


# Science and Man

D. S. KOTHARI

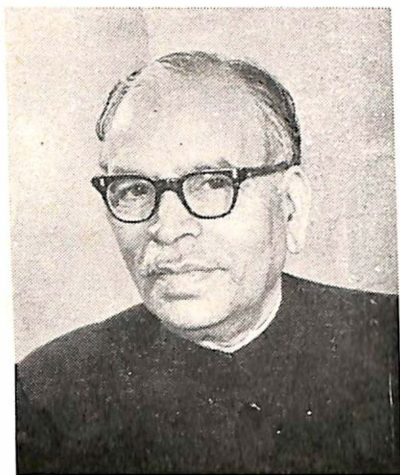


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NATIONAL AND CULTURAL FOUNDATION





PROF. D.S. KOTHARI is India's foremost Scientist and educationist. His notable contribution to research in the genre of Statistical Thermodynamics—theory of white dwarf stars and other physical/astrophysical subjects showing that atoms can be ionised by application of pressure alone—has received world wide recognition.

Prof. Kothari has been gravely concerned about the social consequences of science. His book, *Nuclear Explosions—Their effects*, expounds in the clearest language the danger mankind faces on account of continued explosion of nuclear devices. The book written on the suggestion of Pt. Jawaharlal Nehru has been translated into several Languages.

Dr. Kothari worked as Professor and Head of physics department, University of Delhi; Scientific Adviser to the Ministry of Defence, Govt. of India (1948-61), Chairman of the Committee on Scientific and Technological Terminology (1961-64); Chairman, University Grants Commission (1962-73). Prof. Kothari was Chairman of the Education Commission (1964-66). He was awarded PADMA VIBHUSHAN (1973). Presently he is the President of Indian National Science Academy.



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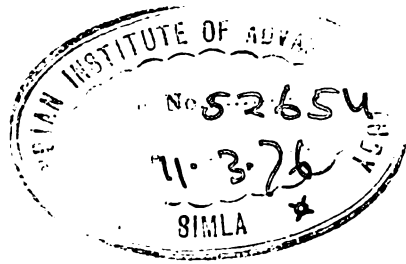


# SCIENCE AND MAN

**D. S. KOTHARI**

INDIANA PUBLICATIONS, NEW DELHI

1974 ZAKIR HUSAIN MEMORIAL LECTURE  
SCIENCE AND MAN



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## PREFACE

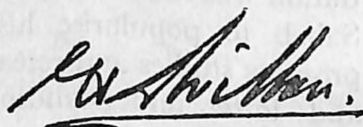
Dr. Zakir Husain Educational and Cultural Foundation was founded by the many admirers of Zakir Saheb to popularise his thoughts and ideals—to promote studies and research on educational problems and foster understanding and fraternity bringing about greater cohesion among our people and among the nations.

Zakir Husain Memorial Lecture, an annual feature, was instituted to perpetuate the cherished memory of Zakir Saheb. We could not have thought of a better person than Prof. D.S. Kothari, an eminent scientist, an educationist of great standing and repute and above all a humanist, to deliver the first of the series. It was so nice of him to have agreed to do so and that too on a subject of so topical an interest



—“Science and Man.” In his lucid address, Prof. Kothari fathoms the malady of the modern technological society—“not pursuit of knowledge but greed and worship of power”—and expounds his remedy. Science bereft of humanism has no place if society were to survive. Prof. Kothari tries as it were to bridge the dichotomy between science and faith, between man as a scientist and a scientist as a human being.

The lecture was delivered to an invited gathering. With a view to making available the profound thoughts of Prof. Kothari to a greater number of people, the lecture has been brought out in this book-form which I commend to the public.



(G.S. DHILLON)

*Speaker, Lok Sabha*

12 Aug. 1975  
New Delhi

## INTRODUCTION

Twenty five years after his death, Gandhi seems to have become much more relevant to our times. When he questioned the basis of technological civilization, many dismissed him as an idealist, some even called him a dreamer. Now with a new awareness among people even in the west, it is increasingly felt that excessive dependence on science and technology is detrimental to human weal. It does not mean that we should discontinue the pursuit of science. What is important is to remember : "If science and technology are to benefit Man, Science must become a part, an integral part of our culture."

Day after day there is a redicoverly of Gandhi and his philosophy of *ahimsa*. Two years ago, Dr. Gunnar Myrdal told us in Delhi that the west is coming round to see that Gandhi has the solution to many of the problems they are facing out there. Then came

the economist Taussing who said much the same. One should not forget that science itself could be put to the service of the cruellest political maniac as was proved in Hitler's Germany. And it shocked the conscience of many, not excluding the most eminent scientists themselves, some of whom like Einstein had to flee Hitler's Germany. Orwell's two books, the *Anima I Farm* and *1934*, expressed through the horror of a scientific utopia, the distinct possibility of science and authoritarianism joining hands to enslave man. But it was thought that Hitler was an aberration and the liberal spirit would ultimately triumph. Even then, Aldous Huxley wisely forewarned that the logic of science will lead to dehumanisation of man as he showed so devastatingly well in his phantasy of the *Brave New World*.

The more recent developments in science have placed the moral choices of our age in a much sharper focus. Take for instance, the growing science of organ transplants. Once the world thought that the gruesome experiments the Nazis conducted in medicine were the aberration of a maniac. But today with organ transplants becoming rather common, the moral choice has become inescapable. Even euthanasia is no longer a distant problem.

