

THE THIRD DAG HAMMARSKJÖLD LECTURE

**The Nuclear Age –
A Curse and a Challenge**

The Role of Scientists

Joseph Rotblat

Uppsala 2001

This is the text of the third Dag Hammarskjöld Lecture given by Sir Joseph Rotblat, Nobel Peace Prize Laureate 1995 and founder of the Pugwash Conferences on Science and World Affairs, at Uppsala University on 16 May 2001.

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PREFACE

In mid-May 2001, Professor Sir Joseph Rotblat delivered the third Dag Hammarskjöld Lecture in Uppsala, Sweden, on the subject of ‘The Nuclear Age – A Curse and a Challenge: The Role of Scientists’. It was an extraordinary occasion. At the age of 92 and after five and a half decades of tireless campaigning against nuclear weapons, Joseph Rotblat spoke as persuasively as ever, insisting on the inescapable responsibility of scientists towards humanity.

The Dag Hammarskjöld Lecture is jointly organised by Uppsala University and the Dag Hammarskjöld Foundation in memory of the second Secretary-General of the United Nations. The guideline established by the two institutions states that the person invited to deliver the lecture should be someone ‘who has promoted, in action and spirit, the values that inspired Dag Hammarskjöld as Secretary-General of the United Nations and generally in his life: compassion, humanism and commitment to international solidarity and cooperation’. Joseph Rotblat’s life has consistently demonstrated these very qualities.

In his lecture, Joseph Rotblat starts by drawing attention to the fact that in January 1946 the UN General Assembly, in its first resolution, called for the establishment of an Atomic Energy Commission to ‘make specific proposals...for the elimination from national arsenals of atomic weapons and of all other major weapons adaptable to mass destruction’. Yet, 55 years later, despite very many similar resolutions, ‘the nuclear-weapon states still ignore these resolutions and pursue policies that perpetuate the division of the world into nuclear haves and have-nots’. As a scientist, Joseph Rotblat stresses in particular ‘the role played by the scientists in bringing about this situation,

and the lessons we should learn about the responsibilities of scientists in relation to potentially dangerous advances in science’.

Moving on to a critical examination of the concept of nuclear deterrence, Joseph Rotblat argues that such a concept is unacceptable in a civilised society for legal, logical, political and military reasons but, above all, on ethical grounds. In the same context he also points out that it is not only the leaders of nuclear powers who are responsible but that ‘each of us is taking part in a gamble in which the survival of human civilisation is at stake. We rest the security of the world on a balance of terror. In the long run this is bound to erode the ethical basis of civilisation.’

The last part of Joseph Rotblat’s lecture deals in more detail with the question of the moral responsibility of the scientist. ‘Should scientists be concerned about the social impact of their work and the ethical issues that arise from it?’ he asks. ‘Should they accept the responsibility for the harmful consequences of scientific research?’ Although many scientists’ answer to these questions is ‘No’, Rotblat argues for a radical change of attitude: ‘Scientists must reveal a human face. They must show that it is possible to combine creativity with compassion; venture into the unknown, yet care for their fellow creatures; allow the imagination to roam, while remaining accountable for their deeds.’ Finally, Joseph Rotblat proposes five practical measures that would thoroughly improve the present situation.

Joseph Rotblat was born in Warsaw, Poland, where he started his career as a nuclear physicist in the 1930s. He left Poland before the Second World War and moved to England and Liverpool University, where he worked on the development of the atom bomb, and later to the Los Alamos laboratory in the US. There, he joined the Manhattan project, the aim of which was to create nuclear weapons ahead of Hitler’s Germany. When it became clear that Germany would not manage to develop such weapons, he resigned from the project – the only scientist to do so before the bomb was tested. Since that time he has devoted over half a century to averting the danger posed by nuclear weapons. In the 1950s he worked closely with Albert Einstein and Bertrand Russell and was a driving force behind the 1955 Russell–Einstein Manifesto on Nuclear Weapons and the Responsibility of Scientists (reproduced here as an Appendix.) In 1957, Joseph Rotblat founded the Pugwash Conferences on Science and World Affairs and he has worked with the organisation ever since. He and the Pugwash movement jointly received the Nobel Peace Prize in 1995.

In his acceptance speech on that occasion Joseph Rotblat said: ‘From my earliest days I had a passion for science. But science, the exercise of the supreme power of the human intellect, was always linked in my mind with benefit to people. I saw science as being in harmony with humanity. I did not imagine that the second half of my life would be spent on efforts to avert a mortal danger to humanity created by science... At a time when science plays such a powerful role in the life of society, when the destiny of the whole of mankind may hinge on the results of scientific research, it is incumbent on all scientists to be fully conscious of that role, and conduct themselves accordingly. I appeal to my fellow scientists to remember their responsibility to humanity.’

It may be said that the wisdom and experience of a whole life are summarised in these lines.

