

The Role of Scientists in Reducing Nuclear Dangers 1945-2025

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**At the end of WWII, many of the top scientists whose work had
led to fission weapons began speaking out on their dangers.**

**Four important Manhattan-project scientists took on particularly
energetic, prophetic, and ultimately far-reaching roles.**

2

Joseph Rotblat 1908-2005



- Polish-British physicist, fled Poland in 1939, worked w Chadwick in Tube Alloys project, joined him at Los Alamos in early 1944.
- Resigned in Nov 1944 & returned to England after it was clear Germany was losing war and wouldn't get bomb—only major scientist to quit Manhattan project on grounds of conscience.
- Helped **Bertrand Russell** launch 1955 Russell-Einstein Manifesto and 1957 initial Pugwash meeting. Served as Secretary General of Pugwash confs 1957-73 and President 1988-97; was at 192 mtgs up to Oct 2004 .
- Founding member of UK Committee for Nuclear Disarmament in 1957; Nobel Peace Prize shared with the Pugwash organization in 1995.

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Russell-Einstein Manifesto (9 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...

...

Here, then, is the problem we present to you, stark and dreadful and inescapable: shall we put an end to the human race; or shall mankind renounce war?

...

...an agreement to renounce nuclear weapons as part of a general reduction of armaments would not afford an ultimate solution ... [but] any agreement between East and West is to the good insofar as it tends to diminish tension... [and] the abolition of thermonuclear weapons, if each side believed that the other had carried it out sincerely, would lessen the fear of a sudden attack...

...

We appeal, as human beings, to human beings: remember your humanity, and forget the rest.

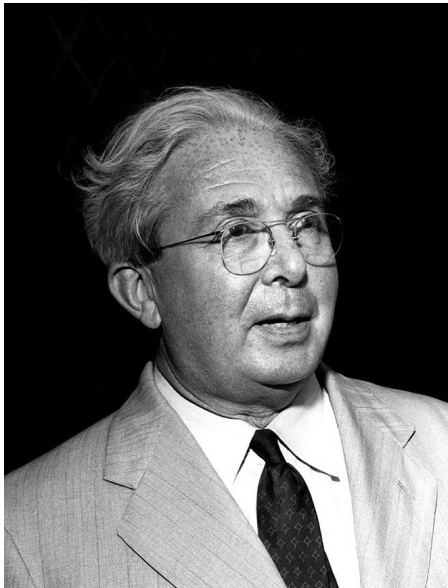
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Signers of the Russell-Einstein Manifesto

- **Bertrand Russell** (1872-1970), UK, Literature Nobel 1950 (humanitarian ideals, freedom of thought)
- **Albert Einstein** (1879-1955), USA, Physics Nobel 1921 (photoelectric effect)
- **Joseph Rotblat** (1908-2005), UK, Peace Nobel 1995 (nuclear arms control)
- **Max Born** (1882-1970), USA, Physics Nobel 1954 (quantum mechanics)
- **Percy Bridgman** (1882-1961), USA, Physics Nobel 1946 (physics of high pressures)
- **Leopold Infeld** (1898-1968), Poland, physicist, Einstein colleague (relativity)
- **Frédéric Joliot-Curie** (1900-1958), France, Chemistry Nobel 1935 (radioactivity)
- **Hermann Muller** (1890-1967), USA, Medicine Nobel 1946 (mutation by x-rays)
- **Linus Pauling** (1901-1994), USA, Chemistry Nobel 1954 (quantum chemistry)
- **Cecil Powell** (1903-1969), UK, Physics Nobel 1950 (nuclear processes)
- **Hideki Yukawa** (1907-1981), Japan, Physics Nobel 1949 (pi-meson)

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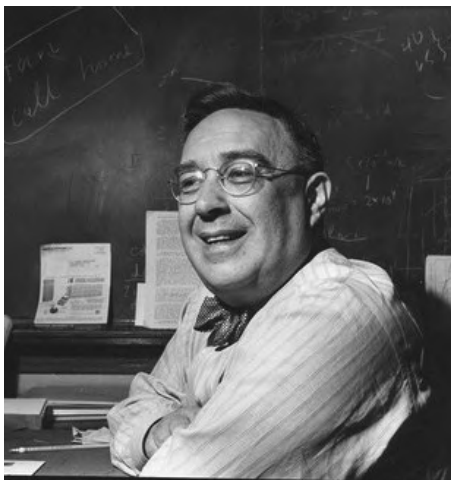
Leo Szilard 1898-1964



- After advocating for a Manhattan Project, joined it to work with Fermi at the Metallurgical Lab in Chicago, playing important role in 1st sustained fission reaction at Stagg Field on Dec 2, 1942.
- Signer of June 1945 Franck Report & organizer of July 1946 petition with 70 signers, both calling for a non-lethal demonstration of US atomic bomb.
- Co-founder of the *Federation of American Scientists* in Dec 1945; also involved w *Bulletin of Atomic Scientists* from its Dec 1945 beginning.
- With Einstein, co-founded the *Emergency Committee of Atomic Scientists* in May 1946.
- In 1962, founded the *Council for a Livable World* focused on education of & interaction with Congress on nuclear-weapon issues.

6

Eugene Rabinowitch 1901-1973



- Russian-American chemist, PhD 1926 U of Berlin. Left Germany 1933 for Copenhagen, then London, finally USA in 1938.
- Joined Manhattan Project's Chicago Met Lab 1942.
- A leader of *Atomic Scientists of Chicago* in 1945, principal drafter of June 1945 *Franck Report*; co-founded *Federation of American Scientists* and *Bulletin of Atomic Scientists* at end of 1945.
- Editor of *Bulletin* until his death; wrote >100 editorials & other articles there.
- Was instrumental in building links between US & Russian scientists; attended 1st Pugwash conf and 25 more; co-organized US Pugwash Committee.