Where should we draw the line and say that here science should end and the moral law should take over? The distinguished physicist Max Born, after considering the scientific revolution, almost came to

the conclusion that it has ushered in mankind into not only post-industrial but also post-ethical world. He pointed out that specialisation had proceeded to such an extreme that each scientist working on part of a project, could look to the whole with a detachment and beyond the question of ethics probably like Adolf Eichmann looking at his concentration camps with stoic detachment.

The west is beginning to view all this with the same fear with which the fisherman viewed the genii he had released out of the bottle. A.F. Skinner has in *Beyond Freedom* questioned the scientific basis of freedom of choice and the individual's moral rights over what he thinks are community's logical growth. This is not the tangential logic of an over-wrought mind. The fact is that in a fundamental manner science has seemingly destroyed the very basis of constitutionalism and the moral sanction behind authority. Harvey Wheeler, a Fellow of the Centre for study of Democratic Institutions, wrote in the *Centre Magazine* in 1969: "Our notion of legislation and or constitutionalisation has long been built on two assumptions, neither of which is now acceptable. The first was that men of common prudence and wisdom are capable of understanding every political problem that needs to be understood. The second was that such men could make laws to deal with these problems. The scientific revolution is undermining the first of these assumptions by posing

problems too technical for laymen to fathom. It is undermining the second by making it impossible for legislatures to lay the foundation for the future. The result is already evident : we either have to invent new procedures for handling science policy or be ruled by technology". Apart from science policy, this has immediate relevance to progress through democracy which is our national goal.

There was a time in the west when science for its own sake was almost elevated to a philosophy and a faith. Now that doubts have begun to assail even the western thinkers over this, Dr. Kothari's lecture has a universal relevance. To us in the developing countries particularly in India where we are trying to harmonise moral values, freedom, democracy and social justice, the humanistic technology that Dr. Kothari advocates should be of immense value. He draws attention to an important consequence of science. People, as he points out, worship power, not knowledge. Hence science in its use as technology for money power or as weapons for furthering political or military power, has immediate takers, often mass hysteria could be built around such use (or should we not say, misuse) of science and even many votes gathered. I would like to point out here that many decades ago, Neitzche posed the dangers between an alliance of technocracy and political and social autocracy in these words. "By its very structure the machine shows how masses of men become cogwheels in activities where each of us

has only one thing to do ; it provides a model for the organisation of parties and for the conduct of war. On the other hand, it does not teach the self glorification of the individual ; it makes a machine of the many, and a toll for a specific purpose of each individual. It compels absolute regularity punctual and unconditional obedience ; it prescribes a way of life once and for all, and regulates how time is to be used ; it allows, indeed compels men to be impersonal, to forget their own selves'. Heinrich Weinstock, a German professor of philosophy who has made a special study 'of man and machine, points out in this connection : "if we ask how it has been possible to negate personality, to dehumanise man, the answer is as simple as it is terrifying : the blame can only be put on the creator of the machine, i.e., man himself. But he certainly did not deliberately take all this trouble to hurt himself. On the contrary, he thought only good could result from the machine, increasing happiness for more of his kind... Whenever, then, man thinks he is quite safe, whenever in the intoxication of success, he feels secure in his mastery over his physical surroundings and absolutely confident of the irresistible advance of civilisation and culture, believing firmly in his ability to achieve an increasingly beautiful and rich life, he is already off the rails. The disaster he is heading for would destroy his humanity and all its attributes—human freedom, responsibility, dignity, and respect for others'. (*Das Parlament*,



*Aus Politic and Zeitgeschchn, Jan. 29, 1958*). This was written decades before the ecology and energy crises hit man full in the face and threw the first spanner in the technology works and the question of human survival on this planet began to be seriously considered.

Dr. Kothari underlines such dangers even more. As he very rightly points out, the country which produced Albert Einstein also produced Adolf Hitler—one the scientist and the compassionate man,—and the other who used science most ruthlessly to further his power-mania. However, he also points out that the country which decided to use atom bomb was a democracy. Also, nothing prevents a society from emerging in which even multiplication of men is done by science in laboratories and everything is “scientifically” regulated—but de-humanised, something like Huxley’s *Brave New World*. Would such a society satisfy man? Dry “logic” devoid of all humaneness, seems to support such Brave New Worlds but if the misuse of science and its dehumanising effect is to be prevented, it is not enough merely to have formally democratic regimes. Dr. Kothari advocates decentralisation of decision-making power and, more important than that, a coexistence of science and *ahimsa*, a choice beyond pure rationality, a choice of ethics and value judgement.

All this only proves how prophetic Gandhi was in this 20th century in the very first half of which he

foresaw what was going to come in the next one. It is, of course, not enough for us who are his direct inheritors, to congratulate ourselves on how he foresaw this human predicament. It is necessary for us to try to translate many of his ideas into action. In the lecture that follows, Dr. Kothari has shown how science has to be mellowed with ethics, religion and moral judgements, if the full benefits of science are to be enjoyed by man. "Knowledge and faith", he says, "are complementary, and not contradictory."

To quote Dr. Kothari again: "The choice before modern man is clear. It is an open society based on science and *ahimsa*." As Niels Bohr emphasized in his 1950 letter to the UN Secretary-General. "An open world where each nation can assert itself solely by the extent to which it can contribute to the common culture and is able to help others with experience and resources must be the goal to be put above every thing else...the very fact that knowledge is in itself the basis for civilisation points directly to openness as the way to overcome the present crisis"

A re-enthronement of Gandhian ideas would mean appropriate alternative in education. It was because Gandhi foresaw how education is becoming dismembered from ethics and pursuit of knowledge is being encouraged apart from faith (in fact even in contradiction to it) that he made evolution of a "New Education" part of his all comprehensive programme of socio-political reform. As was his

wont, he did not start with a dogma but wanted experimentation and cross fertilisation of ideas to develop this system of education to its full potential. It was this task that Dr. Zakir Husain undertook in Jamia Milia Islamia.