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Photo: Tommy Westberg

*Joseph Rotblat
delivering the third Dag Hammarskjöld Lecture
Uppsala University*

THE NUCLEAR AGE – A CURSE AND A CHALLENGE

THE ROLE OF SCIENTISTS

By Joseph Rotblat

The memory of that Monday in September, 40 years ago, will always haunt me. I was in New York, walking in Times Square, when the flashing lights on the famous building spelled out the dreadful news: Dag Hammarskjöld had died in an air crash.

This tragic event occurred at a time of a further deterioration in relations between the superpowers. I was in New York on my way back from a Pugwash Conference in Vermont, a meeting overshadowed by the announcement of the resumption of nuclear testing by the Soviet Union. The voluntary moratorium of 1958 had been broken, heralding an intensification of the arms race, with an alarming series of atmospheric tests by both sides. A month later, the Soviet Union detonated the largest ever hydrogen bomb, with an explosive power of 58 megatons – 4,000 times more powerful than the Hiroshima bomb. A year later, our civilisation came close to annihilation in the Cuban Missile Crisis. But already then, in mid-September 1961, I could see what was coming. The nuclear arms race was gathering momentum; the Cold War was in danger of turning into a Hot War. And the organisation that had been set up ‘to save succeeding generations from the scourge of war’

was impotent, sidestepped by the superpowers. The person who had been fighting hardest for the United Nations to fulfil its role was dead.

Nuclear weapons and the United Nations are historically linked. They were born at about the same time, only three weeks separating the signing of the Charter from the first nuclear test in Alamogordo, an event that rendered the Charter out of date even before it was ratified. The atom bomb radically changed the nature of war and the ways of dealing with it. The General Assembly made a valiant effort to tackle the new situation. Its very first resolution, No. 1 (1), adopted unanimously at its first meeting in London in January 1946, called for the establishment of an Atomic Energy Commission to:

... proceed with the utmost despatch and ... make specific proposals ... for the elimination from national arsenals of atomic weapons and of all other major weapons adaptable to mass destruction.

Fifty-five years later, and after a multitude of resolutions by the General Assembly calling – by overwhelming majorities – for the elimination of nuclear arsenals, the nuclear-weapon states still ignore these resolutions and pursue policies that perpetuate the division of the world into nuclear haves and have-nots.

In this lecture, dedicated to the memory of Dag Hammarskjöld, I want to review the events that have led to a situation in which the will of the great majority of nations is continually thwarted by a Security Council dominated by the nuclear weapon states. Speaking as a scientist, I want, in particular, to stress the role played by scientists in bringing about this situation, and the lessons we should learn about the responsibilities of scientists in relation to potentially dangerous advances in science.

The crucial issue in nuclear policies is deterrence. Deterrence was the starting point of the whole problem. The scientists who – like myself – began research on the atom bomb almost immediately after the discovery of fission, would normally have recoiled from work on military projects. Our rationale was the fear that the bomb might be developed in Germany and enable Hitler to win the war. The only way to prevent this happening, we reasoned, was by acquiring the bomb ourselves and threatening its use in retaliation. I developed the concept of nuclear deterrence in the summer of 1939.

Looking back, I think it is very doubtful whether the deterrence argument would have worked with an irrational leader like Hitler. It is quite likely that even if both sides had had the bomb, Hitler's last order from the bunker in Berlin would have been to drop it on London, in the full knowledge that this would bring terrible retribution upon Germany. This would have been in the spirit of his philosophy of *Götterdämmerung*.

As it happened, this thesis was never put to the test. Hitler was defeated by conventional weaponry, before the atom bomb was manufactured. But the end of the war in Europe did not bring the bomb programme, known as the Manhattan Project, to an end. On the contrary, its momentum increased. The politicians and the military had decided that the bomb would be used on Japan. General Leslie Groves, the head of the Manhattan Project, said in 1945, 'The target is and was always expected to be Japan'. By this time, moreover, many scientists had been recruited to the Project who did not share the motivation of the originators. Harrowing stories about cruel treatment of prisoners in Japanese camps had driven them to accept the use of the bomb against Japan in retribution, as well as to bring the war in the Far East to an end.

Other scientists were, nonetheless, strongly opposed to this idea on both political and moral grounds. Outstanding among these was the great Danish physicist, Niels Bohr, who had much influence on Dag Hammarskjöld's thinking. With prophetic vision, Bohr predicted the dire consequences of the nuclear arms race that was bound to follow the use of the atom bomb by the United States. To forestall such an arms race he suggested that the Soviet Union be informed about the bomb *before* it was used, and that it be offered the chance to share in the great potentialities of the discovery of nuclear energy provided it agreed on a system of joint management and control of nuclear energy in all its aspects. Although Franklin Roosevelt was sympathetic to Bohr's ideas, they were decisively rejected by Winston Churchill, who even wanted to have Bohr interned as a dangerous alien. He said: 'It seems to me that Bohr ought to be confined or at any rate made to see that he is very near the edge of mortal crime.'

