Reflections on scientists and disarmament

Science and technology constantly break through the limits of what is possible, even what we can imagine. These developments entail complex ethical, moral and humanitarian implications that challenge all concerned humans—but perhaps most of all the scientists who actually push forward new discoveries. Joseph Rotblat, recipient of the 1995 Nobel Peace Prize and one of the founders of the Pugwash Conferences on Science and World Affairs, clearly articulated this concern. 'Whether directly through the development of new military capabilities, or indirectly through the uneven distribution of the benefits of new technologies, the future of civilization and the very existence of the human species is imperilled. Scientists bear much responsibility for this danger and must take steps toward its removal.'[1] We have asked three contributors, Serge Franchoo, Arjun Makhijani and Arthur Petersen, to address the subject of involving scientists—a potential and often overlooked audience—in disarmament education and ethics. – *The Editor*

Engaging natural scientists in disarmament

There are three significant structural and institutional reasons why natural scientists often remain outside of the arms control debate: the focused nature of science education; the importance of scientific objectivity; and scientists' relation with society.

Lack of interdisciplinary study

Science education is highly specialized, unlike other disciplines where an interdisciplinary or 'liberal arts' education is valued as a way to develop well-rounded intellectuals. Interdisciplinary study in the natural sciences is limited to related sciences (for example, a physicist might study mathematics and chemistry, but not sociology). Doctorates are based upon the thorough investigation of one specific detail of a scientific theory or experiment. Science students have little time or opportunity to explore courses other than those directly related to their research. This intense concentration does not end once the science student becomes a professional researcher—often he or she is forced to specialize even further.

For most natural scientists, their day-to-day research on the one hand and disarmament and non-proliferation issues on the other seem worlds apart. Why, for example, would a natural scientist study disarmament treaties? It would seem that the topic would be much more relevant to, for

instance, lawyers or political scientists. At first glance, fundamental research into the laws of nature has little in common with geopolitics or security analyses. The forefront of natural science often finds its motives in itself, without too much concern regarding practical applications. Those applications surely will come later, but other people—not the researchers having unveiled the physical principles or pushed forward new discoveries—will implement them. This compartmentalization of the scientific process with strictly delimited tasks for the actors involved is intrinsically linked to the high degree of specialization necessary in many aspects of a high-tech society.

The belief in independent, objective science

In addition to the structural constraints of science education, there are often institutional hindrances to scientists wanting to get involved in politically charged subjects. By this we mean the relative scarcity of 'intellectual spaces' where scholars and natural scientists can dialogue about their common concern for public problems. Science is meant to be objective and factual. Many universities and laboratories are wary of taking political positions and therefore do not encourage public debate on politicized issues such as disarmament.

Even if one argues that every issue has its political dimension, the conviction that research should be guided by its own thrust, independent from and indifferent to the outside political and social world, is deeply rooted. At variance with the all-embracing worldviews typical of Greek and mediaeval philosophers, this conviction is probably linked to the principles of modern scientific method established during the Enlightenment. Determinism perceived in the physical laws excluded temporary human interference in the evolution of society, whilst encyclopedism strove to gather the full spectrum of opinions, from which authoritative objectivity was to be extracted. Today scientific objectivity, beyond doubt, remains a goal, but scientists should perhaps reconsider the innate idealism of this attitude.

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The perceived absence of political consciousness (by remaining objective) amongst scientists creates a vacuum that others might happily take advantage of. By means of illustration, consider the ongoing debate on depleted uranium (DU). For the public at large, DU is a mysterious substance and only gradually has a correct definition seeped through the media. Although the DU debate also circulated amongst scientists, hardly any institute or laboratory 'weighed in' on the subject. Nuclear laboratories raise the objection that while they can calculate the radiological properties of a material, it is beyond their competence to evaluate its toxicity, its effect on living organisms or the risks posed by its use on the battlefield, and therefore remain mute.

Ultimately political institutions like the United Nations[2] and military organizations such as NATO[3] appointed their own specialists to investigate the matter. Whereas the conclusions of these studies have proven to be essentially convergent, the impartiality of those undertaking the research has been questioned. In such cases, the public often rates the credibility of the research results at the value it attaches to the body that ordered the study. It is difficult to say whether the impartiality of research would be as questioned had an independent panel of scientific experts carried out the work. Of course, a purely scientific committee probably would not be perceived as 100% objective either, as long as one could not guarantee that its members had nothing to gain or lose in its findings.