The Dr. Zakir Husain Education and Cultural Foundation is, therefore, happy in presenting this monograph consisting of 1974 Zakir Husain Memorial lecture on "Science And Man" delivered by one of our foremost scientists and educationists Dr. D. S. Kothari, who has expounded the realms of both science and education with equal felicity, eminently qualifying for the talk on this important and fundamental question of the day. In the scientific field he devoted equal attention to research and teaching before he was called to head the University Grants Commission in one of its most significant phases of growth. He was Chairman of the Education Commission appointed by the Government of India in 1964. He promoted both specialisation and fertilisation of science with humanities. He naturally speaks with the authority of a teacher and the humility of a scientist.

The Foundation hopes to continue to provide the emphasis on the ideals of education enunciated by Gandhiji and Zakir Saheb. It would also initiate experiments in education, culture and other aspects which were so dear to Dr. Zakir Husain and which he covered in his own eventful life-span.

The Foundation owes a deep sense of gratitude to all those particularly to a number of leading intellectuals who have taken so much interest in its work. We hope to embark soon on more comprehensive activities in education and culture. Goethe ended his quest for human wisdom with the formula 'Thinking and doing, Doing and thinking'. We shall endeavour to both, think and do. Uniting work and learning in the manner that Gandhi and Husain thought education should be.

7.8.1975

Dr. Zakir Husain  
Educational & Cultural Foundation,  
New Delhi.

RADHEY MOHAN

*Secretary*



# Science and Man

*To the esteemed Chairman and members of the Zakir Husain Education and Cultural Foundation, I am indebted for the honour, and pleasure, to give the Zakir Husain Memorial Lecture. I am acutely aware of my inadequacy to present an address worthy of the occasion. The presence of so many kind friends is a great encouragement.*

The title of the lecture is Science and Man. Why not Man and Science? Perhaps, the first one is more typical of our times. We often tend to give *first* place to science and technology and the *second* place to man. This is a sign of an *un-scientific* age. It is also reflected in the use of such words as 'developing' and 'developed' countries. Some aspects of *Science and Man* which I shall consider are related to the theme of *knowledge and faith*. This was very close to Dr. Zakir Husain's heart.

By science, I mean experimental science, that is *objective knowledge*. It is an outcome, continually



expanding, of systematic confrontation of theories (based on abstract concepts including mathematics) and facts (experiment and observation). What is man we all know. It is the least known and “the most wonderful” of all things. I say the least known for we do not know any generally acceptable answers to the *elementary* questions : What is “I” ? What is the relation of the “I” to the body ? Has man a soul ? The answer of the Upanishads or of Plato, or say of Newton, no longer enjoy the status and the conviction these once did. And there are no new satisfying answers to take their place. This at bottom is responsible for much of the agony and unrest of spirit in our age. I shall say a little more about it later. There may be some for whom these questions hold no interest. These are fortunate people, but they should not resent if this good fortune is also shared by other species.

Zakir Husain (b. 8 February 1897 : d. 3 May 1969) is an inspiring and elevating name. It brings to mind vision of a person of uncommon compassion, sensitivity and graciousness, selflessness and personal charm. His was a life of unflinching dedication to education and to service of the people. Few equalled him in his freedom from covetousness and greed. He possessed an enduring faith in man’s goodness, and “that the highest in us must, and will assert itself.” His personality had a certain beauty and wholeness reminding us of what Gandhiji said : “True beauty after

all consists in purity of heart :’ and, “There is no Beauty apart from Truth”.

### **National Education**

Education was Dr. Zakir Husain’s life-long passion. It was his conviction that education should be “an organic fusion of faith and knowledge”. It was the ideal he set for the Jamia Millia Islamia. This national educational institution was started by him in 1928 at Okhla (New Delhi). It had Gandhiji’s blessings from the beginning. Dr. Zakir Husain’s salary at the Jamia Millia was only Rs. 80 a month. This emphasised his identification with those with whom he worked and whom he served. He left the institution in 1948 when he was prevailed upon to accept the Vice-Chancellorship of the Aligarh Muslim University. But, may be, what free India needed was Dr. Zakir Husain “on Rs. 80 a month” at the helm of education to bring about its reconstruction to meet national needs and aspirations.

Dr. Zakir Husain emphasized that in the reform of Indian education changes will have to be introduced in the entire system from top to bottom. “*It is essential to Indianize our whole educational system* (italics added). It is essential so to change education as to render it impossible that young men should be condemned to live as foreigners in their own land... incapable of thinking their own thoughts; with borrowed speech, as the poet has said, on their lips, with

borrowed desires in their hearts”.

“The second thing that will have to be done”, he said, “is to do everything to make the school an instrument of character-formation ... (and) where a sense of social and political responsibility could be engendered in the younger generations of our country”. This was said in 1934, but is equally valid today. For this quotation, and very much more, I am indebted to the excellent and forthright biography of Dr. Zakir Husain by Professor Mujeeb.

Education should be concerned not only with *knowledge*, but also promotion of *values* and *faith* in man and his future.