Nearer the time of the completion of the bomb, several other scientists on the Manhattan Project attempted to influence events. The most active among these was the Hungarian scientist, Leo Szilard. He prepared a petition to President Truman, appealing, on moral grounds, against the use of the bomb on civilian populations. Among the scientists Szilard approached for a signature was his countryman Edward Teller, who replied as follows:

Since our discussion I have spent some time thinking about your objections to an immediate military use of the weapons we may produce. I decided to do nothing. The accident that we worked out this dreadful thing should not give us the responsibility of having a voice in how it is to be used.

I have quoted Teller's reply because it articulates a view held to this day by many scientists: a complete disavowal of responsibility for the con-

sequences of their actions. In this particular case, however, there is something more: it illustrates the hypocrisy that pervades the nuclear issue; the hypocrisy, mainly exhibited by politicians but occasionally also by scientists, of saying one thing and doing just the opposite. For it was Edward Teller who, more than any other scientist, influenced the development of nuclear weapons; he was the prime mover in the H-bomb project and, later, the ‘Star Wars’ concept.

Building the hydrogen bomb was the real start of the nuclear arms race; it resulted in the accumulation of obscenely huge nuclear arsenals by both superpowers, and gave a new dimension to the nuclear issue. Awesome as the destructive power of the Hiroshima bomb was, it did not pose a threat to the existence of the human species. For this, one would need to detonate a very large number of nuclear weapons – of the order of 100,000. Even in the most pessimistic scenarios, we did not envisage the accumulation of arsenals of that magnitude, because we could not see any purpose for this. Yet, the unimaginable happened. Within a few decades, nuclear arsenals of that magnitude were built, with a total destructive power of more than a million Hiroshima bombs – a hundred times more than was needed for any conceivable deterrence purpose. How did this happen?

To some extent it was due to the changing strategic doctrines: from massive retaliation, to counterforce, to mutually assured destruction (MAD), to flexible response, to countervailing, plus strategic missile defence. But to a large degree, it was due to the work of scientists; they masterminded the arms race and gave it its momentum. Scientists on both sides of the Iron Curtain were relentless in inventing new ways to make their own weapons more effective and those of the other side more vulnerable. Often, they would bring in new designs, not because of any real need but simply for

the sake of the exhilaration experienced in inventing new gadgets. It became a kind of addiction.

This severe indictment of members of a highly respected group in society is echoed by scientists closely familiar with the problem. For example, Theodore Taylor, a former chief designer of atom bombs at the Los Alamos laboratory, had this to say about their motivation:

... the most striking factor of all was simply the intense exhilaration that every scientist or engineer experiences when he or she has the freedom to explore completely new technical concepts and then to bring them into reality.

Scientists have much to answer for, for what they did during the Cold War period; and for what they are still doing today, as I will explain later. But other groups in society too must take a share of the blame for creating the dangerous situation. There is no doubt an element of truth in Eisenhower's warning about the military-industrial complex. There are groups in various countries with an interest in, or motivation for, keeping nuclear weapons, or developing defences against them, and they try to find, or if needs be to invent, excuses for this. During the Cold War years this was quite easy; the ideological divide between East and West provided fertile grounds for propaganda. People in the West were manipulated into believing that the Soviet government was planning the conquest of the world by military means, using its overwhelming supremacy in conventional arms. We were led to believe that the only way to prevent this from happening was for the West to threaten retaliation with nuclear weapons. This was the rationale for the setting-up of the North Atlantic Treaty Organization (NATO) under which the United States guaranteed the security of European states.

The assertion in the West – still widely accepted today – that the possession of nuclear weapons prevented a Soviet military attack, is one of the deliberately propagated myths of the Cold War. Careful studies by reputable historians from the West have found no evidence for this assertion. The Soviet government would have liked, of course, to see Communist regimes all over the world, but they tried to achieve this through propaganda and by supporting subversive groups.

All the evidence indicates that the build-up of nuclear armaments by the Soviet government was a response to that by the United States. Almost every step in the nuclear arms race, every technological advance, was initiated by the United States, with the Soviet Union struggling to keep up. But although the Americans were usually ahead – initially in the number of warheads, later in the quality of their armaments – they were never satisfied that their offensive weapons would provide full security, and they made an attempt to achieve extra security through the Strategic Defense Initiative, commonly known as Star Wars. A likely response to this by the Soviet Union would have been an increase in its offensive arsenals, to ensure saturation of the defences – a situation that would eventually have led to a catastrophe, were it not for the emergence of a common-sensical leader, Mikhail Gorbachev. Listening to the advice of Soviet scientists – most of them participants in Pugwash Conferences – he made a rational assessment of the situation, and called a halt to the arms race.

