THE ROYAL SOCIETY

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The individual and collective roles scientists can play in strengthening international treaties

This paper has been produced for the United Nations Foundation, Nuclear Threat Initiative (NTI) and National Academies peer review round table on biological threats to security, held in Washington DC, on 19 April 2004 (see www.un-globalsecurity.org for more details), and represents the views of the Royal Society, the UK national academy of science.

1 Summary of key points

- It is essential to support international agreements, such as the Biological Weapons Convention, through the formation of international scientific advisory panels to keep up with the rapid pace of technological advance in the relevant sciences.
- The research community must exercise judgement in the publication of their work and raise awareness of the ethical and legal requirements related to their research.
- There should be a clear objective of moving towards an international consensus on adopting appropriate codes of good practice, particularly in relation to their role in combating the diversion of science advances into activities that pose a threat to global security and peace.
- The existing legal constraints relating specifically to biological weapons development both nationally and internationally should be examined and consideration given to what needs to be done to strengthen such laws and how they can be built in to an enforceable code of practice.

2 Introduction

A major challenge facing societies today is the threat to global peace and security, which can be perpetrated by special interest groups or by nations acting illegally. Of particular concern is the potential use of sophisticated weapons based on cutting edge science in the fields of nuclear, chemical and biological technology. This discussion paper outlines the individual and collective roles scientists can play in strengthening international treaties aimed at preventing the proliferation and use of chemical, biological, radiological or nuclear weapons. There is a range of issues to be addressed, from the potential for science to be misused to its role in risk reduction and mitigation. There is a need for the scientific community, governments and relevant agencies to be fully aware of the potential of scientific advances both in enabling the illegal development of more lethal weapons and in developing more effective counter measures to the use of such weapons. Measures are needed to ensure that governments and relevant agencies have access to informed scientific advice. In addition, scientists need to be informed about the potential misuse of science and their responsibilities in meeting the requirements of international treaties and conventions aimed at preventing the proliferation and use of chemical, biological, radiological or nuclear weapons. The need to underpin the Biological Weapons Convention (BWC) is emphasised, because of the use in biomedical science of potentially harmful pathogens and toxins and the risks of this research being misused in bioterrorist attacks.

3 Scientific underpinning of international treaties and conventions

3.1 The role of advisory panels

In countries with a developed technological infrastructure basic science research is largely publicly funded through government agencies. In addition, major areas of technology development perceived to be in the national interest in both defence and civil sectors often receive substantial public funds. Thus governments have direct routes to the research community and often use this as a means of accessing science advice

including via science advice panels. Even so, such means can be ad hoc with important sources of expertise being overlooked. On an international scale the situation can be even patchier, although there are examples of successful advisory bodies such as the International Panel on Climate Change, the European Pharmacopoeia Commission and various science advisory groups supporting the World Health Organisation.

Threats posed by the proliferation and use of chemical, biological, radiological or nuclear weapons can at the most sophisticated level involve cutting edge science and technology. International treaties and conventions aimed at combating such threats must therefore incorporate as far as reasonably practical sound scientific principles. Access to the best science advice is essential and an important framework for achieving this can be an international science advisory panel with access through the membership to nationally based science expertise. Again there are examples where international agreements are backed by access to cutting edge science such as the Organisation for the Prohibition of Chemical Weapons (OPCW), which informs the Chemical Weapons Convention (CWC), and the International Atomic Energy Agency (IAEA), which sponsors R&D to underpin decisions taken with the Nuclear Non-Proliferation Treaty (NPT).

The BWC has encountered significant problems in its effective implementation because of a lack of agreement on verification procedures to ensure that the Parties comply with the rules set out in the Convention. A particular issue is that laboratories and installations connected to the BWC are more diffuse and harder to monitor than those connected with for example nuclear materials. There is also the consideration that many agents may have 'dual use' application, ie some research unconnected with biological and toxin weapons may also have a military value. Similar 'dual use' issues might arise in the chemical and nuclear industries.