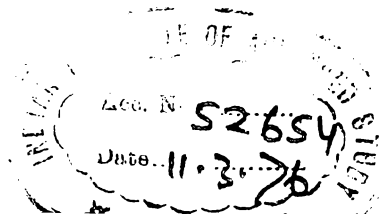
### **Science and Public Service**

It is strange, if not humiliating, that twenty-five years since independence the most ‘popular subjects’ offered by successful candidates at the Indian Administrative Service Examinations are European history and British history. Economics is way down, and life sciences and the Indian languages are at the bottom of the list. (Agriculture has no place). May be, European and British history is a ‘royal road’ to get into the IAS (as it was for the ICS), but for the thousands who do not succeed it would certainly be better if their preparation for the public service examinations had some relation to their future. Perhaps enough attention has not been given to the contribution which the Public Service Commissions could

make, through their examinations and recruitment policies, to promotion of educational standards and relevance. Also, it is important to recognise that in an age of science there cannot be an 'all rounder' or 'generalist' administrator who is ignorant of science, its strength and limitations.

Many countries have a reasonably efficient civil service but suited to an environment and an age that is no longer there. There is, perhaps, no country which is an exception. The Fulton Report (1966-68) on the UK civil service opens with the observation : "The Home Civil Service today is still fundamentally the product of the nineteenth-century philosophy of the Northcote-Trevelyan Report (1853). The tasks it faces are those of the second half of the twentieth century. This is what we have found ; it is what we seek to remedy."

In the past, an earlier-past served as the guidelines. But in the atomic age this no longer holds. The tasks and problems, and "tools" and resources are altogether different. Events happen at too fast a speed. Crises come too suddenly, and often are global in character. Witness the energy crisis! Added to all this there is an important element of unpredictability inherent in a world powerfully influenced by science and technology. From this uncertainty there is no escape. The reason is simple. Future discoveries cannot be predicted, If this could be done, these



would not be *future* discoveries but part of the existing knowledge.

I have digressed. It is not my intention to discuss reform of education or of public service. As regards the former I could say little which has not been said many times over ; and as regards the latter I have no competency. Let me turn to the subject of the lecture, the relation between science and man.

### **Science and Technology**

Science and technology are expanding at a fantastic pace. The doubling period is about 10-15 years. That is, at the end of every 10-15 years the yearly output of original papers in science and technology, the total number of scientists and engineers, the output of electricity, and so on grows to twice of what it was before. There is a close interaction, mutually reinforcing, between science, technology and productivity.

A consequence of science and industrialization is the rapid growth of the population. The world population in the time of the Buddha was probably no more than 200 million. It slowly increased to about 500 million by the time of the emperor Akbar, and added another 500 million in the course of the next two centuries. It rose to 2000 million (2 billion) at the time of World War II ; and is now nearing 4000 million. The current growth rate of world population is 2.0 per cent a year. This means that the

world population becomes double within the lifetime of a generation. This is a fantastically high growth rate. Further, the growth rate is even higher in parts of the world which are educationally and industrially backward. A new thing in our times is the high disparity in life span. People in industrialized countries have an average life span about twice that in the poor countries.

### **An Unscientific Age**

We live in an *unscientific* age. Rational decisions are rare. There is more violence and crime than at any time in history. It is on an increase. There is acute tension *between* and *within* nations, with no signs of its abating. The frighteningly wide gap between the rich and the poor is widening rapidly.

The utterly callous use of science and technology including even the life sciences, for military ends, and exploitation of 'weaker nations', is without parallel in man's history. The global military-expenditure exceeds \$200 billions a year (Rs. 150,000 crores a year.) It is still rising. Its only contribution is to aggravate fear, mistrust and misery, and to make a mockery of peace. While tens of billions of dollars a year are spent on weapons R & D, research of real benefit to man is grossly neglected and suffers lamentably for lack of funds.

The Arab-Israel war of October 1973 was under 'eye-watch' all the time by the satellite-networks of



the super-powers' armaments race. Several billion dollars worth of high-technology weapons, supplied by the super-powers, were consumed in less than two weeks of fighting. While energy is so scarce in most parts of the world, in some parts there is callous waste. In several highly industrialized countries, for the young and middle-aged, the overwhelming cause of death is not disease but traffic accident. It has been said that in the rich countries the chances of a woman taking a college degree is about the same as her entering a mental hospital. Both are high. While high nutrition food is so scarce and expensive, human milk, the ideal food for infants (and important for their brain development), literally worth many crores of rupees a year is allowed to go to waste. This is a matter of particular concern for us. Thanks to the millions of dollars spent on baby-food sales promotion, bottle-feeding, a typical western export, has become a status symbol. And this despite the unique advantages, nutritional and psychological, of breast feeding, and also its (well-recognised) contraceptive benefit. Another example of an unfortunate invention is the water-closet which has turned great rivers into dreaded sewers.

We tend to ignore or grossly undervalue the *human* implications of *technological* solutions to our problems. The population problem is a telling example. This often aggravates the situation.

The phenomenal developments, during and since the Second World War, in the science and technology

of communication have helped to bring the world together more than anything else. Continents are closer today than neighbouring villages were a generation ago—and are still in many parts of the world including our own. The radio and TV project the world (and even beyond it) into our very homes. Mariner 10, launched on 2 November 1973 and carrying two television cameras and instruments, encountered the planet Venus on 5 February 1974, and radioed to Earth a wealth of information about the planet's atmosphere. But the same technology can be also employed to mislead and paralyse the public mind.

A common abuse of mass media—radio, TV, printed words—is for aggressive advertising, exploiting psychological research to make people believe what multinational giant corporations in the interest of their own empire building wish the people to believe. The interests of the people are irrelevant, to put it mildly. It is particularly sinister in the case of the drug industry which in this respect could be classed with the weapons industry.'

