Joseph Rotblat: Visionary for Peace

Edited by Reiner Braun, Robert Hinde, David Krieger,
Harold Kroto, and Sally Milne

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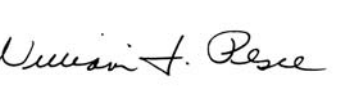

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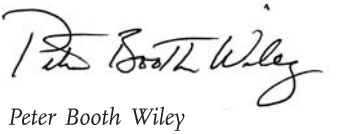

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The Editors

Reiner Braun
IALANA
Glinkastr. 5–7
10117 Berlin
Germany

Prof. Robert Hinde
St. John's College
Cambridge CB2 1TP
UK

Dr. David Krieger
Nuclear Age Peace Foundation
PMB 121
1187, Coast Village Road
Santa Barbara, CA 93108-2794
USA

Prof. Harold Kroto
Department of Chemistry and Biochemistry
The Florida State University
Tallahassee, FL32306-4390
USA

Sally Milne
Pugwash Conferences on Science and World Affairs
Ground Floor Flat
63A Great Russell Street
London WC1B 3BJ
UK

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Fig. 1 Joseph Rotblat speaking at the Nuclear Age Peace Foundation in Santa Barbara, 1997. Courtesy of Nuclear Age Peace Foundation. (Richard A. Carter Photography.)

Dedication

We, members of the Executive Committee of the British Pugwash Group, having worked closely with Jo over the years, are conscious that he is irreplaceable. We miss his almost unfailing perception of the right way forward, his courage and his kindness, his modesty, and his sense of humor. We miss his dedication and his singleness of purpose, which led so often to heated debate. We miss his absolute integrity. We shall never be able to reconcile his clear-headedness with the ever-growing pile of unsorted papers which built up on his desk, or his old-fashioned politeness with his unswerving obstinacy over issues that mattered. We shall do our best to carry on his work, aiming for the elimination of nuclear weapons and ultimately of war itself.

London, January 2007 *Robert A. Hinde*

Preface

Professor Sir Joseph Rotblat died at the age of 96 on August 31, 2005. This is a book about his life and work. In it friends and colleagues write about his life as a human being, as a scientist and a peace activist, and about his efforts to build a more peaceful and fair-minded world.

He was the last living signatory of the visionary Russell–Einstein Manifesto, which he and Bertrand Russell presented to the world at a press conference on July 9, 1955.

In the spirit of this Manifesto he became the founder and long-term guiding light of the Pugwash Conferences on Science and World Affairs. With his expertise as a natural scientist he opposed the nuclear arms race, and during the Cold War Pugwash made a substantial contribution to the treaties that helped prevent the use of nuclear weapons. In 1995 he received, jointly with the Pugwash Conferences, the Nobel Peace Prize.

His tireless engagement with peace and nuclear disarmament, continuing until he died, remains legendary. For decades his courage and optimism inspired the actions of scientists and citizens working to prevent nuclear catastrophe.

His optimism was contagious. His name was, and still is, synonymous with moral courage and ethically responsible action, both as a person and as a scientist. A modest man, he provides us with a shining example of how to live one's life. We hope that this book will help to perpetuate his example.

In one of the last papers he wrote, he portrayed his peace philosophy in the following way:

> In the course of many thousands of years, the human species has established a great civilization; it has developed a rich and multifarious culture; it has accumulated enormous treasures in arts and literature;

and it has created the magnificent edifice of science. It is indeed the supreme irony that the very intellectual achievements of humankind have provided the tools of self-destruction, in a social system ready to contemplate such destruction.

Surely, we must not allow this to happen. As human beings it is our paramount duty to preserve human life, to ensure the continuity of the human race.

A nuclear holocaust does not appear imminent. Having come close to it on several occasions during the Cold War, we are now somewhat more cautious. But war is still a recognized social institution, and every war carries with it the potential of escalation with fatal consequences for our species. In a world armed with weapons of mass destruction, the use of which might bring the whole civilization to an end, we cannot afford a polarized community, with its inherent threat of military confrontations. In this scientific era, a global equitable community, to which we all belong as world citizens, has become a vital necessity.