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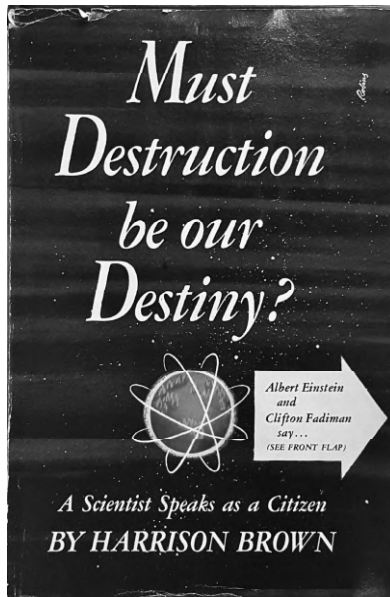
Harrison Brown 1917-1986



- US nuclear chemist, Johns Hopkins PhD 1941; recruited to Chicago Met Lab by Seaborg 1942; Ass't Director of Chemistry at Oak Ridge in 1943 at 25.
- Finished *Must Destruction Be Our Destiny* Dec 1945, correctly outlining course of US-USSR nuclear arms race if no internat'l control of nucl weapons.
- Was a co-founder of *Assoc of Oak Ridge Scientists* in Fall 1945; 1st Vice Chair of *Federation of Atomic Scientists* (formed late Oct 1945), then co-founder of *Federation of American Scientists* in December; Exec VP of *Emergency Committee of Atomic Scientists* & member of 1st BA editorial board in 1947.
- Helped lay groundwork for Pugwash confs, later attending 17 and serving on Pugwash Continuing Committee & US Pugwash Committee.

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H. Brown on nuclear weapons as of December 1945



- US monopoly unlikely to last > 3 yrs. (It lasted <4.) Bombs w 1000x power of Nagasaki are coming.
- Arsenals of major powers will reach 1000s of nuclear weapons each, carried by rockets of intercontinental range.
- Interest in defenses against nuclear weapons will arise periodically, but offense has insurmountable advantages.
- Major conventional conflicts betw nuclear powers will almost certainly become nuclear and, once nuclear, will very likely to destruction of civilization.
- Widespread access to nucl energy tech is incompatible with tight control on producing bombs; possibility of bombs concealed in cities will threaten civil liberties as well as lives.
- Deterrence is unreliable as a long-term strategy; some form of world government will be required.

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Other important Manhattan-project scientists also became involved after the war in efforts to communicate and reduce the risks from nuclear weapons.

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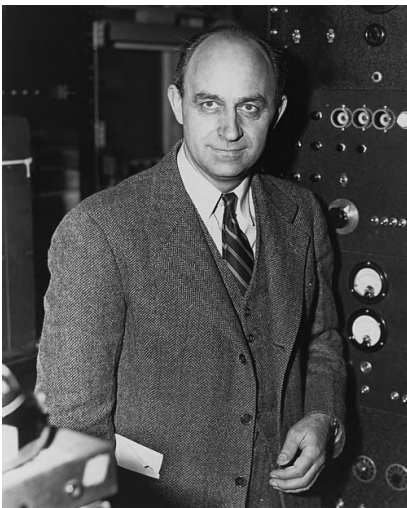
J Robert Oppenheimer 1904-1967



- US German-trained physicist; recruited to Manhattan Project in 1942, Director of Los Alamos Lab 1943-45.
- Said at an NAS-AmPhilSoc symposium in Nov 45:...
It is a practical thing to recognize as a common responsibility, wholly incapable of unilateral solution, the completely common peril that atomic weapons constitute for the world, to recognize that only by a community of responsibility is there any hope of meeting the peril.
- Lobbied for internat'l control of nuclear power and nuclear weapons to avoid arms race with the USSR.
- Opposed US development of a hydrogen bomb, losing his clearance in famous 1953 hearing as a result.
- Declined to sign 1955 Russell-Einstein Manifesto but made similar arguments independently.

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Enrico Fermi 1901-1954



- Italian-American physicist, 1938 Physics Nobel, moved to USA immediately afterward.
- Headed Manhattan Project Met Lab in Chicago in 1942, led design-development of Stagg Field reactor; led F Division at Los Alamos 1943-45.
- Didn't believe atomic bombs would deter nations from starting wars, nor think time was ripe for world gov't; didn't join *Association of Los Alamos Scientists*.
- Member of AEC *General Advisory Committee* from 1947, opposed developing H-bomb, then worked on it.
- Testified for Oppenheimer in 1953 hearings.
- Supported the Baruch Plan for international control of nuclear weapons & energy.

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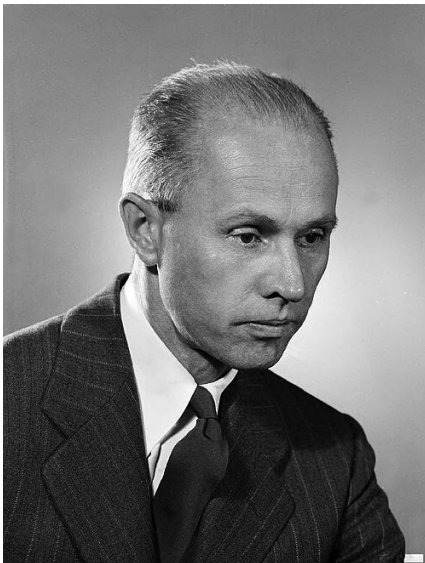
Hans Bethe 1906-2005



- German born & trained physicist, worked w Fermi in Rome 1931-33, in England 1933-35, to USA 1935. Physics Nobel 1967 for elucidating fusion reactions.
- Became head of Theory Division at Los Alamos in 1943. Initially opposed program to develop hydrogen bomb, then joined it while hoping to prove bomb infeasible.
- Testified for Oppenheimer in 1953 hearing; tried unsuccessfully to persuade Teller not to testify against.
- As PSAC member under Eisenhower, was important voice supporting PTBT.
- Attended 3rd Pugwash conf in 1958; was founding board member of Council for a Livable World in 1962.
- In 1995 published open letter calling on all scientists to “cease and desist” from work on nuclear weapons.