The modern drug industry has given rise to a new disease, quite common and expensive. Its name is ESAESID-ON (No Disease). It is an epidemic of healthy persons, and its "cure" is hundreds of drugs carrying fashionable brand names. It is increasingly becoming a symbol of 'development' that one cannot have peace without tranquillisers, pleasure without

euphorogens, or sleep without sleeping tablets. What a corruption of the word 'development', and 'developed' countries ?

Examples could be readily multiplied a thousand-fold. Even devices of torture have become a part of technology. Torture implements unspeakably more cruel than of the middle ages are now items of trade. What has happened to man's conscience, to his morals, and to his dignity ?

### **Science and Ahimsa**

Yet despite all the rampant violence amplified beyond imagination by the abuse of science and technology, and despite all the *inhuman* applications of *science, science, and more of it, is the only* hope of mankind. What lies at the root of man's troubles and suffering is not *pursuit of knowledge but greed and worship of power.*

Violence *can be* eliminated and suffering *can be* reduced. But it can be achieved, and gradually, only on the basis of *objective* knowledge, especially of the life sciences (including *ourselves*). In the very nature of things it is a long and arduous road, and an unending road. *Every forward step, and by each one of us, counts.* It would be contrary to the spirit of science to think that the 'road' is already laid for us in advance. No, not so. As we move so we make the way. We are certain to make mistakes, but equally certain it is that mistakes (I am thinking of

honest ones) are corrected, sooner or later.

Man has no future without science. This is abundantly clear. But there has to be something more than science. If science and technology are to benefit man, science must become a part, an integral part, of culture. The wise use of science and technology, and the progress of science itself is, in the long run, possible only in a society which values and actively encourages freedom of discussion and dissent : which tolerates and not liquidates opposition. In other words *science and ahimsa* (which are perhaps the greatest achievements of the East and the West) go together.

Albert Einstein, the greatest natural philosopher of the age, had in his later days on the bare walls of his study only two portraits—one of Gandhi and another of his friend a German musician. “The greatest man of the age”, that is how Einstein described Gandhi.

The history of *ahimsa* is undoubtedly the most important aspect of the history of man. Yet nearly all the history we are taught is the history of *himsa* (violence). *Ahimsa*, that is the *human part* of human history, has no place in education. Karl Popper, one of the greatest philosophers of science, writes (*The Open Society and its Enemies*, vol. II, p. 270) :

“There is no history of mankind, there is only an indefinite number of histories of all kinds of aspects of human life. And one of these is the history of poli-

tical power. This is elevated into the history of the world. But this, I hold, is an offence against every decent conception of mankind. It is hardly better than to treat the history of embezzlement or of robbery or of poisoning as the history of mankind. *For the history of power politics is nothing but the history of international crime and mass murder* (including, it is true, some of the attempts to suppress them). This history is taught in schools, and some of the greatest criminals are extolled as its heroes”.

### **Nuclear Weapons**

At this point I should like to say a few words about what is perhaps the most violent act in man’s history, the dropping of the atomic bombs on Hiroshima and Nagasaki. A fundamental discovery in pure science is the relation ( $E = Mc^2$ ) between energy and mass. The quantity  $c$  is the speed of light. The mass-energy relation is a direct consequence of Einstein’s theory of relativity which is one of the greatest achievements of the human mind. The relativity theory for the first time joined together the concept of space and time into a more basic concept of space-time. *Time is not absolute*. Let me take an example. Elementary particles called muons have an average lifetime of two millionths of a second, decaying into electrons and neutrinos. But if the velocity approaches the velocity of light, the observed lifetime (of the muons) is hundreds of times larger, as

is the case for muons in cosmic rays. This spectacular application of the relativity theory we owe to H.J. Bhabha. If a man were in a spaceship moving with speed of muons in cosmic rays, his life span would be hundreds of times longer. But it would need a fantastically large amount of energy, more than hundreds of times the annual global output of electrical energy, to impart such a high velocity to our spaceship.

The atomic and hydrogen bombs became possible because of the discovery, in 1905, of the theory of relativity by Einstein. How came about this gross perversion and flagrant abuse of (pure) science, a development which is a total menace and a permanent shame for man?

The country which gave birth to Albert Einstein—the greatest scientist and a most compassionate of men—also produced Adolf Hitler. And whom shall we blame for giving the world a Hitler and for what he did. Is it his parents; is it only he himself; is it the education system; his people; or the capitalist world; or the communists; or historical necessity? Or, is it that none is to be blamed; or, is it the entire world which should share the blame? The last answer is preferable. In any case it is innocuous.

In the early years of World War II, the USA government decided to develop an atomic bomb on a high priority basis. It was their fear that if Germany succeeded in making the bomb, Hitler, an abnormal person, could not be trusted not to use it despite



the *totally inhuman character of the weapon*. If the USA made the weapon first, Hitler, even if he had the bomb, would be deterred from using it for fear of immediate retaliation.

What Hitler would have done if Germany had the atomic bomb we do not know? Germany did not make the atomic bomb. (As a matter of history Germany made no serious effort to develop an A-bomb). The sombre fact is that the Government which did succeed in making an atomic bomb, did also use it, though probably there was no such intention before the bomb had been successfully tested. And the decision to reduce to dust and ashes, in an instant and without any warning, two populous Japanese cities—men, women, children and all—was made by a democratic President, and not an ‘insane dictator’. Power corrupts, and when that power is atomic, corruption is total : It is absolute.