London,
January 2007

Reiner Braun, Robert Hinde, David Krieger, Harold Kroto, Sally Milne

Part 1
Joseph Rotblat

Joseph Rotblat and Pugwash

Jack Harris

One of Joseph Rotblat's few indulgences was his membership of the Athenaeum Club, which was a useful venue when he had to invite one of his many visitors for lunch or dinner. He also used to organize dinner parties for distinguished guest speakers from abroad after they had addressed a Pugwash meeting. It was on such an occasion that I happened to be sitting next to Rotblat when he turned down a waiter's offer of some boiled potatoes. Noticing my surprise, he explained that so strong was his memory of the bitter taste of frost-damaged potatoes which was often all he had to eat as a child during World War I, that he could no longer bear the taste of even the Athenaeum's most excellently prepared potatoes. He went on to tell us of his almost idyllic childhood in pre-war Warsaw and at country retreats, enjoying the comfort so generously provided by his wealthy father. But then disaster struck; with the outbreak of war, his father's business collapsed and they literally faced starvation – the family's only source of income was from the sale of illicit vodka distilled in their cellar.

After the war the family's fortunes did not recover and Joseph was forced to leave school early and train and practice as a domestic electrician. By studying in the evening he eventually passed enough examinations to follow a degree course in physics at university level and in 1932 he gained a Masters from the Free University of Poland in Warsaw. Subsequently, while working for his PhD, he carried out research at the Radiological Laboratory of the Polish Science Society under the guidance of its Director, Professor Ludwik Wertenstein, and in 1938 was awarded a Doctorate in Physics by the University of Warsaw. During these years a young Polish nuclear physicist, such as Rotblat, could hardly escape being influenced by the work and achievements of Marie Curie. He in fact lived in the same street as Madame Curie, but separated in time

by 40 years. Wertenstein had been an assistant to Curie and the good lady was an Honorary Director of the Warsaw Radiological Laboratory, though she rarely visited it. In addition, Rotblat was to receive an invitation to work in Paris with Marie Curie's son-in-law and daughter, Pierre and Irene Joliot-Curie possibly at the newly opened Marie Curie Radium Institute. In spite of these links Rotblat only met Marie Curie once, when she was quite elderly. I once asked him what he thought of the great lady and he replied that he was not greeted with any degree of warmth. I was reminded of Einstein's description of her as "highly intelligent but has the soul of a herring, which means that she is poor when it comes to the art of either joy or pain".

The 1930s was a propitious period to launch an up-and-coming nuclear physicist, such as Rotblat. The decade began with the German scientists Bothe and Becker publishing their findings that when beryllium is bombarded with alpha particles from a polonium source it emits astonishingly penetrating rays or particles which, two years later, Chadwick and Webster identified as neutrons (the fundamental particles with zero electrical charge and mass close to that of a proton, the existence of which had been predicted by Rutherford in his 1920 Bakerian Lecture). Like Bothe and Becker, Chadwick and Webster used a polonium/beryllium couple as a neutron generator: such a couple was also used, incidentally, to detonate the atomic bombs some 13 years later. However, for his experiments at the Warsaw Radiological Laboratory Rotblat did not have a sample of polonium and he was forced to carry out his radiation experiments using just 30 milligrams of radium in a phial. Every few days he pumped into a tube filled with beryllium powder the radon which had accumulated in the phial by the radioactive decay of the radium. The subsequent decay of the radon over a few days bombarded the beryllium making it an, albeit short-lived, neutron source. How Rotblat must have envied the Rutherford and the Joliot-Curie schools with their plentiful stocks of polonium, and the Fermi group with its *one gram* of radium. Nevertheless, Rotbat succeeded in carrying out valuable experiments involving the neutron irradiation of a number of elements. A main line of research, which became the subject of his doctoral thesis, was based on his investigation of the fact that neutrons are scattered *inelastically* (that is to say that when a neutron strikes the nu-

cleus of an atom it not only changes direction but also loses energy – consistent with the Bohr model of a complex nucleus).

