

## **P R E F A C E**

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# **A Message to the Scientific Community**

### **Sergei P. Kapitza**

Professor of Physics, Institute for Physical Problems, USSR Academy of Sciences and Moscow Physical-Technical Institute, working on the development and uses of electron accelerators; Vice Chairman, Committee of Soviet Scientists for Peace against the Nuclear Threat. Dr. Kapitza is a member of the World Academy of Arts and Sciences and moderator of a Soviet television program on science and society.

### **Martin E. Hellman**

Professor of Electrical Engineering, Stanford University. Dr. Hellman is best known as the inventor of the "public key" and "trap door" cryptographic techniques. He is a Fellow of the Institute of Electrical and Electronics Engineers.

In the present state of world affairs, one of the major sources of disparity is the discrepancy between our scientific and technical progress and our level of societal and individual development. The magnitude of the forces we command today are such that mankind can alter the environment of the planet as a whole, as we are now doing. The subsequent emergence of global problems and the recognition of their importance is certainly one of the great intellectual events of our time.

#### *Evolution*

The future belongs to those with the ability to change. Those that cannot adapt to changes in the environment, die off. That simple,

seemingly harsh demand has brought forth eagles and doves, elephants and sponges, humans and ants. From that evolutionary perspective, the challenge is seen not as harsh and unnatural, but as the essential driving force in realizing the human potential in the DNA of our primitive, single-celled ancestors.

Today, the evolutionary imperative applies to our species in a totally new way. A change in thinking is required for our physical survival. The magnitude of the physical forces that we command today is so great that we are altering the environment of our planet as a whole. Human damage to the ecosystem already has extinguished a large number of species and threatens all. The emergence of global problems and the recognition of their importance is perhaps the greatest accomplishment of contemporary thought. (1, 2)

#### *Global Problems and the Nuclear Threat*

Among the global issues we face are energy, natural resources, food, and water – and the threats to the planetary life-support system that occur in our attempts to meet these challenges. As important as these issues are, the nuclear threat must head any list of the global problems that threaten humanity.

Over the last forty years we have seen the world's arsenals grow to immense proportions. In destructive power, they are equivalent to 1 million Hiroshimas. Our planet itself has finally become too small for them. Apart from their sheer might, the intelligence and the deadly accuracy of these weapons have grown to an extraordinary extent. The Goliath of the bomb has joined forces with the David of microelectronics.

There is talk of expanding armaments into the realm of outer space, as if the sea and land of our globe were not enough. Detailed technical, scientific, and military analyses of this latest move have shown its fallacy. While the technical content of these analyses may be beyond the average person, the landing of a Cessna in the heart of Moscow by a lone West German pilot in May 1987 shows in common sense terms the futility of a perfect aerospace defense.

The further buildup of armaments gives no promise of increased security for any nation, much less for the world as a whole. In pursuing the outmoded concept of "a balance of power" as a guarantee of stability we have long passed the stage where the notion was applicable.

The overkill of today's nuclear arsenals makes the concepts of "military parity" and balance of power meaningless. Deterrence, that dubious contraption of a balance of terror, finally shows its true colors. It no longer offers even the hope of security it might profess to provide at a lower level of armaments.

From a more general point of view, one may also consider the conflict that we are facing to originate from the conflict between the rational and irrational parts of human nature. In its most dangerous form, we see this in the supposed rationality of the scientific contributions to the arms race and the concept of deterrence, based on irrational fear and vengeance.

We have become trapped in a futile pursuit of supremacy, and the ever-increasing power of our armaments provides us with less and less security. In the looking-glass world of the arms race, the risk of an accident or an unforeseen loss of stability is growing ever more likely, both as a direct consequence of the supercharged level of our armaments and of the resultant trigger-happy frame of mind.

### *The Role of Thinking*

We are forced to look elsewhere in seeking a way out of the race to oblivion. Not by a technological fix, nor by constructing bigger and better gadgets and rockets will we find a haven from the nuclear threat.

Making the analogy of our world to a computer, we have developed our hardware far beyond our software and, for the hardware of technology to be useful, we must now develop the software, our thinking. As with computers, the development of software now demands much greater effort than the buildup of hardware. To move from one societally sanctioned view of the world to another is not easy. An old set of "truths" gives way to a new paradigm begrudgingly.