The end of the Cold War brought a complete change in both military and political aspects of the superpower confrontation. Militarily, the roles were reversed: the United States emerged with great superiority in conventional weapons, and Russia had to rely on its possession of nuclear arms to maintain its superpower status. The Warsaw Pact Organization was

dissolved, but its counterpart, NATO, not only stayed on but embarked on a policy of enlargement, bringing into its fold erstwhile Soviet satellites in Europe, thus raising apprehension in Russia. Politically, too, there was a thorough transformation. With the collapse of the Communist regime, the threat of an attack on the West could be entirely discounted.

Under these conditions it would seem to be in the best interests of the United States to heed the call from the great majority of nations in the General Assembly and proceed towards nuclear disarmament. But although, officially, the United States acknowledges its commitment to the elimination of nuclear weapons, its actual policy is a continuation of that during the Cold War, a policy implying on the indefinite retention of nuclear weapons.

US nuclear policy, supported by the UK, France and many NATO countries, is based on the concept of extended deterrence. It is a first-use policy: the use of nuclear weapons is the threatened response to an attack on the United States or its allies, not only with nuclear forces but also with chemical, biological or even conventional weapons.

If this is the purpose of nuclear weapons, then these weapons will be needed as long as disputes are settled by recourse to military confrontation; in other words, as long as war is a recognised social institution. Such a policy is unacceptable in a civilised society on many grounds: legal, logical, political, military and ethical.

It is unacceptable on *legal grounds*. One hundred and eighty nations, that is to say 98 per cent of the UN membership – including all five official nuclear weapon states – have signed and ratified the Non-Proliferation Treaty (NPT), by which the non-nuclear states have undertaken not to acquire nuclear weapons, and the five nuclear states have undertaken to get rid of theirs. There was some ambiguity in the formulation of the relevant Article

VI of the NPT, which provided the hawks with an excuse for the retention of nuclear weapons until general and complete disarmament had been achieved. This ambiguity has now been removed. The statement issued after the NPT Review Conference in New York, in April/May 2000, a statement signed by all five nuclear-weapon states, contains the following:

... an unequivocal undertaking by the nuclear weapon states to accomplish the total elimination of their arsenals leading to nuclear disarmament to which all States parties are committed under Article VI.

This makes the situation perfectly clear. The policy of extended deterrence, which implies the continuing existence of nuclear weapons, is in direct contradiction to the legally binding Non-Proliferation Treaty. It is a sine qua non of a civilised society that nations fulfil their legal commitments and adhere to international treaties. Without this, there would be complete anarchy in the world.

The present policy is unacceptable on *logical grounds*. If some nations – including the most powerful militarily – say that they need nuclear weapons for their security, then such security cannot be denied to other countries which really feel insecure. Proliferation of nuclear weapons is thus the logical consequence of the policy of nuclear deterrence. The US and its allies cannot deny other countries the right to acquire nuclear weapons while retaining them for themselves. The policy of extended deterrence is in contradiction to the non-proliferation policy.

There is yet a further aspect of the logical argument, which strikes at the very basis of deterrence. This is the assumption that both sides in a dispute think and behave rationally; that they are capable of a realistic assessment of the risks entailed in any action contemplated. This would not be the case with

irrational leaders. I mentioned this earlier in relation to Hitler. Even a rational leader may behave irrationally in a war situation, when facing defeat or mass hysteria incited by religious fanaticism or nationalistic fervour.

The policy of extended deterrence is unacceptable on *political grounds*. It is highly discriminatory in that it allows a few nations to usurp certain rights, which should be the prerogative of the United Nations, such as policing the world (by imposing sanctions on nuclear proliferators). Indeed, it goes against the very purpose of the United Nations, an organisation set up specifically for the maintenance of international peace and security. The policy of extended deterrence also means a permanent polarisation of the world, with some nations being offered protection by one or other of the nuclear weapon states.

It is not credible on *military grounds*. The enormous destructive power of nuclear weapons – which puts them in a class of their own – makes resort to their use, particularly in retaliation to anything but a nuclear attack, very unlikely, thus diminishing their military value as weapons. Witness the fact that they have not prevented the several hundred wars that have occurred since 1945.

But above all, the nuclear deterrent is not acceptable on *ethical grounds*. The whole concept of nuclear deterrence is based on the belief that the threat of retaliation is real, that nuclear weapons *would* be used against an act of aggression. George W. Bush, Vladimir Putin, even Tony Blair, must show convincingly that they have the sort of personality that would enable them to push the button and unleash an instrument of destruction, which would harm not only the aggressor but other innocent nations, in a dispute that could have been resolved at a much lower cost in casualties. By acquiescing

to this policy, not only our leaders, but each of us, figuratively keeps our finger on the button; each of us is taking part in a gamble in which the survival of human civilisation is at stake. We rest the security of the world on a balance of terror. In the long run this is bound to erode the ethical basis of civilisation.