At that time, from the mid to late 1930s, confusing messages were coming through about the consequences of neutron irradiation of uranium from the studies carried out by the Curies, the Fermi group and Hahn and his associates at the Kaiser Wilhelm Institute at Dahlem. Much of the confusion was resolved when Frisch and Meitner realized that what Hahn and Strassman had been observing during their slow neutron bombardment of uranium was *nuclear fission*. Rotblat independently discovered that during the fissioning of uranium neutron multiplication occurred – he thought the multiplication factor was as high as $\times 6$ whereas the actual value was later found to be about $\times 2.5$. Nevertheless multiplication *did* occur, and as Rotblat himself remarked, it did not take a great intellectual leap to realize that the huge energy released by fission together with neutron multiplication led inevitably to the possibility of a chain reaction and hence to an ''atomic'' explosion of unimaginable power. This was a Pauline moment for Rotblat – the possibility of developing an atomic bomb, and the consequences of any such development, affected the whole of the remainder of his very long life.

Although the Rotblat–Wertenstein partnership was successful, they did not have the good fortune of a big stroke of luck as has been experienced by other investigators. For a short account of the role of luck in atomic research, see the Appendix.

Rotblat must have shown much promise as a research scientist because when he completed his PhD he was offered positions with two of the leading research centers – with the Joliot-Curies in Paris or with James Chadwick at Liverpool University. Although he could speak French quite well, his command of English was rudimentary. Nevertheless, he elected to take up a position in Liverpool, drawn there no doubt by the relatively advanced stage of construction of their cyclotron. In 1930 Rotblat had met Tola Gryn, a student of Polish literature and they fell in love and in 1937 they were married. Unfortunately, the salary offered by Chadwick was insufficient to support both Rotblat and Tola, so he was forced to leave his wife behind when he first moved to Liverpool in March 1939. However, so impressed was Chadwick by Rotblat's performance as a research scientist that in August he offered him the

Oliver Lodge Fellowship which carried a higher stipend, which meant that Tola could join him. Rotblat returned to Warsaw to make arrangements for Tola to accompany him on his return journey to Liverpool, but tragically she suffered an attack of acute appendicitis and was too ill to travel so Rotblat returned to Liverpool alone. A few days later, on September 1 Germany invaded Poland. During the following months Rotblat made several desperate attempts to arrange for Tola to leave Poland. He recruited Niels Bohr's help for her to travel to Denmark, sought the assistance of relatives for her to reach Britain via Belgium and arranged for her to travel to Italy, but all in vain – Denmark and Belgium were invaded by the Germans and Italy joined the Axis cause. In due course both Tola and her mother died in a Nazi concentration camp, but Rotblat was unaware of their fate until after the end of hostilities.

During his brief visit to Warsaw Rotblat had a discussion with his friend and mentor Ludwik Wertenstein at the Radiological Laboratory and showed him his calculations which gave the strong indication that an atomic weapon was feasible. He sought guidance from Wertenstein on whether the fear that Nazi Germany might develop such a weapon would justify the Allies embarking on an atomic bomb program. Wertenstein was reluctant to commit an opinion but merely replied that he would not himself get involved in such a program. Back at Liverpool, Chadwick too was at first noncommittal on the subject of nuclear weapons, but he did provide Rotblat with some research assistance so that he could explore the feasibility of such a possible development.

The initiating event for the UK nuclear weapon program was, however, a simple calculation by Peierls and Frisch carried out at Birmingham University in February 1940. They demonstrated that the critical mass of the uranium-235 isotope for fast neutrons was only a matter of kilograms, so that an atom bomb capable of being carried by an aircraft was feasible. Oliphant, the then head of the Birmingham Physics Department, recommended that they send their report containing this information to Sir Henry Tizard, who set up the Maud Committee under the chairmanship of Sir George Thomson to study this matter further. Paradoxically, Peierls and Frisch, being enemy nationals, were not allowed to sit on the committee, but could only act as advisers. Subsequently Frisch, at-

tracted by Liverpool's cyclotron, moved to Chadwick's team to carry out research on methods of separating the uranium-235 isotope from uranium-238 (natural uranium consists of 99.3% uranium-238 and 0.7% uranium-235). He became a friend of Rotblat, and drew an affectionate caricature of him which he included in his autobiography *What Little I Remember.*