Meeting these challenges and developing measures to counter the use of biological weapons by terrorist groups and rogue states requires access to scientific knowledge at the forefront of biotechnology. However, currently there is no equivalent international organisation, such as the IAEA or the OPWC, supporting the BWC to ensure access to leading edge science. We believe that such support is essential and the framework for providing this is through the formation of an international advisory panel that is able to keep up with the rapid pace of technological advance in the life sciences.

3.2 Key features of successful international science advisory panels

Such groups have in common highly respected memberships working under the authority of bodies set up with international political agreement. They also work to a clear set of objectives that are widely accepted as beneficial to human welfare. The key requirements can be summarised as follows.

Expertise: The membership must have international status and represent a broad perspective on the science relevant to the area under consideration. Rotation of membership is beneficial, particularly in maintaining knowledge of scientific advances in the States Parties.

Independence: Transparency on potential 'conflicts of interest', for example from industrial affiliations, is essential.

Personal Attributes: The group requires commitment, vision, and a strong motivation to engage in debate to arrive at a collective view.

Strong Leadership: The chair of the group should have a clear understanding of both the intellectual and political issues, as well as an ability to motivate the group and to optimise its effectiveness.

Mandate: A clear mission and terms of reference defining scope, aims and accountabilities are required.

Size: A balance must be made between keeping the group to a manageable size and having a sufficiently broad representation to have international influence with Governments.

4 Compliance with legal and treaty requirements

4.1 Scientists' responsibilities

The scientific community must be aware of their responsibilities to work within ethical boundaries and comply with the requirements of both national legislation and international treaties and conventions. While this responsibility is clear in excluding the illegal development of weapons systems it is less clear in areas where there is the potential for dual use of scientific advances such as in biotechnology. The scientific community both at the individual and institutional levels must understand the requirements of national and international laws as they apply to their work. This is well established, at least in the technologically developed countries in the case of health and safety, with robust assurance and auditing functions in place even in small R&D laboratories. However there is often less of an awareness among the research community of the requirements of international treaties and conventions such as the BWC.

As a further measure to reduce the risk of illegal activities and key data and material getting into the wrong hands there is a need for a more systematic approach through education and communication to ensuring the scientific community is properly informed. In Summer / Autumn 2004, the Royal Society will jointly hold a meeting with the Wellcome Trust to identify measures that would help the wider life science community address concerns over biosecurity and bioterrorism, and contribute to the 2005 BWC Annual Meeting, which the UK Government is chairing.

4.2 Institutional constraints

The enormous expansion in the life sciences coupled to the concerns about the potential for developing biological weapons capable of causing major societal damage and chaos has stimulated discussions on the need for more rigorous regulation to filter out research that could lead to such weapons.

The key questions relating to institutional constraints are as follows.

- Should publicly and industrially sponsored research proposals be subject to an additional layer of vetting (in addition to the traditional evaluation of excellence and timeliness) with the objective of preventing potentially harmful research being carried out?
- Should papers submitted for publication, particularly in the life sciences be subject to a further layer of vetting to prevent diversion of the information into harmful applications?

Such filtering is clearly appropriate in the case of research proposals and papers where there is a tangible cause for concern in terms of harmful applications. However this is probably best achieved on a case by case basis by the relevant sponsors and journal editors. Going beyond this, for example in applying a vetting process across the spectrum of basic research proposals, even where there may be some, although unidentified, dual use potential, would be difficult and impose a burdensome layer of bureaucracy on the research enterprise. For example, how would such a process have applied to the fundamental nuclear physics research proposals in the 1920's and 30's that provided the foundations for the development of nuclear weapons? Equally difficult is the filtering of basic research papers on grounds of a potential threat to security. This was highlighted by the Statement on Scientific Publication and Security published by editors of a number of editors of leading scientific journals in Science, Nature and the Proceedings of the National Academy of Sciences. They advocate increased vigilance in identifying papers where the potential harm of publication outweighs the potential societal benefits but they do not identify hard and fast rules for doing this. The choice of actions will depend on the judgement of the editors and their referees. Nevertheless the research community must exercise judgement in the publication of their work and this emphasises the need to raise the awareness of the science community of ethical and legal requirements related to their work.