We all crave a world of peace, a world of equity. We all want to nurture in the young generation the ‘culture of peace’. But how can we talk about a culture of peace if that peace is predicated on the existence of weapons of mass destruction? How can we persuade the young generation to cast aside the culture of violence when they know that it is on the threat of violence that we rely for security?

I do not believe that the people of the world accept this policy, or any policy that implies the continued existence of nuclear weapons. Numerous public opinion polls have shown general abhorrence towards nuclear weapons and a strong desire to get rid of them. Even the governments of the nuclear weapon states realise this; they feel compelled to issue statements, of the type quoted earlier, asserting their unequivocal commitment to the elimination of nuclear weapons. But what they are preaching is quite different from what they are practising. The nuclear weapon states – or at least four of them – are persisting in the policy of extended nuclear deterrence.

This hypocrisy must be challenged. We have to keep hammering home the fundamental thesis that compliance with international commitments is an essential element of a civilised state. We have to keep on reminding governments that world peace cannot be achieved without respect for international law and adherence to the Charter of the United Nations.

Many non-governmental organisations, including the scientists in the Pugwash Conferences, are engaged in this task. Recently, governmental organisations, for example, the group of seven nations, known as the New Agenda Coalition, of which Sweden is a leading member, became prominent in these endeavours. All of these groups should now mount a grassroots campaign to compel the nuclear weapon states to implement their undertaking under the direct auspices of the United Nations.

I envisage this being accomplished in two major steps. The first step should be a No-First-Use Treaty. All nuclear weapon states, official and *de facto*, should sign a treaty by which they undertake not to be the first to use nuclear weapons. The great importance of such a treaty is that it would bring to an end the pernicious effects of extended deterrence and remove any alleged military utility of nuclear weapons. The only ‘purpose’ of nuclear weapons, while these remain in the arsenals, would be to deter nuclear attack, not to solve disputes between nations. The No-First-Use Treaty would be relatively simple to negotiate, since it would not require an elaborate verification system.

Once a No-First-Use Treaty has been agreed to, the main task – agreeing on a convention to eliminate, or prohibit, nuclear weapons – would become much easier. If the only purpose of nuclear arsenals is to deter a nuclear attack, then the rationale for retaining nuclear weapons if nobody else has them would disappear. The only problem would then be to prove that nobody has them; that is to say, to ensure that nobody has retained, or will in future build up in secret, a nuclear arsenal.

This brings me to the second major step: establishment of an effective verification regime in the programme of nuclear disarmament. The fear of cheating or breakout is indeed the main argument advanced against a nuclear

weapon-free world, and it is incumbent on those who seek such a world to show that the risk of such scenarios can be made very small by appropriate safeguards regimes, based on technological and societal verification. It is not claimed that such regimes would provide 100 per cent security. There is no such thing as absolute security. The claim that can be made is that they would make for a safer world than the alternative. As the above analysis has shown, the alternative – based on extended nuclear deterrence – is bound to fail sooner or later. Nonetheless, we must do our utmost to ensure that the probability of a nation violating a convention prohibiting nuclear weapons is very small.

The tasks that I have outlined are essential and urgent because there is a real possibility of the situation deteriorating, with a return to the Cold War climate.

The immediate threat arises from the US plan – strongly promoted by the new Administration – to go ahead with the national and theatre missile defence programmes, which may lead to the violation, or abrogation, of the 1972 Anti-Ballistic Missile Treaty. In response to this, Russia and China may decide to increase their nuclear arsenals, and a new nuclear arms race may ensue.

Actually, a sort of nuclear arms race may be going on already, although not openly. In the early 1990s – after the end of the Cold War and the collapse of the Soviet Union – there was a period of goodwill when both sides agreed to take measures to reduce their enormous nuclear arsenals. As part of this, the United States government decided to halt the production of new nuclear warheads and to end nuclear testing.

There is a general assumption that new nuclear weapons cannot be developed and made militarily usable without them being tested. Hence, the

great importance of the Comprehensive Test Ban Treaty (CTBT), which has been signed and ratified by a number of nations, though not enough for it to come into force. President Clinton signed it on behalf of the United States, but when it came up before the Senate for ratification it was rejected by the Republican majority. Initially, this was seen as a purely political, rather petty act of vengeance against Clinton, which would soon be rectified. But, since then, arguments of a technical nature have been put forward against the ratification of the CTBT.

The policy of extended nuclear deterrence requires the retention of a nuclear arsenal. This necessitates an infrastructure to ensure the safety and reliability of the warheads in the stockpile, as well as the capability to resume testing at short notice should a situation arise demanding it. An adequate core of scientists and engineers would be employed to carry out these tasks. This was the origin of the Stockpile Stewardship Management Programme which began in 1994 and is currently running on an annual budget of about USD 4.5 billion, which the new Administration wants to increase to USD 5.3 billion.