The Maud Committee deliberated for 15 months and issued its final report in July 1941. It became obvious that having done much of the groundwork it was clearly beyond Britain's capability actually to manufacture an atom bomb under wartime conditions (the diffusion plant at Oak Ridge used more electricity than the whole of the UK). In July 1942 Sir John Anderson sent Churchill a minute proposing that the bomb project be a joint US/British effort but carried out in the USA. Churchill agreed and steps were put in place for the British team to move to the USA. Chadwick was to become the leader of the British team. There was an American-imposed rule that all members of the Manhattan Project in the USA should hold either American or British passports. Rotblat did not want to lose his Polish nationality and refused to be made a British citizen so was excluded from the initial party which set sail for the USA (if their ship had been sunk think of the loss of all that brain power and expertise). However, the nationality requirement was later waived in Rotblat's case so he followed the rest of the British team a few weeks later and eventually arrived in Los Alamos.

Rotblat was never particularly happy at Los Alamos. As well as being frustrated that his experience and talents were not used usefully, he had worries about the morality of the whole enterprise. His doubts were reinforced when he heard the project administrator, General Groves, declare that the real reason to develop the bomb was to subdue the Russians! When it became clear towards the end of 1944 that Germany could not possibly develop an atomic bomb he decided to resign from the project and return to Liverpool. Chadwick was sorry that a member of his team wished to leave but assisted with the arrangements for his return, only to discover that the authorities had been monitoring Rotblat as a potential spy! Back in Liverpool Rotblat decided to devote the rest of his working life to nuclear medicine and, after the explosion of the Hiroshima and Nagasaki bombs, to the abolition of atomic weapons.

The origins of the British Pugwash group date back to early 1946 when Peierls, Rotblat and others formed the Atomic Scientists Association (ASA), most of whom had worked on atomic weapons during the war. Their objectives were to bring before the public information about atomic energy and its implications, to explore possibilities about the international control of atomic energy and to help shape the policy of the UK in all matters relating to atomic energy. The chairman of the Association was Professor Massey with Rotblat as its Executive Vice President. The members of the Executive Committee, all of whom were Fellows of the Royal Society, were: Bates, Blackett, Chadwick, Cockcroft, Darwin, Lonsdale, Moon, Mott, Oliphant, Paneth, Peierls, Powell, Pryce, Schonland, Simon, Skinner, Taylor and Thomson.

Perhaps the ASA's most notable achievement, which Rotblat took a large part in organizing, was the creation of the Atom Train Exhibition designed to educate the public about the military and peaceful applications of nuclear energy. It comprised two complete carriages of exhibitions and live experiments and there were associated public lectures by eminent scientists, such as Chadwick, Oliphant, Peierls, Cockcroft and Flowers. It went on a 26-week tour of England, Wales and Scotland visiting 25 venues and informing 150,000 visitors. The demand was so great the train did another 20-week tour and later its equipment was loaned to UNESCO for conferences in Lebanon, Paris and Scandinavia.

In 1949 Rotblat was offered the Chair of Medical Physics at the medical school at St. Bartholomew's Hospital in London, but his appointment was not well received by some of the medical staff. He started to take an interest in radiotherapy and began to be involved with the design and operation of linear accelerators and to write papers relating to the potential diagnostic and therapeutic applications of radio-iodine. He developed a happy working relationship with his friend and colleague, Professor Patricia Lindop.

Rotblat became a leading authority on nuclear fallout following atomic tests in the atmosphere. He took an especial interest in the explosion of America's second hydrogen bomb at the Bikini Atoll in March 1954, the fallout from which contaminated a Japanese fishing boat, ironically named "The Lucky Dragon", causing the delayed death of one of the crew. He calculated that the Bikini bomb must have been a three-tage device (fission–fusion–fission)

with its outer casing consisting of a great deal of uranium-238 which would fission when struck by the fast neutrons from the fusion explosion. It was hence a very "dirty" bomb. Rotblat drafted a note for *Nature* on his findings but first consulted Sir John Cockcroft who advised delay for fear of upsetting the Americans. Soon a US physicist, Ralph Lapp, published similar conclusions so Rotblat published his paper, which had a controversial reception and made Rotblat a nationally known figure.