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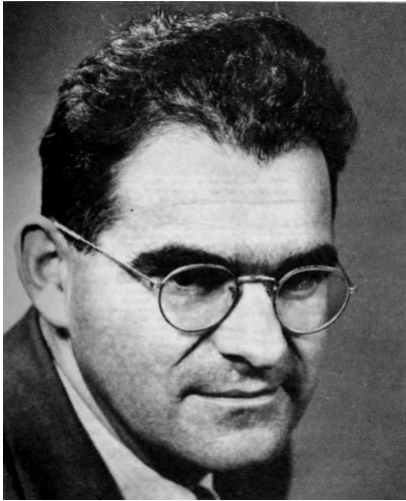
George Kistiakowsky 1900-1982



- Russian-born, German-educated physical chemist; moved to USA 1926, joined Harvard faculty 1933.
- Joined Manhattan Project Oct 1943, put in charge of developing explosive lenses for the Trinity Pu bomb.
- Appointed to Eisenhower PSAC in 1957, suggested to Ike in 1959 that arms control strategy focus on disarmament rather than inspections because of technical difficulty of the latter.
- In 1960 proposed banning nuclear tests above the threshold of seismic detection & working with Soviets to improve detection over time, lowering threshold.
- Attended multiple Pugwash conferences; was active in Council for a Livable World (becoming Chair in 1997).

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Victor Weisskopf 1900-1982



- Austrian-born, German-educated, US physicist; joined U of Rochester as prof of physics in 1937.
- At Los Alamos, served as Deputy Director of Theoretical Division under Hans Bethe.
- Founding member of *Emergency Committee of Atomic Scientists*; Co-founder and board member of *Union of Concerned Scientists*.
- A member of the Pontifical Academy of Sciences, led a team of 4 scientists dispatched by Pope Paul II to propose to Pres Reagan a prohibition of use of nuclear weapons.
- Best-known quote:

*Compassion without knowledge is ineffective;
knowledge without compassion is inhuman.*

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Rudolf Peierls 1907-1995



- German-born, German-educated, UK physicist; studied under Heisenberg, Arnold Sommerfeld, Fermi; in UK after 1932 as prof at Birmingham & Cambridge.
- Wrote memo w Otto Frisch leading to MAUD committee and UK Tube Alloys bomb project; succeeded Chadwick as head of UK mission at Los Alamos in 1944.
- Post-war again prof at Birmingham, then Oxford.
- Consummate insider-outsider: Sr Advisor to UK Atomic Energy Agency, questioning wisdom of nucl armament; President of the *UK Atomic Scientists' Assoc*, Royal Society discussions on instability of deterrence.
- Pillar of the Pugwash confs, attending 34 meetings betw 1960 and 1993.

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Some of the youngest Manhattan Project participants also played later important roles in nuclear-risk-reduction efforts.

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Bernard Feld 1919-1993 Physicist, career at MIT. As grad student was an assistant to Fermi & Szilard at Los Alamos.

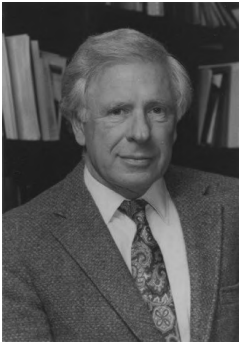
- Attended 1958 Pugwash mtg & 90 more; Chair US Pugwash Committee 1963-73, Pugwash Sec-Gen'l 1973-78.
- Editor of *Bulletin of Atomic Scientists*, President of Albert Einstein Peace Prize Foundation.



Paul Doty 1920-2011 Chemist, career at Harvard. Worked on chem probs around fission weapons as grad student at Los Alamos.

- One of 7 US participants at 1st Pugwash conf in 1957; attended 24 later Pugwash mtgs.
- After 1957 conf promptly formed "Doty Group" w other nuclear scientists offering advice informally to White House & State Dept & to meet off-the record with Russian nuclear scientists.
- Founded the Center for Science and Internat'l Affairs at Harvard's Kennedy School 1973 (an academic home for people like him).

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Marvin "Murph" Goldberger 1922-2014 Physicist, PhD w Fermi at U of Chicago. Served under Fermi in Manhattan Project 1943-46.; President of Caltech 1978-87.

- 1st chairman of the science-and-security JASON advisory group.
- Member of Doty Group.
- 1st chairman of NAS Committee on National Security & Arms Control (CISAC) 1980-87.
- Attended 2 Pugwash mtgs.



Herb York 1921-2008 Physicist, recruited as grad student late 1942 to Berkeley Rad Lab Berkeley PhD after war (1949).

- 1st Director at Livermore Lab in 1952 at 31; then 1st ARPA Chief Scientist, 1st DoD Director of Defense Research & Engineering.
- Member of Doty Group.
- ACDA advisor in 1960s, US delegate to CTBT talks 1979-81.
- *Race to Oblivion* 1971, *Making Weapons - Talking Peace* 1987.