The decision leading to the most gruesome mass murder in history was not taken in the *open*, but in utmost *secrecy*. It was not a democratic decision. I am not implying that those determined to deploy weapons of mass destruction (whether atomic, or chemical and biological as in Vietnam) would or should do so after a public debate. What I am suggesting is the obvious thing that effective decentralisation of decision-making process tends to discourage gross misuse and perversion of power. It is also worth remembering that though there were some top

scientists (in the U.S. and outside) in the know of the atomic bomb, and who were against its use on Japan, *none* of them lodged a public protest. And, of course, no one offered (or even thought of offering) *Satyagraha*. Even one utterly sincere *Satyagrahi* against the bomb, prepared to give up everything, his life, might have influenced Truman's conscience and the course of events. Or, it might not have. Who can tell? But the fact is 'there was no *Satyagraha* against the atomic bomb.

### **Science and Politics**

All the terrible implications of the atomic bomb—and the spiraling arms race it was certain to generate—were not fully appreciated. A fundamental difficulty was, and still is, the “communication gap” between *science and politics*. As a classic case we may recall the interview between Churchill and the universally acknowledged leader of atomic science, Niels Bohr. It took place a few fateful months preceding the dropping of the atomic bomb on Japan. As recorded in Professor M. Gowing's *Britain and Atomic Energy 1939-45*, p. 355: “Practically the whole of the time (of the interview) was consumed in argument on irrelevant points. Bohr was unable to bring the Prime Minister's mind to bear on the implications of the bomb...When he asked as he left if he might address a memorandum on the subject to Mr. Churchill, the Prime Minister replied that he would always be

honoured to receive a letter from Professor Bohr but hoped it would not be about politics. Bohr came away greatly disappointed at the way the world was apparently governed, with small points exercising a quite irrational influence. 'We did not speak the same language', said Bohr afterwards. Churchill retained a very disagreeable memory of the interview''.

The discovery of nuclear fission in 1938, an epochal discovery in *pure science*, was the achievement of persons with not the slightest idea or any intention whatsoever to use it for military purposes. There was no motivation other than to advance pure science—in this case the physics and chemistry of interaction of neutrons with matter. And yet within barely seven years it was applied to murder hundreds of thousands of innocent human beings. The history of man has been, as Bertrand Russell said, that if any folly or crime however cruel or despicable, was at all *possible*, then man *would* commit it. But, in the nuclear age man's *folly* could put an end to all civilization, and even an end to all life. The way out is to persevere with courage and faith, individually and collectively, for an *open society* and *ahimsa* as a way of life. The *open society* and *ahimsa* go together.

The choice before modern man is clear. It is an open society based on *science* and *ahimsa*. As Niels Bohr emphasized in his 1950-letter to the UN Secre-

tary General : “An open world where each nation can assert itself solely by the extent to which it can contribute to the common culture and is able to help others with experience and resources must be the goal to be put above every thing else...The very fact that knowledge is in itself the basis for civilisation points directly to openness as the way to overcome to present crisis...

The efforts of all supporters of international co-operation, individuals as well as nations, will be needed to create in all countries an opinion to voice with ever-increasing clarity and strength, the demand for an open world”.

The case for man to pursue science and *ahimsa* cannot be established *scientifically* or by rational arguments alone. It goes beyond science, and beyond reasons. It is a question of choice. And *choice implies a value judgment*.

### **An Act of Faith**

To choose the path of nonviolence as man’s highest duty and obligation, and to endeavour ceaselessly to advance the theory and practice of *ahimsa*, is to make an *ethical, a moral choice*. Ultimately, it is an expression of faith—faith in man and his future. This is to say that science by itself is not enough. *Knowledge and faith are complementary* (not contradictory). Even to believe in reason (science) is in the end an act of faith.

At this point it may be asked that does not science

rule out faith altogether ? Let me take an example to illustrate what I have in mind.

There is a severe drought, a famine in some area ; or a manned spacecraft is in some mortal danger. Will earnest *prayers* be of any avail ?

The “official” answer of any scientific establishment or institution would obviously be, I believe, “no”, and rightly so. But what about the personal views and beliefs of scientists ? Would no scientist, no astronaut, pray to God when in serious trouble or grave danger. Would no scientist pray for recovery of a sick relative or friend ? In fact many would and do. There is little difference in this regard between scientists and non-scientists. But for an honest scientist this dichotomy between his public and personal views as to the value and efficacy of prayer can be deeply disturbing. An agricultural scientist, say, “knows” that prayers will not bring rain. Yet in his heart he may believe differently. Medical people face such situations only too often.

Gandhiji said : “Prayer has been the saving of my life. Without it I should have been a lunatic long ago. My autobiography will tell you that I have had my fair share of the bitterest public and private experience. They threw me into temporary despair, but if I was to get rid of it, it was because of prayers...I am indifferent as to the form (of prayer)...I have given my personal testimony. Let everyone try and find that, as a result of daily

prayer, he adds something new to his life, something with which nothing can be compared."

A scientist may agree with Gandhiji in his *heart* but his scientific mind cannot assent to the supernatural implicit in Gandhiji's statement.

This fundamental conflict, a flagrant contradiction between the head and the heart of a scientist—rather of any sane person who takes *science* seriously—is a relatively new thing. The schizophrenia is agonizing. When the cause of this dichotomy is not properly understood, as is often true even in the case of scientists, the public image of science and scientists suffers adversely. It appears as if a scientist has two different standards or compartments: one for "official" another for "personal" use.

There are many grave dangers facing man today. There is the population explosion; massive malnutrition; violence rampant in society, threat of nuclear and biological weapons; industrial pollution and so on. All these pose terrific problems. But these can be attributed to inadequate knowledge or to misuse of science and technology. We are not thinking of them at the moment. The crisis, the dichotomy, we are speaking of is inherent in science. Its cause is science itself. It is the paradox of matter and mind, that is, of body and soul.