The stewardship programme includes the following tasks:

... maintain nuclear weapon capability; develop a stockpile surveillance engineering base; and demonstrate the capability to design, fabricate and certify new warheads.

This brief is broad enough to allow the scientists to do almost anything as long as it does not openly entail nuclear testing with critical masses and the actual production of new nuclear warheads. In light of what Theodore Taylor said about weapon laboratory scientists, it is a fair assumption that they will go to the limit of their brief.

The development of new warheads is not allowed, but this obstacle can be circumvented by taking an old weapon and introducing a number of modifications. These would be permitted under the terms of the programme but would in the end produce something that can be claimed to be a more usable weapon, although eventually it would have to be tested, to give the military people confidence in the improved product. Indeed, scientists in the nuclear weapon establishments are now openly calling for the resumption of nuclear tests.

There are persistent rumours, reported in articles in reputable journals, that work in Los Alamos has resulted in the development of effective new warheads. Most of the military research in the national laboratories – in Los Alamos, Lawrence Livermore and Sandia – is carried out in secrecy, making it impossible to say how trustworthy these rumours are, but on the grounds described above they seem feasible. The main point is that even the suspicion that one of the nuclear weapon states is acquiring new capabilities is likely to induce some other nuclear weapon states to follow suit.

In Russia, for example, there are still many scientists working in the former secret cities, such as Snezhinsk or Sarov. The end of the Cold War brought them a dramatic drop in stature and salaries. Many of them are incapable of adapting to the new situation, and are eagerly waiting for a change in the situation, for example, a decision by the US to proceed with the Ballistic Missile Defense system, to feel needed once again.

The decision as to whether to continue with an old, or start a new, programme of nuclear development, rests, of course, with governments, but it is scientists who are the first to be called upon to implement any such programme. There would be no progress with nuclear arms proliferation if scientists as a body refused to do any work on weapons of mass destruction.

This raises the general question of the moral responsibility of scientists: should scientists be concerned about the social impact of their work and the ethical issues that arise from it? Should they accept responsibility for the harmful consequences of scientific research?

A large proportion of the scientific community refuses to take any such responsibility. These scientists claim that there should be no limitation on research that pushes forward the frontiers of knowledge and deepens our understanding of the world around us and its inhabitants. The only obligation on scientists, they claim, is to make the results of their work known to the public. What the public does with these is their business.

This *laissez-faire* attitude is a remnant of the old days, when science had hardly any impact on the life of the community, when pure science and its applications were well separated in time and in space. In those days it would take decades before a practical application was found for a scientific discovery; and even then, different people, working in different institutions, would take it up in different ways.

All this has changed radically. Nowadays, the distinction between pure and applied research is barely discernible in many areas of science. Practical applications follow hard on the heels of scientific discoveries, and may be pursued by the same people.

The most spectacular demonstration of this was in nuclear physics, in the development of nuclear weapons, as I have described earlier. The same scientists who were involved in the discovery of the fission process were also involved in establishing the scientific feasibility of the atom bomb. The close link between science and technology is also seen in other areas, notably in biotechnology, in the amazing progress made in genetic engineering, and in the dazzling growth of computing and communication technologies.

The tremendous advances in pure science, particularly in physics during the first half of the 20th century, and in biology during the second half, have completely changed the relation between science and society. Science has become a dominant element, affecting us in every walk of life. It has brought enormous improvements to the quality of life, but has also created grave perils. Scientists can no longer claim that their work is unrelated to the welfare of the individual or to state politics.

We live in a world community of ever greater interdependence, due largely to technical advancements arising from scientific research. An interdependent community offers great benefits to its members but, by the same token, it imposes responsibilities on them. Every citizen has to be accountable for their deeds. We all owe an obligation to society.

The responsibility weighs particularly heavily on scientists, precisely because of the dominant role played by science in modern society. Scientists very often see the adverse effects of their work earlier than other members of the community, and it is incumbent on them to take steps to prevent, or to minimise, such adverse effects.

It is also in scientists' self-interest to accept this responsibility and thereby avoid the consequences to science of having a bad public image. The public holds scientists responsible for the dangers arising from scientific advance. For example, human cloning is distasteful to the public, and viewed as immoral, and science as a whole is castigated because of the few scientists who want to pursue it.

The general public, through elected governments, has the means to control science, either by withholding the purse, or by restrictive regulations. Obviously, it is far better that any control is exercised by the scientists themselves.

It is vitally important that science regains the respect of the community for its integrity; that it recaptures public trust in its pronouncements. Scientists must reveal a human face. They must show that it is possible to combine creativity with compassion; venture into the unknown, yet care for their fellow creatures; allow the imagination to roam, while remaining accountable for their deeds.

Achieving these *desiderata* calls for a number of measures to be taken, including the following:

Firstly, the *establishment of international guidelines and codes of conduct setting ethical norms for scientific work*. It should be made mandatory for national academies of science to make explicit reference to ethical issues in their terms of reference.