Rotblat met Bertrand Russell at the BBC when they both appeared on a Panorama TV program, and they became friends, Russell often asking Rotblat for advice on nuclear matters. By 1955 both the USA and the Soviet Union had exploded thermonuclear weapons which were a thousand times more powerful than the bombs that destroyed Hiroshima and Nagasaki. Russell became fearful for the future of humankind and drafted a text calling on scientists to help combat this danger. In one of the last acts of his life Albert Einstein signed this document, which became known as the Russell–Einstein Manifesto. Russell wanted the Manifesto to be launched at a major public meeting and this was arranged at Caxton Hall, London, on July 9, 1955 – a crowded gathering which was chaired by Rotblat. The Pugwash Conferences began two years later in response to the Manifesto.

Of the signatories of the Manifesto all were scientists, except Russell, and ten of the total were Nobel Laureates (NLs) or were to become Laureates subsequently. They were: Max Born, Germany (NL Physics 1954); Percy Bridgeman, USA (NL Physics 1946); Albert Einstein, Germany (NL Physics 1921); Leopold Infeld, Poland; Frederic Joliot-Curie, France (NL Chemistry 1935); Herman Muller, USA (NL Physiology or Medicine 1946); Linus Pauling, USA (NL Chemistry 1954, NL Peace 1962); Cecil Powell, UK (NL Physics 1950); Joseph Rotblat, UK (NL Peace 1995); Bertrand Russell, UK (NL Literature 1950) and Hideki Yukawa, Japan (NL Physics 1949).

With the passing of Rotblat all the signatories are now dead; we can only hope their spirit lives on. Here are some extracts from the Manifesto:

> 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 ...

> 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.
>
> 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? . . .
>
> 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.

The first of the conferences advocated in the Manifesto took a great deal of organizing and had a long, two-year, gestation period. Initially it was planned to hold it in Delhi but there were political difficulties and it was doubtful if many scientists from Western Europe and America would be able to raise the travel funds for such a long journey. Cyrus Eaton, a US–Canadian industrialist and philanthropist came to the rescue. He wrote to Russell offering to host and finance the first conference of the new organization providing the venue was his home town of Pugwash in Nova Scotia and that the name "Pugwash" should appear in the title of the conference. (Incidentally, Pugwash takes its name from the Indian word *pagwechk* which means "shallow waters" – perhaps not entirely appropriate for an organization which so frequently, figuratively speaking, gets into deep waters!). Eaton's offer was gratefully accepted and Rotblat and Cecil Powell set about organizing the conference which was held in July 1957 and attracted 22 delegates – sixteen were physicists, two chemists, one biologist, two physicians and a lawyer. Ten countries were represented including the USA, UK, Japan and China. Unfortunately, Bernard Russell was too ill to attend, but among the notable delegates was Eugene Rabinowitch, the founder of the *Bulletin of Atomic Scientists*, Leo Szilard, the first person to envisage the atomic bomb, and a vice-president of the Soviet Academy of Science. Amongst the "staff" members was Ruth Adams, who became editor of the *Bulletin of Atomic Scientists* and played an important part in the Pugwash movement, particularly in the creation of the International Student/Young Pugwash organization. A report of the conference conclusions was sent to leaders

in the USA, Canada, the USSR, the UK and the Soviet Academy of Sciences.

Since 1957 there has been at least one major Pugwash conference every year and until 2004 Rotblat attended every one of them. From 1957 to 1972 he was Secretary-General of the movement (with Patricia Lindop as Assistant Secretary-General from 1964 to 1970), and President (later Emeritus) from 1988 to 1997 and chair of British Pugwash from 1978 to 1988. Following Rotblat's death in 2005 the current Secretary-General Cotta-Ramusino said that without Rotblat there would have been no Pugwash.

