, without the knowledge of the profound forces which shape our destiny? How can our leaders in government, in industry, and in education make wise decisions, now in the middle of the twentieth century, without a deep understanding of scientific thought and feeling for scientific tradition?

These anguished thoughts have impelled many scientists, to their own personal peril, to concern themselves with matters which in the past were the exclusive domain of statesmen and military leaders. They have tried to advise, importune, and even cajole our leaders to include the scientific factor in our fateful policy decisions. More often than one would expect, they have been successful. The greatest difficulty which stands in the way of a meeting of the minds of the scientist and the non-scientist is the difficulty of communication, a difficulty which I believe stems from a serious defect in education.

The mature scientist can listen with pleasure and understanding to the philosopher, the historian, the literary man, and even the art expert. There is no difficulty of communication from that side, because the scientist has been educated in our general culture.

Unfortunately this channel of communication is a one-way street. The non-scientist cannot listen to the scientist with pleasure and understanding. Despite its universal outlook and its unifying principles, science

seems to be no longer communicable to the great majority of educated laymen. They simply do not possess the background of the science of the day and the intellectual tools to know what it is doing to them and their world. To his colleagues in the university the scientist tends to seem more and more as a man from another planet, a creature uttering profound but incomprehensible truths, or a technician scattering antibiotics with one hand and atomic bombs with the other.

The solution to this problem of the integration of scientific thought into our general culture can lie only in education. We must somehow find the way to integrate the scientific tradition and scientific thought with the rest of the general culture of our time. This cannot be done by giving the student a smattering of scientific ideas any more than a knowledge of French which suffices to order ham and eggs will give one the key to the beauties of French literature. A thoroughgoing revision of the curriculum in our secondary schools and colleges will be required to make the scientific mind and tradition an integral part of our culture.

We must bridge the ever-widening rift that has opened between science and what goes by the name of "the humanities" by achieving the understanding that both science and the humanities are creations of the human spirit. Only by the fusion of the two can we reach the wisdom appropriate to our day and generation. To this end we must learn to teach science in the spirit of wisdom and in the light of the history of human thought, and human effort, rather than as the geography of a universe uninhabited by mankind. Our colleagues in the non-scientific faculties must understand that if their teachings ignore the great scientific tradition of modern times, however eloquent and elegant their words, they will be meaningless in this generation and barren of fruit.

## A united effort

What the world needs is a fusion of the sciences and the humanities. The humanities express the symbolic, poetic, and prophetic qualities of the human spirit. Without them we would not be conscious of our history; we would lose our aspirations and the graces of expression that move men's hearts. The sciences express the creative urge in man to construct a universe which is comprehensible in terms of the human intellect. Without them, mankind would find itself bewildered in a world of natural forces beyond comprehension, victims of ignorance, superstition and fear.

With a united effort of the sciences and the humanities, we may succeed in discovering a community of thought which will transcend the boundaries of state and nation and help bring the peaceful world which we all desire with all our hearts.