In a way it is understandable that research institutes take extreme care not to mix in political life. Throughout history, the first application of a scientific discovery often has been a military one, driven to an apogee fifty years ago with the Manhattan Project and the subsequent development of the

thermonuclear bomb. Out of fear that Nazi Germany was working on a nuclear weapon, Albert Einstein wrote a letter to President Roosevelt in 1939 to urge him to accelerate similar research by the United States. The resulting somewhat negative reputation of nuclear physics being pro-armament has perhaps led to science as an institution receding to what its critics call an 'ivory tower' and avoiding politics. With a remarkable obstinacy it firmly adheres to its insular position and distances itself from parliamentary quarrels and military mayhem.

Yet this is not necessary an accurate perception. It should not be forgotten that after the war, the Russell-Einstein Manifesto of 1955 was an appeal by some of the world's premiere scientific minds against any further use of these weapons. In 1960, Max Born (Nobel Prize winner in physics in 1954) wrote 'We physicists are, moreover, very willing to place our experience at the disposal of politics. For we are aware of the fact that the political crisis was brought about by our research, and we feel greatly responsible.'[4] This contrast between the role of scientists in armament through weapons development and in disarmament serves as a poignant example how science can dominate public life when scientists decide to take a stand.

The relationship with society

The belief that funding for fundamental scientific research can be secured by not rebuffing any governmental authority may turn out to be flawed. At some point science needs to justify how it spends the money it receives from funding agencies. Since in many countries this predominantly concerns tax money, science should be accountable to the public. This is a critical issue, as professional researchers often cite the ignorance of the public whenever they feel misunderstood. Public outreach by universities and laboratories as well as continuous education are the proper remedies. Public ignorance should not be a pretext to lock oneself up in a laboratory and shirk one's responsibilities towards society, as epitomized in the stereotype of the inaccessible scientist lost in his experiments.

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In an age where science and technology have a major impact on everyday life, the decoupling of science from society is an unfortunate evolution. Although governments today are far from technocracies, it is worrisome that less privileged parts of society experience difficulties in gaining access to new technologies. Apart from financial considerations, the increased complexity of equipment, computers and techniques can be off-putting. It is understandable that a general public lacking a basis of scientific knowledge feels confused by the conflicting messages about science proffered by industry, politicians, scientists and advocacy groups. In a sense there is a reciprocal lack of education—for the public to keep up with scientific and technological developments, and for scientists to nurture the necessary skills to render their research accessible to non-scientists in a concise and digestible way.

In this area, the situation is improving. Several research establishments have realized the need for communication about scientific discovery and developments and have public outreach/communications offices at their disposal. However, in the end it is only a half-measure—scientists must learn to communicate directly with the public.

Currently, much of this communication is accomplished through scientific journalism, which introduces scientific discoveries and progress to the general public. While helpful, scientists must learn to 'cut out the middle man' and do their own communication. There are two crucial elements for this to happen. First, there must be a shift in the scientific mentality. Scientists must understand that communication with the non-scientific public is essential. Second, scientists must have the opportunity to develop the necessary oral and written communication skills to achieve this goal.

To take one example, CERN, the European Organization for Nuclear Research,[5] has been extremely proactive in its approach to education and communication. Guided visits to the laboratory, travelling expositions, public lectures, webcasts, school visits and so on are elements of CERN's efforts to demystify their work, as well as offer an introduction to particle physics to the general public.

A unique element of CERN visits is that many of the guides are volunteers from among the scientists or students working at the lab. This offers an excellent opportunity for researchers to interface with the public and to communicate about their work. Perhaps such a programme could be even further improved by offering the researchers some sort of training for oral presentations, which in conjunction with writing resources, might augment their communication skills. Similar sorts of initiatives could be encouraged during science studies. While pursuing a doctorate, students might be urged to develop speaking and writing skills, perhaps through working at a science museum or visiting schools.

Scientists concerned with disarmament

Despite the constraints outlined here, a number of organizations seek to engage natural scientists with a concern for disarmament and arms control.[6]

The Union of Concerned Scientists (UCS)[7] originated at the Massachusetts Institute of Technology in 1969. Advocating a stronger focus in scientific research on environmental and social problems, its founders understood the need to combine expert analysis with citizen advocacy. Nowadays about 50,000 members strong, the technical reports issued by the UCS are transmitted to policy-makers and the media through the Sound Science Initiative. The UCS Action Network encourages public debate.