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Wolfgang ("Pief") Panofsky 1919-2007



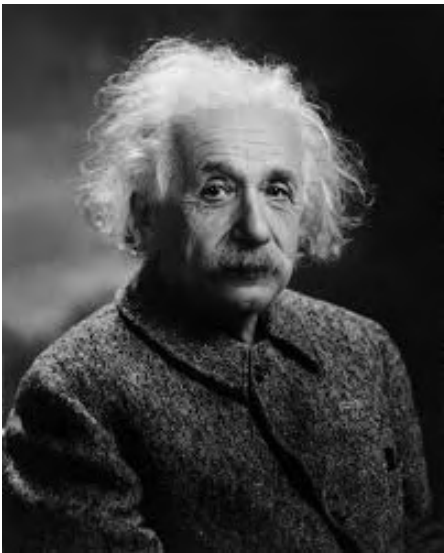
- German-born physicist, moved to USA at 15; Caltech PhD, Director Stanford Linear Accelerator 1961-84.
- As junior figure in Manhattan Project in 1945, designed instrument to determine yield in Hiroshima explosion, flew in B-29 chase plane to deploy it.
- In 1960s-80s, was regular participant in "Doty Group".
- Member of National Academy of Sciences Committee on International Security & Arms Control (CISAC) from its founding in 1980; 2nd Chair of CISAC 1987-1993;
- As Chair led initial engagement w Chinese counterpart group & continuing engagement w Russian counterpart; led reports on "The Future of Nuclear Arms Control" (1991), "Management & Disposition of Excess Weapon Plutonium" (1994).

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A number of the top scientists whose work had led to fission weapons but were not in the Manhattan Project also spoke out about the dangers once the war ended.

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Albert Einstein 1879-1955



- Denied a clearance because of his pacifist inclinations, wasn't part of the Manhattan Project.
- Said after the war that he'd never have sent the Einstein-Szilard letter to FDR if he'd the known the Germans wouldn't get close to developing an atomic bomb.
- With Szilard, co-founded the *Emergency Committee of Atomic Scientists* in May 1946 to warn the public about the dangers from nuclear weapons.
- As one of his last acts before he died in April 1995, added his name to B Russell's manifesto, which ensured additional top-scientist signers worldwide and guaranteed worldwide attention.

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Linus Pauling 1901-1994



- US chemist, 1925 Caltech PhD in physical chemistry & mathematical physics; discoverer of plutonium; Chemistry Nobel 1954, Peace Nobel 1962.
- Invited to lead Chem Division at Los Alamos, declined on moral grounds (although he did other war-related work).
- Founding member of *Emergency Committee of Atomic Scientists*, signed Russell-Einstein Manifesto & attended 2nd Pugwash conference in 1958 and 3 more.
- Supported biologist **Barry Commoner's Committee for Nuclear Information** in research on strontium-90 in baby's teeth & criticism of atmospheric nucl tests.
- Co-led petition to stop nuclear testing with 11,000 scientist signatures, presented to UN Secretary General.

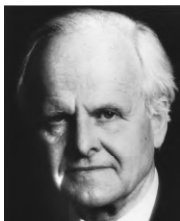
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Edoardo Amaldi 1908-1989 Italian physicist. Most influential Italian anti-nuclear voice following the war. Warned of huge risks, opposed nat'l nuclear armament, favoring internat'l control; attended 12 Pugwash confs from 1958; co-founded ISODARCO w Carlo Schaerf in 1966.



Frédéric Joliot-Curie 1900-1958 French chemist-physicist, 1935 Chemistry Nobel; avowed Communist. Spoke out publicly against nuclear weapons, promoted nuclear energy under international control, signed Russell-Einstein Manifesto in 1955.



Carl Friedrich von Weizsäcker 1912-2007 German physicist. Worked w Heisenberg on German bomb project. (Did they want to succeed?) Wrote & spoke post-war on danger of nuclear war; opposed arming Bundeswehr w tactical nukes; wanted Germany to renounce nuclear weapons permanently; attended 8 Pugwash confs from 1958.

24



Patrick Blackett 1897-1974 British physicist, 1948 Physics Nobel. Head tutor of Oppenheimer at Cambridge. Opposed Britain developing nuclear weapons; active in UK scientist discussion groups about nuclear dangers; attended 5 Pugwash conferences starting in 1959.



Max Born 1900-1958 German-UK physicist (left Germany 1933). Saw nucl weapons as existential threat; argued scientists have moral duty to warn humanity; many written & spoken appeals on the topic; signed Russell-Einstein Manifesto; attended 3rd Pugwash conf in 1958.



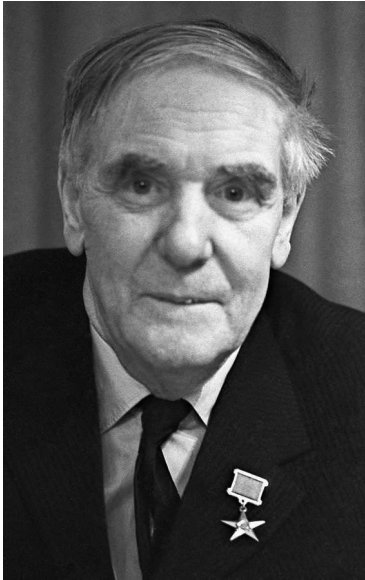
Hideki Yukawa 1907-1981 Japanese physicist, 1949 Physics Nobel. Advocated abolition of nuclear weapons. Signed Russell-Einstein Manifesto; attended 5 Pugwash confs starting with the 1st in 1957.

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USSR nuclear scientists—some involved in the Soviet A-bomb project—also became engaged in work on nuclear policy and nuclear risks after WWII.