The main feature of the new paradigm is clear: In global thinking, the interests of humankind as a whole take precedence over those of any one nation or any one group of people. None can survive without survival of the common life-support system that sustains us all. From the past, we can see how difficult it has been for the individual to recognize the need to surrender his more limited view in order for him to survive as part of a larger entity, be it his country, tribe, or class.

How to accept and respond to this challenge is in no way obvious. Which path are we to follow so as to provide a safe and secure world?

How can we reach a new level of control and understanding, while at the same time preserving all that contributes to the dignity and freedom of the individual? These questions face us all and it is to these issues that we here address ourselves.

### *War and Nuclear War*

If we keep having wars it is only a matter of time before one escalates out of control. So the real problem is not nuclear weapons and nuclear war, but all weapons and all war. Hints of this can be seen in the difficulty of fashioning an arms control agreement to eliminate nuclear-armed missiles from Europe. Fear that conventional war would break out thereafter is slowing progress on this important front. So long as we pretend that conventional war is still feasible, we will never eliminate nuclear weapons.

Do our nations still prepare for war? Do statesmen still consider war in the nuclear age to be "a continuation of politics by other means"? In spite of protestations and even beliefs to the contrary, the unfortunate truth is that both parties still do. The US and the USSR each have millions of men under arms, tens of thousands of tanks, thousands of fighter aircraft, and tens of thousands of nuclear weapons arrayed against each other. Although proclaiming the desire not to use them, each nation has plans at the ready to do precisely that. What is planned for, however contingently, can happen.

In spite of the tremendous destructive power of modern weapons, it is now more hopeless than ever to resolve social issues or those of national destiny by military means. The lesson of Vietnam is clear. Similarly, it is now recognized after seven years of a futile military effort, that the conflict in Afghanistan can only be resolved by political means.

On the positive side, the impossibility of war is beginning to be recognized in Europe. There has been no war on that continent for more time than ever before, and definitive steps have been taken toward military disengagement. This is encouraging for a region that twice in this century has been the origin of and battleground for world wars.

We recognize that ending all war is infinitely easier to say than to do and that no nation can unilaterally disarm in the current, very dangerous state of the world. So the challenge is to find an evolutionary path which brings us to that point. An important first step would be to

recognize that we can no longer develop national security except as a consequence of common security.

The efforts of the leaders of our two nations, pioneered in Reykjavik, mark a significant move toward this goal. To them we owe a debt of gratitude for creating a fertile climate for cooperative projects such as this. It is our duty as scientists to take their initiative even a step further in exploring the path to a world without war.

#### *Discovery and the Scientific Spirit*

While the path is not yet clear, the method needed to discover it is well known: the scientific spirit, exemplified by a dedicated search for the truth, with a courageous disregard for commonly held beliefs when they are contradicted by observations. We have used this approach to discover the right paths into other unknowns – the design of the solar system, the structure of the atom, the makeup of our psyches.

As men and women of science, we have ventured, somewhat tentatively, into the more complex worlds of the human psyche and society. But it has been considered improper for those of us in the natural sciences to attempt to use the scientific spirit to bring about fundamental changes in the "unnatural sciences" of public opinion, politics, and international relations. But improper we must be. Science demands it of us if science, along with humanity, is to survive. This book marks an attempt to marshal some of the considerable resources of the international scientific community in the effort to build a world beyond war. Everyone has a life-and-death stake in this endeavor. So everyone has a responsibility to participate. As scientists, we cannot claim any special role other than that we earn by our involvement.

It is instructive to recall what was said by the founding fathers of modern science. (3) More than thirty years ago, Bertrand Russell wrote: "We have to learn to think in a new way. Remember your humanity and forget the rest. If you can do so, the way lies open to a new paradise; if you cannot there lies before you the risk of universal death." These passionate and wise words of the Russell-Einstein Manifesto, signed by Einstein on his deathbed and by other great scientists, have set the pattern for the thinking of many of us.