The Federation of American Scientists (FAS)[8] dates back to 1945 and can boast of a Board of Sponsors that includes fifty-one American Nobel laureates. Originally focused solely on arms control and nuclear disarmament, it currently engages in various areas of public policy, ranging from population, energy, medical care and ethnic conflict to global and national security, still with a predilection for intelligence gathering, arms sales, space policy and emerging technologies. While the FAS engages in a fair amount of lobbying, its work is complemented by public education campaigns.

The *Bulletin of Atomic Scientists*, published by the Educational Foundation for Nuclear Science,[9] offers a forum for concerned scientists to enter into debate with the public. It is famous for its Doomsday Clock on the front cover, the hands of which move closer or further from midnight in reaction to international tensions and nuclear developments. Its hands moved most recently in 1998 from fourteen to midnight to nine to midnight, following the nuclear tests in India and Pakistan and the failure to realize cuts in nuclear weapon arsenals.

In Europe we single out Scientists for Global Responsibility (SGR).[10] The successor of Scientists Against Nuclear Arms, Electronics and Computing for Peace, and Psychologists for Peace, SGR campaigns for the elimination of nuclear weapons and, more generally, for an ethical attitude towards the use of science and its impact on human life and the environment. It reaches its target public through conferences and briefing papers.

Together with several other organizations and individuals, SGR is part of the German-based International Network of Engineers and Scientists for Global Responsibility (INES).[11] Active worldwide, INES focuses on sustainability, although one of its prominent member organizations, the International Network of Engineers and Scientists Against Proliferation (INESAP),[12] is dedicated to non-proliferation issues, technology transfer concerns and the promotion of nuclear-weapon-free zones. One should add that INESAP leans towards a professional research institute rather than a membership organization.

The Italian Union of Scientists for Disarmament (USPID)[13] promotes the belief that scientists have a social responsibility to provide information and analysis on aspects of arms control and development. USPID organizes conferences, courses and seminars, the proceedings of which are communicated to national politicians and opinion makers. It has linked up with the Landau Network-Centro Volta[14] for several of its research programmes on international security, energy resources and biotechnology. Jointly with the regional office of UNESCO in Venice, the Landau Network-Centro Volta is in charge of organizing the International School on Science for Peace.

An international event of particular interest is the International Conference on Public Communication of Science & Technology (PCST)[15] initiated in 1998 by the Laboratory for Research on Communication and Scientific and Technical Information (LABCIS)[16] at the University of Poitiers in France. The next meeting will be held in South Africa in 2002. Addressing many of the issues concerning the relationship between science and the public raised in this article, it tries to create a bridge between researchers and communications professionals.

International Physicians for the Prevention of Nuclear War (IPPNW)[17] is a federation of physicians across the globe founded by a group of American and Soviet medical doctors in 1980. With national branches in over sixty countries, IPPNW tries to convince fellow physicians, political leaders and the public of the urgent need to raise consciousness through education and take concrete action through grassroots initiatives. Its focus has widened from nuclear war to the prevention of all war, landmine and small arms issues as well as the remission of world debt.

The Pugwash Conferences on Science and World Affairs[18] are held annually with intermittent workshops on specific topics. Since the Russell-Einstein Manifesto of 1955 and the subsequent first meeting in the village of Pugwash in Nova Scotia in 1957, Pugwash has diversified its activities from nuclear disarmament to the elimination of chemical and biological weapons, the origin of war, questions of national sovereignty, international security, and the ethical responsibility of scientists. A particular feature is that all participants attend the meetings in their personal capacity and not as representatives of any government or organization. Whereas at first the participants were selected from among prominent scientists, gradually diplomats and public figures were invited, such that at present about 2,000 people are involved. The principle of invitation, however, has not been abandoned.

The rather closed nature of Pugwash has guaranteed the high quality of its meetings and efficient lobbying of government officials. On the other hand, it has held up the influx of younger generations. The creation in 1978 of International Young/Student Pugwash (IYSP),[19] which adheres to the same objectives as Pugwash but has remained organizationally independent, intends to address this concern. Student conferences are organized every year.