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Peter Kapitsa 1894-1984



- Engineering degree from Petrograd Polytechnic Inst 1918; Physics PhD 1923 from Cambridge U under Ernest Rutherford.
- Physics Nobel 1978 for helium-superfluidity work in late 1930s; inventions in microwave generators and plasma physics in 1950s & 1960s.
- Worked on Soviet atomic-bomb project; refused to work on a hydrogen bomb on practical & moral grounds and told Stalin why not. He & wife Anna placed under *de facto* house arrest 1950-53.
- Tried unsuccessfully to persuade Sakharov not to work on H-bomb; later refused to denounce him for dissidence.
- Attended 5 Pugwash mtgs between 1960 & 1974.

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Lev Artsimovich 1909-73

- Physicist, Academician from 1953 & Presidium member from 1957. Head of Soviet fusion-power program 1951-73; conceived Tokamak approach.
- Worked on electromagnetic isotope separation in Soviet A-bomb program, then separation of Li-6 for fusion.
- Attended 10 Pugwash mtgs starting 1962.



Mikhail Millionshchikov 1913-1973

- Physicist, Deputy Director Inst of Atomic Energy 1960-, VP of Soviet Academy 1962.
- Attended 12 Pugwash mtgs starting 1964, Chair Soviet Pugwash Committee 1964-, Pugwash President 1969

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Vitaly Goldansky 1923-2001

- Nuclear chemist, served in WWII, PhD 1947; Director of Semenov Inst of Soviet Academy 1988-; a sci advisor to Gorbachev; 34 Pugwash mtgs starting 1977; member Soviet Pugwash Committee



Evgeny Velikhov 1935-2024

- Physicist, ScD 1964, prof at Moscow U 1968-, Director of Kurchatov 1988; a science advisor to heads of state from Brezhnev to Yeltsin, attended 3 Pugwash mtgs starting 1983, led Soviet Academy/NAS interactions on Russian side.



Roald Sagdeev 1932-

- Physicist, Director of Academy's Space Research Institute 1973-88; active in think tank on disarmament under Andropov, advisor to Gorbachev on space & weapon issues 1987-; 4 Pugwash mtgs starting in 1970.

29

Andrei Sakharov 1921-1989



- Physicist, ScD 1947, Academician 1953-.
- Work on Soviet A-bomb project under Tamm & Kurchatov 1948-49; key role in developing Soviet H-bomb & refinements 1950 onward.
- Warned Soviet leaders on fallout 1957-61; supported PTBT 1963.
- In *Reflection on Progress, Peaceful Coexistence, & Intellectual Freedom* (1968) declared ABM defenses a grave threat.
- Peace Nobel 1975; exiled to Gorky 1980-86 before release by Gorbachev.
- Attended Pugwash mtgs 1987 & (briefly) 1989.

After more than 40 years, we have had no third world war, and the balance of nuclear terror may have helped to prevent one. But I am not at all sure of this; back then...the question didn't even arise.

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Overlapping Participants & Roles of the First Three US Post-WWII Atomic Scientists' Organizations

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Federation of American Scientists Founded Oct 1945 by **E Rabinowitch**, **H Brown**, & Manhattan Project physicist **Philip Morrison**, with initial participation by **Szilard & Bethe**.

- Initial purpose was to lobby for civilian control of nuclear weapons; later for arms agreements, support of interactions with Soviet & Chinese scientists.

Bulletin of Atomic Scientists Founded Dec 1945 by **Rabinowitch** & Manhattan Project Physicist **Hyman Goldsmith** with involvement by **Szilard**, **Brown**, **Franck**.

- Initially envisioned as journal for advancing ideas of interest to FAS, aimed at scientific community; later aimed for wider focus, authorship, and audience.

Emergency Committee of Atomic Scientists Founded May 1946 by **Einstein & Szilard**. Initial members included **Bethe**, **Linus Pauling**, & **Victor Weisskopf**.

- Main purpose was to alert the public to nuclear-weapon dangers.

FAS & BAS still going strong today, retaining focus on nuclear-weapon issues but also covering wider ground. ECAS shut down in 1951, as FAS & BAS had taken more public role.

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The Pugwash Conferences Connected the First Generation of Scientist Nuclear-Risk Reducers to Subsequent Generations

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The first conference—Pugwash, Nova Scotia, July 1957

Following release of Russell-Einstein Manifesto in April 1955 and early failed attempts to find venue & funding for a conference...

- Canadian-American industrialist Cyrus Eaton offered his waterfront estate in Pugwash, Nova Scotia, as venue, with funding for hospitality & local travel.
- Russell, Rotblat, & Rabinowitch were co-organizers; illness prevented Russell's attending.
- Conference topic: "Appraisal of Dangers from Atomic Weapons".
- Ground rules: Invitation-only, no public & no press (other than post-meeting press conference releasing a consensus statement).
- Nominally, participants took part as individuals, but most reported to their gov'ts afterwards about the discussions.
- 22 official participants, 2 of whom brought assistants.



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Participants at the 1st Pugwash Conference

- Official participants came from USA (7), USSR (3), Japan (3), UK (2), Canada (2), & Australia, Austria, China, France, & Poland (1 each); the comprised 16 physicists (4 working in biophysics), 2 chemists, 2 physicians, 1 biologist, and 1 lawyer; all prominent, many of them advisors to their gov'ts.
- US participants included Rabinowitch, Szilard, Weisskopf, Doty, & Muller (mentioned earlier here), plus **D. Cavers** (Harvard) & **W. Selove** (Penn); Rabinowitch brought BAS Deputy Editor **Ruth Adams** as his assistant.
- Russian participants were **Alexander Topchiev** (Chief Scientific Secretary, Presidium, USSR Acad of Sciences), **Dmitri Skobeltsin** (Director, Lebedev Physical Institute of the Academy), **Alexandr Kuzin** (Head of Radiobiology, Inst of Bio-physics of the Academy). **Vladimir Pavlichenko** attended as Topchiev's ass't.
- Japanese participants were Hideki **Yukawa**, **S. Tomonaga**, & **I. Ogawa**
- Chinese participant was **Zhou Peiyan**, President, Peking U; member of Chinese Academy of Science; advisor to top Chinese gov't officials.