Modern science makes the conclusion inevitable that in the operations of nature there is no place, no role whatsoever, for the *supernatural*. The reign of

reason and logic is supreme. This is no simple, no obvious conclusion. It was not at all apparent in the days of Newton, and Akbar, not to think of earlier times.

No considerations of purpose, divine or human, can enter the domain of objective science. The exclusion is complete. *Science is objective*, not subjective. If we ask what purpose do the stars in the sky serve, the answer of astronomy is: the stars serve no purpose whatever. In the realm of science any other answer is inadmissible. It would be absurd. To think of any purpose or goal for the universe (or for any parts of it) is alien to science. It is incompatible with it.

But for the "I", purpose (teleonomy) is everything: without it there is nothing. What is the bridge, the connecting link, if any, between the objective science and the subjective "I"? How to resolve the flagrant contradiction between the "determinism" that science predicates and the "freedom of the will" which the "I" experiences? In truth, we are no nearer to an understanding of this unfathomable "mystery" than the insight and wisdom provided by the Upanishads. In this context, the remarkable book, *My View of the World* (1961) by Erwin Schroedinger, one of the great pioneers of modern physics, is of deep interest. The recent developments in quantum physics, cybernetics, and molecular biology emphasize that, if anything, the mystery is far

deeper than ever thought before. It is one thing to recognise that we have no "solution", but altogether another thing to assert, as some people do, that there is no "real problem", no "mystery" about the mind-brain relationship. The distinction is important. Otherwise there is a real danger that science which is mankind's greatest intellectual and fruitful enterprise may, in the end, smother man's spirit instead of enlarging and enriching it.

### **Mind-Matter Complementarity**

This is not the place to embark on a detailed discussion of the complementarity of mind and matter. Let me make a few brief rather unrelated comments.

(a) We ask the question : What is the difference between one man and another, say, between a selfish and a selfless person, between a sinner and a saint ? As all men, like everything living, are built from the same "molecular bricks", is the difference between one person and another nothing more than a difference of molecular architecture ? Or is there something else besides ? (The most important of the molecular bricks are the four nucleotides constituting the genes, and the twenty amino acids which make more than a million different proteins. There are some million and a half different species of which a little less than a million are animals. Three-fourths of all animal species are insects). The difference between the *brain* of one person and another is



entirely a question of molecular architecture. But the same cannot be asserted about the *mind*. For, as Charles Sherrington, one of the greatest physiologists of our times, has observed (*Man and his Nature*, Cambridge University Press, 1951) :

“The mental is not examinable as a form of energy. That in brief is the gap which parts psychiatry with physiology... Thoughts, feelings, and so on are not amenable to energy (matter) concept. They lie outside it. Therefore they lie outside Natural Science...In some ways this is embarrassing for biology. Biology as its name says is the study of life...Natural science has studied life to the extent of explaining away life as any radically separate category of phenomena...There is no radical scientific difference between living and dead...But though living is analysable and describable by natural science, that associate of living, thought, escapes and remains refractory to natural science...Our mental experience is not open to observation through any sense-organ...Mind, for anything perception can compass, goes therefore in our spatial world more ghostly than a ghost. Invisible, intangible, it is a thing not even of outline, it is not a ‘thing’. It remains without sensual confirmation, and remains without it for ever.”

All biologists would not agree with Sherrington. But none can deny that the brain-mind relationship,

and how these interact, is as yet a totally unresolved mystery.

(b) Man is made up of inanimate atoms, then how can consciousness or mind originate ?

The *atom* is a scientific concept. Science is an inseparable mixture of theoretical (abstract) *concepts* and *facts* of experience. This mixture of “intellect” that is, concepts, and “senses” (perception of facts) is inseparable, even in principle. To “see” anything is to see it in terms of some concepts : No theory, no facts. Thus, *though man is made of atoms, it is man who makes the atoms.* (Democritus, around 420 B.C., put the same thing superbly. The Intellect says to the Senses. “Ostensibly there is colour, ostensibly sweetness, ostensibly bitterness, actually only atoms and the void” ; to which the Senses retort : “Poor Intellect, do you hope to defeat us while from us you borrow your evidence ? Your victory is your defeat.” (E. Schroedinger, *Nature and the Greeks*, 1954.)

(c) In recent years far-reaching advance has been made in our knowledge of genes and their functioning. (At a symposium on Science and Technology : The next 50 years, the French physicist Pierre Auger speculated on the possibility of genetic engineering being available one day to double the size of the human brain : to control ageing, and even death. (*Science*, 9 November 1973).

Imagine that some day, in very distant future, it becomes possible to “grow” from a given person any

number of *genetically identical* individuals by a process of “budding”, similar in principle to what occurs in some species of marine animals (e.g., coelenterates). Suppose these “copies” of the original person are placed in an environment identical to that to which the original was exposed. The new individuals possess identical brains. The question is would they have *identical minds*. This leads to the paradox of ONE MIND and MANY MINDS.

(d) What about the question of *prayer*, raised earlier? To believe that “prayers” could influence the course of *physical phenomena* – affect or alter material things – would be, it seems, overstepping the bounds of science. Indeed it would be untrue to science. But in the realm of the mind this need not be so. And, if we believe the evidence of many spiritually minded persons of the highest integrity, the answer is definitely “yes”. (There could possibly be an *indirect* physical effect of prayers, mediated by the mind-body interaction. It reminds us of the analogy that though acquired characters are not *directly* transmitted to the offspring, yet it *appears* sometimes as if it is so. This arises indirectly through the selection pressure of environment strongly favouring those of the random mutations which have an expression in the direction of the acquired characters).