With the publication of the Russell-Einstein statement, the "Pugwash movement" of scientists came into being. For the first time, scientists from the East and the West engaged in a regular dialogue on matters of

science, war, and peace. Strategic defense systems were first discussed at the Pugwash meetings of scientists before they were negotiated by statesmen and finally formulated in the 1972 ABM Treaty.

Another signpost from the early days of the nuclear era is the idea of the open world. This concept was first suggested and discussed at length by the great physicist Niels Bohr as early as 1944, and later propagated in his Open Letter to the United Nations in 1950.

Today, the very progress of science and technology has opened up the world in a remarkable way. Modern transportation has brought unprecedented mobility to people and goods – and bombs. Communication technology has produced the "global village" and much noise. Space technology has opened up the world to an extent unimagined before. The whole concept of national privacy as part of national sovereignty has gone: The sacred cow of military secrecy cannot conceal itself from the "eye in the sky." It is only a slight exaggeration that reconnaissance satellites can count the number of stars on a general's epaulets.

Unfortunately our social behavior, our mentality both on an institutional and personal level, seriously lags behind in its ability to face this new technology, this new world, this new openness. The US jealously guards its integrated circuits from the USSR, as if their possession or nonpossession would determine the winner in a war no one can win. The USSR forbids the taking of pictures from airplanes and tall buildings, as if they might affect a military outcome. Rather than adding to either nation's security, these manifestations of old thinking fuel the other side's fears that the first is preparing for war.

We often spend more effort to control information than spread it, to entertain rather than educate, to distort information to fit our worldview rather than vice versa. In spite of these human failings, information does flow increasingly freely. The latest, most dramatic, and most hopeful changes have been the Soviet Union's move, under its new policy of glasnost (openness), to a freer flow of information.

### *Historical Precedents*

In choosing to speak out now, we act as inheritors of a proud tradition. Einstein, Bohr, and the Soviet geochemist and pioneer global thinker Vernadsky belonged to the brilliant generation that flourished during the first decades of our century, from 1900 to 1930. In that

golden age, on a scale unknown since, we saw the emergence of new arts and new sciences: modern music and mathematics, literature and architecture, physics and biology. All these came into being, together with the new cosmology and the understanding of man himself.

These developments in science and the arts took place simultaneously with revolutionary developments in social conditions. While much, if not all, was arrested by the Great Depression and the advent of dictatorial regimes, the intellectual and artistic masterpieces of those years still set the pattern for our modern culture.

Scientists were not only pioneers in this century. The Renaissance in Europe five centuries ago is an example of an important change in mentality, a change in the very concept of the world in which we live. The discovery of a new world, America, enlarged the image of the planet much to its present dimensions; the ideas of Copernicus, Vesalius, and Galileo laid the foundations for the modern scientific approach; in the seventeenth century humanism and enlightenment explored new values and modes of thinking; the Protestant Reformation carried a redefinition of work and success. These are but some of the hardly coincidental changes introduced in rapid succession during that tumultuous period in European history. It was also a time marked by the Thirty Years War and by witch hunts. Discovery of new views of the world evoked, then, as now, a certain amount of fear.

To pass to times more connected to our age, the October Revolution in Russia and the thinking that then launched major social changes elsewhere should be seen as another example. The New Deal in the United States belongs to the same type of event, when new thinking was instrumental in changing the very fabric of society. Perhaps from a broader historical perspective we should view these changes in society as part of the transformation we are undergoing now under the impact of modern science and technology, as we recognize the vital importance of emerging global issues.

Historically, it has been customary to speak of the great disparities that split our world. Of these, the most noticeable is that of wealth and misery, which today divides the North and the South on a global scale. But here we would rather draw your attention to the disparity of things and ideas, between our material and cultural development. This dichotomy of "having" and "being" is fundamental to all the other dichotomies. It is in no way new. At present, however, we have reached such a state of affairs that it jeopardizes our very existence. Our world is

too small, and the forces we command too large, to ensure our planet's survival into the indefinite future without our taking ultimate responsibility for our actions.

### *The Contribution of Scientists*

We have rather impressionistically reminded you of these events and ideas because today we are at the crossroads. Our future, and the very existence of future generations, is at stake and our mettle as scientists, citizens, and human beings is put to the test.