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Excerpts from the Pugwash consensus statement—11 July 1957

The main work of the meeting was centered around three principal topics: (1) the hazards arising from the use of atomic energy in peace and war; (2) problems of the control of nuclear weapons; (3) the social responsibility of scientists. ...

A general war with nuclear weapons would indeed represent a disaster of unprecedented magnitude. ... In the combatant countries, hundreds of millions of people would be killed outright ... additional hundreds of millions of people would die from delayed effects of radiation from local fallout...

[T]he greatest peril comes from the possibility that a war might break out between two smaller nations, that Russian and American might intervene militarily on opposite sides, and that such a war might be fought by using atomic bombs in combat. We believe that...what may start out as a local war may end as general atomic catastrophe. ...

War must finally be eliminated, not merely regulated by limiting the weapons which may be used. For this purpose, it is necessary to reduce tensions among the nations; to promote mutual understanding among the peoples; to strive for the ending of the arms race; and to provide an adequate control system...

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Subsequent evolution of the Pugwash Conferences

- Two further conferences were held in 1958, 2 in 1959, 1 or 2 per year from 1960 through 1964, and 1/yr thereafter down to the present.
- Participation was quickly broadened to include more social scientists, as well as politicians, senior military officers (both serving & retired), and women.
- Substantive focuses were broadened to include chemical & biological weapons, conventional forces, international cooperation in S&T, and tech for development.
- Narrower study groups, workshops, & symposia were added starting 1964.
- Meetings have remained invitation only and closed to public & press to this day.
- Pugwash discussions are widely credited with contributing to achievement of the PTBT (1963), the NPT (1968), the ABM Treaty (1972), the Biological Weapons Conv (1972), the INF Treaty (1986), & the Chemical Weapons Conv (1993).
- Behind the scenes, Pugwash also played roles in ending the Vietnam War and maintaining USSR-Israeli communications when there was no official channel.

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Some pillars of Pugwash 1958-95

In addition to people already mentioned, important contributors have included...

Georgy Arbatov 1923-2010 Russian political scientist, Founding Director of USA & Canada Institute of Soviet Academy 1965-95; 11 Pugwash mtgs from 1969

Martin Kaplan 1915-2004 US virologist based in Switzerland; long-time senior WHO official; 170 Pugwash mtgs starting 1958, Secretary General 1978-89

George Rathjens US chemist/political scientist; official at ACDA, ARPA, DoD, State; co-founder MIT Security Studies Progr; 71 Pugwash mtgs starting 1962, Secretary General 1997-2002

Francesco Calogero, Italian physicist, prof U of Rome; 200+ Pugwash mtgs starting 1965, Pugwash Secretary General 1989-97

Carlo Schaerf, Italian physicist, prof U of Rome 1973-; 15+ Pugwash mtgs starting 1968, co-founder/Chair f Italian Pugwash Committee, co-founded ISODARCO 1966

Shalhevet Freier 1920-94 Israeli, Physics MS, intelligence official, Israeli AEC head; 42 Pugwash mtgs from 1966, Pugwash Council, Israeli Pugwash Chair.

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Pugwash 1995-2025

1995 Nobel Peace Prize awarded jointly to Joseph Rotblat & Pugwash organization “for their efforts to diminish the part played by nuclear arms in international politics and, in the longer run, to eliminate such arms.”

Pictured: **Francesco Calogero**, Pugwash Secretary- General 1989-97, **Joseph Rotblat**, Sec-Gen'l 1957-73, Pres 1988-97



Post-1995, Pugwash maintained its focus on nuclear risks overall—notably erosion of arms control & risk reduction efforts generally--while increasing attention to regional issues...

- Iranian nuclear issue: Pugwash convened multiple Track II mtgs w Iranian and US experts & officials when official channels were blocked.
- India-Pakistan: Pugwash worked on crisis prevention, escalation control, & confidence-building after the 2 countries tested.
- Middle-East nuclear-free zone: Pursuing a long-standing proposal treating nuclear-weapon issues as inseparable from CBW & broader security arrangements.
- Non-state-actor WMD risks: Major focus on terrorist acquisition & use after 9/11.

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Some women of Pugwash



Dorothy Hodgkin, UK, 1910-1994. Chemistry Nobel 1964; longest-serving President of Pugwash 1976-88.



Ruth Adams, USA, 1923-2005. Attended 1st Conf + 33 more; BAS Editor; Co-founder of MacArthur Fdn Peace Program; an ISODARCO course director...