Secondly, the *routine scrutiny of scientific research projects on ethical grounds*. National academies should set up ethical committees in different disciplines to assess proposed research projects for potentially dangerous consequences at the same time as scrutinising on grounds of scientific merit and cost.

Thirdly, the *establishment of an international 'Early Warning Committee'*, comprising distinguished scientists drawn from a range of scientific disciplines, with a brief to attempt to identify, at the earliest possible time, areas of scientific research with the potential for leading to dangerous new military capabilities.

Fourthly, the *introduction of courses on ethical aspects of science in university curricula*, in order to stimulate reflection by young scientists on the wider implications of their chosen field of research before embarking on their professional careers.

Fifthly, the *formulation of pledges to be taken by scientists, along the lines of the Hippocratic Oath*.

We need specifically to look into the issue raised in this lecture: the responsibility of scientists working in military establishments on the secret development of weapons of mass destruction.

Openness is a basic requirement of science. Science cannot progress unless its findings are published and made available to other scientists. Work in military establishments, by its very nature, violates this principle: workers are not allowed to publish their findings, unless the authorities decide that they can be declassified.

Of even greater import is the very question of working on weapons of mass destruction. If the use of nuclear weapons is generally considered to be a crime against humanity, should not work on developing them come under the same category?

There is growing awareness in the world community about individual and collective responsibility for one's deeds, as exemplified by the establishment of the International Criminal Court. Individuals can no longer hide behind orders from their superiors, or on grounds of national needs, for doing work that does not conform with international treaties. The development of new nuclear weapons is in contradiction to the NPT. Should scientists work on them? Is it not time for military establishments to be boycotted by the scientific community?

The nuclear age is a curse to civilisation. The use of nuclear weapons carries a potential threat to the very existence of the human species on this planet. For the first time in history the destruction of the human species as a result of human action has become possible. This is a challenge to all of us – particularly to scientists – to do our utmost to prevent this from happening, to ensure that this world of ours, with all its faults and blemishes, is preserved, and even made a better place for everybody to live in.



Photo: Tommy Westberg

*Joseph Rotblat
receiving the Dag Hammarskjöld Medal
from Vice-Chancellor Bo Sundqvist
16 May 2001*

THE RUSSELL-EINSTEIN MANIFESTO

issued in London, 9th July 1955

In the tragic situation which confronts humanity, we feel that scientists should assemble in conference to appraise the perils that have arisen as a result of the development of weapons of mass destruction, and to discuss a resolution in the spirit of the appended draft.

We are speaking on this occasion, not as members of this or that nation, continent, or creed, but as human beings, members of the species Man, whose continued existence is in doubt. The world is full of conflicts; and, overshadowing all minor conflicts, the titanic struggle between Communism and anti-Communism.

Almost everybody who is politically conscious has strong feelings about one or more of these issues; but we want you, if you can, to set aside such feelings and consider yourselves only as members of a biological species which has had a remarkable history, and whose disappearance none of us can desire.

We shall try to say no single word which should appeal to one group rather than to another. All, equally, are in peril, and, if the peril is understood, there is hope that they may collectively avert it.

We have to learn to think in a new way. We have to learn to ask ourselves not what steps can be taken to give military victory to whatever group we prefer; for there no longer are such steps; the question we have to ask ourselves is: what steps can be taken to prevent a military contest of which the issue must be disastrous to all parties?

The general public, and even many men in positions of authority, have not realized what would be involved in a war with nuclear bombs. The general public still thinks in terms of the obliteration of cities. It is understood that the new bombs are more powerful than the old, and that, while one A-bomb could obliterate Hiroshima, one H-bomb could obliterate the largest cities, such as London, New York, and Moscow.

No doubt in an H-bomb war great cities would be obliterated. But this is one of the minor disasters that would have to be faced. If everybody in London, New York, and Moscow, were exterminated, the world might, in the course of a few centuries, recover from the blow. But we now know, especially since the Bikini test, that nuclear bombs can gradually spread destruction over a very much wider area than had been supposed.

It is stated on very good authority that a bomb can now be manufactured which will be 2,500 times as powerful as that which destroyed Hiroshima. Such a bomb, if exploded near the ground or under water, sends radioactive particles into the upper air. They sink gradually and reach the surface of the earth in the form of a deadly dust or rain. It was this dust which infected the Japanese fishermen and their catch of fish.

No one knows how widely such lethal radioactive particles might be diffused, but the best authorities are unanimous in saying that a war with H-bombs might possibly put an end to the human race. It is feared that if many H-bombs are used there will be universal death – sudden only for a minority, but for the majority a slow torture of disease and disintegration.

Many warnings have been uttered by eminent men of science and by authorities in military strategy. None of them will say that the worst results are certain. What they do say is that these results are possible, and no one can be sure that they will not be realized. We have not yet found that the views of experts on this question depend in any degree upon their politics or prejudices. They depend only, so far as our researches have revealed, upon the extent of the particular expert's knowledge. We have found that the men who know most are the most gloomy.