As in the past, scientists today can contribute to improving international understanding. International collaboration of scientists helps both the progress of science and the betterment of the world. At the same time, it aids in establishing what the diplomats and military call confidence-building measures. Traveling professorships, exchange of students, postgraduate scholarships, and visiting scientists are the real traffic of scientific intercourse. However small the numbers, this is the way connections and friendships are built up, and channels of understanding are opened that can survive the drastic upheavals of modern history. Personal connections dating back to the Belle Epoque of European culture not only survived the Holocaust, but were instrumental in establishing the Pugwash meetings which deal with the nuclear threat. Similar personal friendships growing out of scientific collaboration laid the basis for this book.

Now large projects on plasma and high-energy physics, space exploration and radioastronomy, deep sea drilling, synchrotron radiation, and mapping the human chromosome have added a new scale to international collaboration. We are all studying the same universe and all building a common world science. There is but one truth to be discovered, be it in Moscow or New York. Up to now, we have pooled our resources and intellect, but not in any dramatic respect changed our way of conducting research or using the universal truths discovered.

Dealing with global issues requires a qualitatively new kind of effort since these problems are not only international but interdisciplinary in their nature. From experience we know that the boundaries between scientific disciplines are often more difficult to cross than those which divide nations or separate the known from the unknown. These projects on global problems demand a new dimension for their conception, planning, execution, and implementation. Perhaps the last step is the



most difficult of all, for here we are leaving the ivory tower of our professional interests as scientists and entering the real world of public relations, business, and politics. As examples of success in implementing this global approach, we may mention conventions relating to whaling, outer space, air traffic, and the law of the sea. In each of these the concept of a common heritage is emphasized. Thus we enlarge our vision and develop our thinking.

#### *Change in the Soviet Union*

While critically needed in every nation, this new thinking has special significance for the development of the Soviet Union. As a political entity the Soviet Union encompasses a variety of lands and people, and is now on a national basis experiencing many of the problems faced by the world as a whole. This modern crisis - there is no other word to describe the situation - is to a great extent due to structural, if not political, disparities in technological and societal development.

In any nation, it is the human condition that suffers first from such disparities, be it due to a loss of economic efficiency, the degradation of the environment, or the menace of war and fear of extinction. This is fully recognized by the new leadership which now has the great task of changing the course and pattern of Soviet development. For Soviet citizens this national challenge is the most exciting and promising thing to happen over the past decades. The new openness pursued in the Soviet Union is helping to establish new values and to exercise new thinking. As with any great change, it will not be easy to achieve. The success of these fundamental changes depends on the extent to which this new way of thinking, these new ideas, can be conceived and broadcast to the public, and the degree to which they become part and parcel of the social consciousness.

Of utmost importance, and this applies to the West as well as the East, is how the mass media - those powerful instruments of social persuasion - can become instruments of positive change and serve the basic goals of society. Here an important contribution would be to destroy, rather than build up, the "image of the enemy," and to develop an atmosphere of hope and understanding. In a longer perspective, the changes and responses of the educational system, the way we teach and train the next generations, will be of even greater importance.

These changes in Soviet society will have repercussions well beyond

the Soviet Union, not only because of the Soviet Union's sheer size, but because these changes are prompted by circumstances of a general nature.

### *The Challenge*

History repeatedly shows that conspicuous consumption - be it in ancient Rome, the French monarchy, or tsarist Russia - is a precursor of revolution. Today, for the world as a whole, the arms race is conspicuous consumption in its most menacing form, and it signals that major changes are imminent.

The evolutionary imperative, once solely physical or solely intellectual, is now both. Old ideologies have once again outlived their usefulness. It has always been the role of science to explore and discover not only new machines but also to break through barriers of human thinking. It is the latter responsibility to which we now respond. Humanity will either change its thinking or it will die a physical death from misuse of its own technological genius.

As scientists, we are dedicated to the search for truth, however far from conventionally accepted beliefs it may lead us. As scientists, we are guardians of the great tradition set by Copernicus, Darwin, Einstein, Bohr, and other courageous men and women who broke with the mind-set of their day. Therefore, as scientists, we have an added responsibility to help society break with the current, dangerously inadequate mind-set.