It is interesting to note that many of these organizations have widened their field of interest from the elimination of weapons of mass destruction to more general commitments on ethical considerations and sustainable development. One interpretation of this shift in focus might be that disarmament as a public concern no longer seems as immediately important as it did during the Cold War. With the loss of public interest in (mainly nuclear) disarmament, these organizations have been forced to widen their focus. An alternative interpretation might see this movement as reflecting the more recent awareness of the interrelation of the threats facing our world. Research on violent conflict cannot be divorced from development theory, which cannot be separated from environmental concerns, and so on. There seems to be growing acceptance that these problems can no longer be broken down into neatly compartmentalized elements.

Options for change

Political parties worry about maintaining and increasing links with their electorate, yet laboratories for the most part appear to be disinterested in public relations. It is therefore not surprising that in the absence of political action from their institutions, the political involvement of natural scientists has often been expressed through NGOs and advocacy institutions.

Unfortunately, awareness-building activities and activism at scientific research sites are on the whole not encouraged and NGOs rarely permitted to flourish. It often requires a great deal of personal motivation from the scientist to find his or her way towards the relevant advocacy organizations. Perhaps universities or laboratories could be persuaded to play a part by supporting an appropriate forum or an interface within their formal structures for NGOs. Some kind of liaison office could facilitate communication and explore further paths without committing the research institute itself to a political position.

Another option is the possibility for scientists to form a think-tank or scientific panel within the institution. Scientists are frequently invited by governments, international task forces or other civilian or military bodies to participate on expert commissions. The scientists approached may have to seek the permission of their employer, but usually accept on a purely personal basis. One might wonder if research centres would be willing to officially collaborate with national or international political bodies by providing well-grounded consultants from an internal pool that is accredited according to a certain set of principles. Those principles could refer to the scientific merits of the researcher, for which the laboratory is suitably placed to judge. If a provision is added that the institute does not necessarily subscribe to the views of the appointed expert, political escalations will be avoided, while at the same time an institutional channel is created for scientists to engage in society.

In the face of the persistent refusal of research establishments to adopt any position that may lean towards politics, these ideas might prove hard to realize. Outside control on the development of science has always been felt as a threat to academic freedom. Although public pressure on the accountability of science should not wane, a change of perception as to its role in society will probably have to arise from inside the laboratories.

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Training scientists in science and in assessing its impacts

Organized science usually legitimizes its claims upon the public purse by making assertions about its activities to the general good, or at least to the good of some particular group. This is a common thread in a large variety of scientific projects, from the building of nuclear weapons, to genetic engineering of plants, to research on new cures for cancer or AIDS. Yet, scientists rarely base their claims on an actual investigation of the likely impacts of their work. All too often, there is little or no factual or analytical basis for their claims. Further, rarely if ever do such claims put forth the potential negative impacts of the proposed work, especially if those impacts may jeopardize the funding of the work.

Moreover, there is little or nothing in the training of scientists that would prepare them to do the requisite analysis to make better-justified claims. Scientists are not required to understand the impact of their work on society; nor do they learn the methods by which they might make such inquiries for themselves. There is almost never any inquiry into or training for understanding conflict of interest issues.

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Interestingly, the idea that science is objective, neutral, and therefore indifferent as to its beneficial or harmful applications, co-exists with the frequent assertion of social relevance of scientific research. The latter generally occurs in the context of appeals for money. The appeal to objectivity is in the everyday pursuit of work, where it helps to prevent questioning. The neutrality of science is also frequently proclaimed when the negative social results are obvious and cannot be denied. By contrast, I know of no instance when neutrality has been claimed when the beneficial aspects of research have become evident.

Given that scientific research not only has beneficial impacts, but also often has negative effects, science education should be structured so as to give analytical and factual foundation to the claims those scientists make about the impact of their work on society. If there is rigor in the pursuit of scientific work, there should also be rigor in the claims that are made for its impacts.

Were science education focused on the private pursuit of knowledge for its own sake without any demands upon the public purse and without significant impacts upon health, well-being, and the environment, there might be a case for focusing science education on technical matters alone. But the pursuit of pure knowledge uncomplicated by social impact is not typical of scientific work. On the contrary, it is the norm that institutional science has major impacts on society and ecology. It follows, therefore, that the current model of science education that focuses mainly on technical issues is fundamentally incomplete and not suited to the real world.