(e) Men in all ages and countries have willingly suffered, and to the utmost, for the sake of their

chosen ideals. To choose an ideal (say, the dedicated pursuit of science), is to go beyond the realm of science into the realm of ethics or faith, or whatever name we give it. Writes W. Heisenberg (*Physics and Beyond, Encounters and Conversation*, Harper and Row, 1971, p. 21) :

“If we ask Western man what is good and what is evil, what is worth striving for and what has to be rejected, we shall find time and again that these answers reflect the ethical norms of Christianity even when he has long since lost all touch with Christian images and parables.” And he continues : “If the magnetic force that has guided this particular compass should ever become extinguished, terrible things may happen to mankind far more terrible even than the concentration camps and atom bombs”.

(f) Einstein's views on religion are described at some length in R.W. Clark's biography of Einstein. His religion was a kind of “cosmic religious sense... which recognises neither dogmas nor God made in Man's image”. Max Born, a close friend of Einstein said that “he had no belief in the Church, but did not think that religious faith was a sign of stupidity, nor unbelief a sign of intelligence”.

(g) *The body is a “machine”*. It is so beyond question, subject to the laws of physics and chemistry which make no distinction at all whether the atoms are parts of a living body or otherwise. Equally, I

cannot deny the incontrovertible direct experience that the motions of my body are under my control. My body is a “machine”, but “I” control its movements. Let us assume, as undisputed, the two facts : (1) my body is a machine, and (2) its motions are under my control. From these two facts what is the inference we can draw which would not be contradictory to science, not violate its basic axioms of objectivity and autonomy ? The only possible inference (as Schroedinger has observed) is that every mind that has ever said or felt “I” is the person (if any) who controls the ‘motions of the atoms’, controls the universe, according to the laws of Nature. This is the Vendanta formula : *individual self and Universal SELF are complementary*. The formula self and SELF, or equivalently, mind and MIND, are complementary resolves immediately the puzzle as to why the perceived world, perceived through different sense organs and by different individuals, should be identical.

However strange and paradoxical the complementarity of mind and matter may seem to us, it is, in all probability, inescapable. What is most important is to investigate—making use of the powerful experimental techniques, and statistical and computer aids available today—phenomena suggested by the complementarity approach. For example, if mind is not energy, *direct* communication between two minds need not be ruled out on grounds of any

violation of energy laws or causality. Again, it would be of interest to know what mental states correspond to random thermal fluctuations in the brain. This would demand a suppression of all voluntary mental activity so that the "mental noise" corresponding to the cerebral "thermal noise" could be observed by the subject. (This may have some relation to *tantra*, one does not know).

### **Humanistic Technology**

For those who genuinely devote themselves to pursuit of science, the experience is deeply satisfying : it is wonderful, exciting and ennobling. The conceptual edifice of science has a beauty and a kind of mystic appeal that makes a lasting impact on the mind. But for those who only avail of the numerous (technological) benefits of science without *doing* science, science seems remote and unintelligible. In our age science has a tremendous prestige. This is not because of science *per se*, but because of the money-making, military, and other "useful" applications of science. People worship not knowledge but power. It is most important that in this age no educated person is ignorant of the philosophy of science, of the strength of science, and even more so of the limitations of science. In the atomic age *philosophy* acquires a new importance. A scientist who is not prepared to meditate on the *purpose of science*—and that is philosophy—can at best be only a slave to science.

To understand the human implications of science is an exercise in philosophy and ethics. To reflect that understanding in policies and programmes is to bring about a *transition from science and technology at the expense of man to science and technology for man*—to an open society based on science and *ahimsa*. More science and technology does not necessarily mean *less* suffering and misery for mankind. On the contrary the opposite cannot be ruled out : “Think of the great wars !” Vietnam ; mounting violence in society ; erosion of morals and compassion ; and so on. In fact, it needed two world wars, Gandhi, and a new generation, to uncover the simple truth that suffering can be alleviated only if use of knowledge is people-oriented and not power-oriented. As Karl Popper has observed : “Reason for him (a true rationalist) is the precise opposite of an instrument of power and violence : he sees it as a means whereby they may be tamed”.

The *human* use of human knowledge is no easy thing. Frightening vested interests of all kinds stand in the way. Today it looks no more than perhaps a dream. But then today’s dream is often the reality of tomorrow. That is the most inspiring and unforgettable lesson of science. That is also what we learn from the lives of great men, and one such was Dr. Zakir Husain.

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# EDUCATION AND NATIONAL DEVELOPMENT

The book which will enlighten the informed.

Whatever be the defects in the present system of education and lopsided development that has taken place in this field only reforming education will not be of much avail. It is good to remember, that the education system does not perform in isolation. It partakes of the social, economic and political scene, the grim poverty of the masses and the slow pace of economic development. The most carefully modulated system will fail to work if "other things" that is, the non-academic factors continue to be what they are today. If we are anxious to transform the agitating students into good citizens and productive workers, a change in the social scene and ensuring reasonable prospects of gainful employment for them are a sine qua non. It is a call to leadership at all levels to set a good example of dedication and sacrifice to the younger generation, to observe certain standards in public life which the young people will follow with pride and satisfaction. It is manifest that in an atmosphere surcharged with corruption, nepotism, violence and slow pace of economic growth, the students will continue to be indifferent to higher values of life and such props as introduction of moral education will not be of much help. Let us therefore, recognise the need for action instead of indulging in a on-going debate which has been in progress for all these years.

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