Karen Hallberg, Argentina, Prof of Physics, Bariloche Atomic Ctr; Pugwash Sec Gen'l 2025--



Ana Maria Cetto, Mexico, Prof of Physics, UNAM; former chair Pugwash Council; Chair, Pugwash Internat'l Advisory Board



Claudia Vaughn, USA-Italy, long-time director internat'l Pugwash office in Rome



Catherine M. Kelleher, USA, 1939-2023; prof Naval War College & U of Md; co-chair US Pugwash



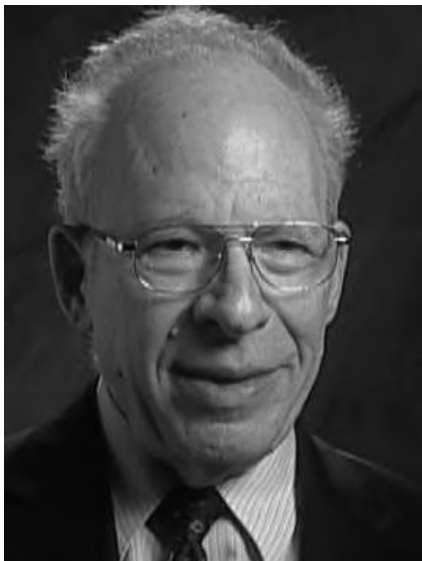
Sandra Ionno Butcher, UK-USA, leader in Student Pugwash & London Pugwash office

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Some Other Successors to the Founding Generation of Scientists Engaged in Nuclear Risk-Reduction

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Richard Garwin 1928-2025



- Physicist, PhD U of Chicago under Fermi. At age 25, turned Teller-Ulam concept into workable device-- 1st thermonuclear device ever exploded.
- Many other inventions for nat'l defense & Intelligence, industry, medicine. Received many honors for these contributions & for work to reduce nuclear risks (Medals of Freedom, Science...).
- A science advisor to Eisenhower, Kennedy, Nixon, Ford, & Carter, and to Clinton & Obama chief S&T advisors; many Pugwash mts from 1966.
- Initial & longest-serving member of NAS CISAC, crucial contributor to all its activities; major figure in JASON, FAS, UCS, CLW.
- One of the most effective opponents of ABM, SDI, & other technological defense follies.

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Spurgeon Keeny 1924-2012 Physics MA , grad work in Soviet studies; advisor on nuclear weapons to US presidents Eisenhower to Carter; senior staff member at *Arms Ctrl & Disarmament Agency* and *Nat'l Security Council*; founding Exec Director & later member, *NAS CISAC*; founding Editor, *Arms Control Today*; nonproliferation leader.



Ted Taylor 1925-2004 Cornell physics PhD; at Los Alamos 1949-56, designing the smallest & largest US fission weapons ever tested. After industry & gov't posts, became active in nonproliferation & danger of subnat'l nuclear weapons. Went public on the sub-nat'l dangers in McPhee's *Curve of Binding Energy* and, with Mason Willrich, *Nuclear Theft: Risks & Safeguards* (both 1974),



Jeremy Stone 1935-2017 Math PhD 1960, arms control work from 1963. CEO of FAS 1970-2000, re-invigorating it, developing arms-ctrl proposals, opposing ABM, advancing US-China & US-USSR science communication & cooperation. On Pres Nixon's "Enemies List"

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Henry Kendall 1926-1999 Physicist, MIT PhD 1955, Nobel 1960, MIT physics prof 1961-99. Co-founder *Union of Concerned Scientists* 1969 & long-time Chair of its board. Member JASON, Council for a Livable World; formidable opponent of ABM and proponent of nuclear-reactor safety.



Frank von Hippel 1937– Physicist, PhD Oxford 1962. Chairman of FAS in early 1970s; partnered w Velikhov in advising Gorbachev on steps on end the nuclear arms race. Mainstay of the long-standing Arm Ctrl group at Princeton U; founding co-editor of *Science and Global Security*.

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- An excellent cross-section of the international successors to the “founding generation” of scientists engaged in reducing nuclear-weapon risks are the speakers & moderators at this ISODARCO meeting.
- Many could be mentioned beyond that group, including speakers & moderators at previous ISODARCO meetings who weren't at this one.

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Scientists' Arms Control Organizations Founded After Pugwash

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The Doty Group

- Formed by **P Doty** in 1958 following 1st Pugwash conference as informal collection of US nuclear scientists willing to offer occasional advice to White House & State Dept and to meet privately from time to time w Soviet nuclear scientists on topics too sensitive for multilateral discussion in Pugwash confs.
- Members in addition to **Doty** included **Kistiakowsky, Panofsky, York, Jerome Wiesner, & Sid Drell**.
 - Wiesner (1915-1924), an electrical engineer, was the Science Advisor to JFK, later President of MIT and cofounder & leader of MacArthur Foundation Peace Program.
 - Drell (1926-2016) was a theoretical physicist at SLAC and prolific advisor on arms control to US gov't; founded Stanford's Center for Internat'l Security & Arms Control.
- Focuses included test-ban feasibility, ABM, arms control-verification.
- Mtgs w Russians in Geneva, Vienna, Moscow, & around edges of Pugwash mtgs included **Millionshchikov, Sakharov, Velikhov, Sagdeev...**

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Council for a Livable World

- Founded in 1962 by **Szilard**, aimed at generating arms-control action by educating Congress and generating public pressure.
- Advisors/board members in early years included **Bethe, Weisskopf, Kistiakowsky, Drell...**

ISODARCO

- Founded 1966 by **Amaldi** and **Schaerf** with the aim of gathering an internat'l mix of senior, less-senior but already distinguished, & younger scientists for intensive week-long discussions of arms-control challenges & options.

Union of Concerned Scientists (UCS)

- Founded 1971 by physicists **Henry Kendall** (MIT) & **Kurt Gottfried** (Cornell), with focus on technical analysis & public advocacy on ABM, nuclear-energy safety; later on wider aspects of science, technology, & public policy.