The minimum requirements of science education, in addition to technical competence, should therefore include:

- Case studies of claims made by scientists of beneficial impacts say for reducing poverty, and the actual results, in all their complexity.
- Ethical studies of conflict of interest including investigations of whether sources of funding tend, on average, to affect the tone and sometimes the outcome of research.
- The extent to which scientifically questionable practices, ranging from shading of interpretation to outright fraud and data fabrication, occur in science.
- The manner in which the selection of topics for study and research is affected by the availability of funds and possible conflicts of such selection for problems that do not get addressed. For instance, after more than half a century, research on the synergistic effects between chemicals and radiation has received scant attention.
- Processes by which scientists as individuals and as members of institutions must be accountable to society.
- Processes in which scientific research and study can become accountable to future generations, which by definition cannot be consulted but nonetheless are likely to experience major adverse impacts of many scientific decisions made today.
- The study of environmental impacts and of assessing alternative ways of solving problems.

One way in which these lines of inquiry could be pursued is for academic research to be subjected to review not only by other technical specialists in the field, but also by the people about whom implicit and explicit claims of beneficial effects are being made. This should become a regular part of the training of scientists so that they become used to operating within an accountable, democratic framework as an essential complement to the narrower world of peer review.

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Ethics, science and society

The public involvement of scientists in societal issues was a central concern in the recent conference 'Challenges for Humanity in the XXI Century' (Geneva, 30 March–1 April 2001) organized by Swiss Student Pugwash. This issue was extensively discussed in the working group on Ethics, Science and Society. It was concluded that many scientists are trained to be narrow-minded in the sense that they are discouraged to take part in ethical discussions and accept social responsibility for their work. The main mechanisms sustaining this situation are early specialization and the lack of sufficient overlap and interaction between disciplines.

Several strategies were discussed that could encourage more 'broad-minded' participation of scientific minds in society:

- involving scientists in two-way (!) communication with the public;
- integrating indigenous and 'alternative' knowledge within science; and
- developing the scientists' ethical consciousness.

The working group focused in some detail on the third strategy. Two proposals were evaluated: compulsory or elective courses on ethics, science and society, and a Hippocratic-type oath for scientists. The courses should not be traditional ethics courses. A considerable amount of time should be spent on general philosophy and social science, preferably together with science students from other disciplines. The real and large-scale problems science and society face today, disarmament and arms control included, should be reflected in the subjects covered by the courses.

In our discussion about an oath for scientists, we used the pledge published in 1995 by Student Pugwash USA (Spusa) as a reference: 'I promise to work for a better world, where science and technology are used in socially responsible ways. I will not use my education for any purpose intended to harm human beings or the environment. Throughout my career I will consider the ethical implications of my work before I take action. While the demands placed upon me may be great, I recognize that individual responsibility is the first step on the path to peace.' The Spusa pledge received wide support among the working group. However, since some members raised specific objections to the text, we embarked on an exercise to come up with alternative wordings on which we all could agree. The new text is not intended to replace the old one, which some working group members may have found more appealing, but can be offered as an alternative in case someone is sympathetic to the idea of a pledge, but has problems with the specific 1995 formulation.

The Geneva 2001 version of the Spusa pledge reads: 'I promise to work for a better world, where science and technology are used in socially responsible ways. Throughout my career I will

consider the ethical implications of my work, and the potential harmful consequences. While the demands placed upon me may be great, I recognize that individual responsibility to humanity is the first step on the path to peace.'

The working group on Ethics, Science and Society is aware that the problems of science and society cannot be solved by the introduction of a pledge. Important topics, such as new institutions and a moral constitution addressing the way society should deal with science and technology, were discussed as well. We recognized, however, that individuals can make a difference and that a pledge can help to shape their sense of responsibility.

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Notes

1 Joseph Rotblat, 'Taking Responsibility, *Science*', vol. 289, 4 August 2000, p. 729.
2 United Nations Environmental Programme, Balkans Task Force, <http://balkans.unep.ch/du/du.html>
3 <http://www.nato.int/du/home.htm>
4 *Bulletin of the Atomic Scientists*, vol. XVI, no. 6, June 1960.
5 <http://public.web.cern.ch/Public>
6 The situation up to the 1980s is covered in a review by Joseph Rotblat, *Scientists, the Arms Race and Disarmament*, A UNESCO/Pugwash Symposium, London/Paris, 1982.
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