Here, then, is the problem which we present to you, stark and dreadful, and inescapable: Shall we put an end to the human race; or shall mankind renounce war?¹ People will not face this alternative because it is so difficult to abolish war.

The abolition of war will demand distasteful limitations of national sovereignty.² But what perhaps impedes understanding of the situation more than anything else is that the term “mankind” feels vague and abstract. People scarcely realize in imagination that the danger is to themselves and their children and their grandchildren, and not only to a dimly apprehended humanity. They can scarcely bring themselves to grasp that they, individually, and those whom they love are in imminent danger of perishing agonizingly. And so they hope that perhaps war may be allowed to continue provided modern weapons are prohibited.

This hope is illusory. Whatever agreements not to use H-bombs had been reached in time of peace, they would no longer be considered binding in time of war, and both sides would set to work to manufacture H-bombs as soon as war broke out, for, if one side manufactured the bombs and the other did not, the side that manufactured them would inevitably be victorious.

Although an agreement to renounce nuclear weapons as part of a general reduction of armaments³ would not afford an ultimate solution, it would serve certain important purposes. First: any agreement between East and West is to the good in so far as it tends to diminish tension. Second: the abolition of thermo-nuclear weapons, if each side believed that the other had carried it out sincerely, would lessen the fear of a sudden attack in the style of Pearl Harbour, which at present keeps both sides in a state of nervous apprehension. We should, therefore, welcome such an agreement though only as a first step.

Most of us are not neutral in feeling, but, as human beings, we have to remember that, if the issues between East and West are to be decided in any manner that can give any possible satisfaction to anybody, whether Communist or anti-Communist, whether Asian or European or American, whether White or Black, then these issues must not be decided by war. We should wish this to be understood, both in the East and in the West.

There lies before us, if we choose, continual progress in happiness, knowledge, and wisdom. Shall we, instead, choose death, because we cannot forget our quarrels? We appeal, as human beings, to human beings: 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.

Resolution

We invite this Congress, and through it the scientists of the world and the general public, to subscribe to the following resolution:

“In view of the fact that in any future world war nuclear weapons will certainly be employed, and that such weapons threaten the continued existence of mankind, we urge the Governments of the world to realize, and to acknowledge publicly, that their purpose cannot be furthered by a world war, and we urge them, consequently, to find peaceful means for the settlement of all matters of dispute between them.”

Max Born

Frederic Joliot-Curie

Joseph Rotblat

Percy W. Bridgman

Herman J. Muller

Bertrand Russell

Albert Einstein

Linus Pauling

Hideki Yukawa

Leopold Infeld

Cecil F. Powell

1. Professor Joliot-Curie wishes to add the words: “as a means of settling differences between States”.
2. Professor Joliot-Curie wishes to add that these limitations are to be agreed by all and in the interests of all.
3. Professor Muller makes the reservation that this be taken to mean “a concomitant balanced reduction of all armaments”.

(Text taken from ‘The Pugwash Conferences on Science and World Affairs’, The Pugwash Council, London, 1990.)

UPPSALA UNIVERSITY

Uppsala University, founded in 1477, is the oldest and best-known university in Scandinavia. Famous scholars such as Rudbeck, Celsius and Linnaeus were professors at the university and from Uppsala the disciples of Linnaeus spread throughout the world. Seven Nobel Prize laureates have been professors at the university, among them Archbishop Nathan Söderblom, who was also the University's Pro-Chancellor and received the Nobel Peace Prize in 1930.

In the same year Dag Hammarskjöld completed his studies at Uppsala with a bachelor's degree in Law. He had begun his studies in 1923, received a BA in Romance Languages, Philosophy and Economics in 1925 and took a further post-graduate degree in Economics early in 1928.

In 1981, the Swedish Parliament established a Dag Hammarskjöld Chair of Peace and Conflict Research at Uppsala University. The university's international studies library is also named after Dag Hammarskjöld.

DAG HAMMARSKJÖLD FOUNDATION

The Dag Hammarskjöld Foundation was established in 1962 in memory of the second Secretary-General of the United Nations. The purpose of the Foundation is to organise seminars, workshops and consultations on social, political, cultural and environmental issues facing the Third World and to publish and disseminate the results. The Foundation is an operating and not a grant-making body which carries out its work programme under its own auspices.

Over the years, the Foundation has organised about 150 seminars and workshops and produced over 100 publications of material arising from these events, among them the biannual journal *Development Dialogue*.

* * *

Copies of this publication may be obtained from the Dag Hammarskjöld Foundation,
Övre Slottsgatan 2, S-753 10 Uppsala, Sweden, fax: +46-18-12 20 72,
e-mail: secretariat@dhf.uu.se, web: www.dhf.uu.se

Other titles in this series are:

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