It is difficult to answer the question "What has Pugwash actually achieved?" When a government takes what is obviously a wise decision, or signs a sensible treaty, it likes to create the impression that the wisdom arises from the ministers themselves or their advisers. The last thing they want is for some peace organization brashly to attempt to take the credit. That is why Pugwash meetings take place quietly in the background. At the end of each annual conference the Pugwash Council issues a statement which it sends to governments and from time to time the Council issues statements on topical issues, or writes a public letter to a prime minister or president. For the most part though, conclusions from Pugwash meetings are transmitted in person to decision-makers. After a suitable interval of time credit for Pugwash initiatives can be claimed; for example, it is known that Soviet Pugwash scientists influenced their government to support the Anti-Missile Treaty.

At the 1990 Pugwash conference Lord Zuckerman, for many years the chief scientific adviser to the British government, revealed that the pressure brought to bear by Pugwash had played an important part in achieving the Partial Test Ban Treaty of 1963. At the same conference, a message from Mikhail Gorbachev contained the following message: "Through its activities, due to scientific and moral authority, Pugwash has contributed in a unique way to averting the military danger, has helped to stop the 'Cold War' and to achieve profound positive changes in the development of the world." It is believed on good authority that Pugwash has laid important groundwork for a number of international treaties, including: Treaty of Tlatelolco, 1967; Non-Proliferation Treaty, 1968; Anti-Ballistic Missile Treaty, 1972; Biological Weapons Convention, 1972; Chemical Weapons Convention, 1993. Pugwash also played a

part in the setting up of the Canberra Commission against the concept of nuclear deterrence.

The year 1995 was an eventful one for Rotblat. To mark the 50th anniversary of the dropping of the Hiroshima and Nagasaki bombs the Pugwash annual conference was held in Hiroshima, at which Rotblat delivered a controversial address. A short time later he was elected a Fellow of the Royal Society, and then heard that he and the Pugwash organization were to share the 1995 Nobel Peace prize. In his acceptance speech entitled ''Remember Your Humanity'' he urged his fellow scientists to refuse to help develop weapons of mass destruction. He was knighted two years later and used his extra ''weight'' to advocate a Hippocratic Oath for scientists and intensified his demands for the release of the Israeli technician Mordechai Vanunu. Right to the end of his life Rotblat was expansive and creative. Quite recently he began to think that Pugwash might be somewhat introspective and might be failing to communicate enough with the general public. Accordingly, he has advocated that a number of non-government organizations could usefully collaborate and communicate better with the general public. In 2004 he persuaded Mikhail Gorbachev to launch jointly with him a ''Nuclear Weapons Awareness Program''. Rotblat has shown he had not lost his perceptiveness by inviting Professor John Finney to take charge of this enterprise.

It is a sobering fact that most of us will die well before we reach the age of 87. It follows that if Rotblat had lived an average lifespan or even quite a long one but nevertheless had died before his 87th birthday, he would not have been elected to the Royal Society, not have been knighted, and not become a Nobel Laureate. Does that say something about those responsible for bestowing honors?

A couple of years ago Rotblat appeared on the BBC radio program Desert Island Discs and one of his choices was Pete Seeger singing ''Last Night I had the Strangest Dream'' and I would like to reproduce the opening lines here. You might feel this is a rather frivolous way to end this appreciation, but at least it is not stuffy . . . and Jo could not bear stuffiness:

> Last night I had the strangest dream I've ever had before,
> I dreamt the world had all agreed to put an end to war.
> I dreamt I saw a mighty room and the room was filled with men,
> And the papers they were signing said they'd never fight again.

In his explanation of his choice Jo said that this song was written in 1956 and he took the positive view and thought that putting an end to war was in more people's minds today than it was in those far-off days. I am not sure he is right, but if he is, then it is in no small measure due to his own remarkable achievements.

Acknowledgments

I have had the benefit of reading Mrs. June Clayton's excellent thesis on Joseph Rotblat and Robert Hinde has kindly shown me his draft of Rotblat's Royal Society Biographical Memoir.