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NAS CISAC and Russian, Chinese, & Indian partners

- CISAC est. 1980 as standing committee of the NAS w **M Goldberger** as Chair & founding members including **Doty, Panofsky, Garwin, & Keeny**.
- Initial purpose was to establish a dialogue w Soviet Academy counterpart group to exchange views on arms-control challenges & opportunities, w leaders on each group reporting back to their gov'ts informally.
- Subsequent focus was serving more usual NAS function of conducting studies of arms-control questions at request of US gov't agencies.
- Soviet Academy counterpart group, chaired by Acad. **E. Velikhov**, included Academicians **Sagdeev, Goldansky, & N.N. Ponomarev Stepnoi**.
- Later members on US side have included former US weapon-lab directors, retired military leaders, & younger scientists (e.g., today, **S. Fetter & M. Bunn**)
- Later participants on Russian side have included Acad. **A. Arbatov**, Gen **Vladimir Dvorkin**, & former weapon-lab director **Evgeny Avrorin**.

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NAS CISAC & partners (continued)

- Corresponding bilateral interaction began 1988 w *Chinese Scientists Group on Arms Control* chaired by **Hu Side** of Chinese Acad of Engineering Physics (CAEP), w members incl **Tian Dongfeng** of CAEP & **Song Jiashu**, head of Chinese nuclear energy program.
- Bilateral interaction w Indian counterpart group est. 1999 under *Indian Nat'l Inst of Advanced Studies* (NIAS). Indian Chair was NIAS director **Roddam Narasimha** (renowned fluid dynamicist); members included **A.P.S. Abdul Kalam, R. Rajaraman, and S. Rajagopal**.
- CISAC studies for the US gov't have included:
 - *Crisis Management in the Nuclear Age* (1985); *Challenges for the 1990s for Arms Control and International Security* (1989); *The Future of the U.S.-Soviet Nuclear Relationship* (1991); *Management & Disposition of Excess Weapons Plutonium* (1994 & 1995); *The Future of US Nuclear Weapon Policy* (1997).

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NAS CISAC & partners (continued)

Some results of bilateral dialogues:

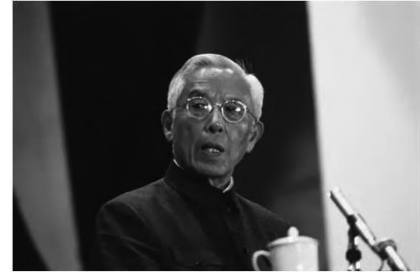
- Over the course of the separate dialogues with Russia, China, and India, virtually all of key nuclear-weapon issues were discussed, to mutual benefit, with interlocutors directly engaged in the relevant deliberations of their governments.
- Chinese participants, including the head of arms control for the PLA, were persuaded, in a key meeting with them on the draft CTBT, to drop long-standing Chinese objections draft; the two weeks later the Chinese government announced it would sign.
- With the Indian interlocutors, who included individuals high in their nuclear-weapon program, we had particularly useful discussions on such sensitive points as command and control of nuclear weapons and Permissive Action links.

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Serendipity in Scientists' Engagement on Reducing Nuclear–Weapon Risks

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- **Zhou Peiyuan**—physicist, Pres of Peking U, & and advisor to Deng Xiaoping--attended 1st, 2nd, 4th Pugwash confs in 1957-59. China dropped out in split w USSR in 1960.
- In 1984, FAS CEO **Stone** and I (then FAS Chair) met w Deng & Zhou in Beijing to discuss building stronger ties betw Chinese & Western scientists.
- We urged Zhou to come back to Pugwash; in 1985 he did.
- Chinese delegation to 1986 Pugwash conf in Budapest included **Hu Side**, then head of Chinese nuclear test site, later head of CAEP. He was struck by benefits of nuclear-scientist engagement in discussions of arms control.
- On return to China, Hu organized 1st-ever discussion group of Chinese nuclear scientists on internat'l security & arms control.
- In 1988, that group became began the long-running partner of NAS CISAC in US-China scientist-led discussions of arms control.



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Serendipity (continued)

- I met **Velikhov** in fusion-energy exchange 1971; collaborated w him on fission- & fusion-reactor safety through 1970s; engaged w him when I led NAS CISAC and he led Russian Academy counterpart in 1990s; in 1996 Pres Yeltsin appointed Velikhov--and Pres Clinton appointed me--to co-chair bilateral Presidential Commission to reconcile US & Russian views on managing surplus weapon plutonium.
- In 2002, **Wan Gang** & I formed collaboration betw Harvard U & Tongji U for collaboration on clean & efficient passenger vehicles; worked closely together for next 6 years. By the time I became Pres Obama's Science Advisor in 2009, Wan Gang had become China Minister of S&T; we had joint responsibility for US-China S&T cooperation overall; used it to advance US-China relations & reduce tensions.
- When US Sec of Energy **Ernest Moniz** (former MIT physics chair & energy lead) was made US technical lead on Iran nuclear negotiations, his Iranian counterpart was **Ali Akbar Salehi** (MIT nuclear-engineering PhD). Their mutual respect and trust from MIT backgrounds overcame tech challenges en route to Nuclear Deal (JCPOA)

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The Path Forward for Scientists' Engagement on Nuclear Risk Reduction

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In scientists' efforts to reduce nuclear risks, we need...

- More engagement by natural & social scientists with nuclear risk-reduction—in governments, academia, firms, & NGOs, and with the public, including...
 - particular emphasis on more senior scientists (e.g., more Nobel laureates) and more younger scientists;
 - more engagement of natural & social scientists with each other--and senior & younger scientists with each other-- and
 - more bilateral & multilateral international interactions among these scientists.
- More coordination across NGOs domestically (e.g., FAS, BAS, UCS, CLW, ACA, academic groups) and internationally (e.g., Pugwash, national-academy groups, other NGOs)
- More communication among governments—between nuclear-weapon states and between weapon & non-weapon states (formal & informal—Tracks I & 1.5)—with ample scientist participation.
- MORE URGENCY for all of it, in recognition of the magnitude of the peril!

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THANK YOU!