5 Codes of conduct

This is a contentious issue that is receiving increasing attention, stimulated by the potential for dual use, particularly in the life sciences. As with institutional constraints there is the danger of a substantial and

complex bureaucratic process being imposed on science that would be extremely difficult to manage and would have limited value in reducing the risk of science being misused.

5.1 General considerations

A clear and agreed understanding is needed of what is meant by codes whether of ethics, conduct or practice. A code in engineering means a rigorous set of rules governing such things as design, construction and operating practice that must be complied with. Failure to do so can result in legal action against the relevant bodies, ie design authority, constructor or operator, particularly if safety has been breached or there is a major loss of investment. Thus an essential question for codes governing scientific practice is that of enforcement.

Researchers in the UK and elsewhere must comply with safety rules and ethical standards as specified by ethics committees relating for example to experiments involving humans and animals. Rules also apply to issues of integrity as in the honest recording of results, plagiarism and declaration of relevant interests in published papers. Breaching the rules is subject to sanction and there have been some high profile cases particularly in the misrepresentation of results and failure to meet ethical standards in published papers. However, the means of detecting such breaches have been rather ad hoc and this highlights the difficulty of having a rigorous process of vetting and enforcement. Nevertheless there is a case for examining the need for having more rigorous codes applied to scientific practice and its role in potentially reducing the risk of misuse for illegal weapons development.

More specifically, the essential elements of good practice can be defined and incorporated into more rigorous codes governing the execution and reporting of scientific research. Such codes while containing many common elements will also have elements appropriate to the field in question eg bioscience, chemistry and nuclear physics. The common elements could encompass meeting general safety and ethical standards such as potential conflicts of interests, plagiarism and misrepresenting or exercising bias in recording and publishing data, as well as practical requirements such as the keeping of comprehensive and auditable laboratory records. Specific elements may cover specific aspects of safety and security such as the handling of potentially dangerous materials. Good practice should also include the responsibility of scientists to be aware of and comply with the requirements of international conventions and treaties in their research area. This needs educational and research institutions to put in place the appropriate measures to enable this requirement to be met.

Going beyond this to define and apply enforceable codes governing wider ethical and moral aspects related to good conduct would be extremely difficult. Nevertheless, there would be merit in giving careful consideration to identifying guiding principles that should be used by researchers in the conduct of their research. These would cover areas relating to personal integrity beyond those referred to above, in meeting their responsibilities to society, for example in carefully identifying and communicating the balance of risks associated with research outputs. Clearly this should include the potential misuse of their results for illegal weapons development, in so far as such potential is discernible when the research is done.

5.2 Application of codes and guiding principles

Careful consideration needs to be given to whether a code of good practice will be effective. This includes questions such as how the code and good practice procedures will be enforced, who will be responsible for checking a researcher's work, what penalties would occur if a researcher contravened the code, whether 'whistleblowing' would be encouraged, and what mechanisms would be in place to protect the whistleblower. There are a number of examples of codes of conduct in fields of science that could be used as a model, perhaps the best known in the UK being the General Medical Council's code of ethics for doctors. Many professional organisations have required members to subscribe to a code of conduct for a

number of years (eg UK Institute of Electrical Engineers since 1972, the American Society of Microbiology since 1988, American Chemical Society since 1965), which includes consideration of the member's role in serving society's interest. Guidance on professional practice is also commonly available, for example for microbiologists to keep written records of all requests for reagents, technologies and knowledge, and to monitor such requests and derive a risk assessment before deciding whether or not to fulfil a request. This raises the question of checking how such procedures would be upheld: a practical answer is for individual research institutes to be responsible for application of the rules in the execution of research. Only when the work is exposed to the external world through publication and/or application is there a need for a wider examination of any breaches of codes of practice.

5.3 Codes and international agreements

There should be a clear objective of moving towards an international consensus on adopting appropriate codes of good practice, particularly in relation to their role in combating the diversion of science advances into activities that pose a threat to global security and peace. This is a formidable task but one way forward would be for international agreements aimed at preventing illegal weapons development and application to be underpinned through the incorporation of such codes with each government acting as guarantor. Given its present state of development there is an opportunity to take this forward in the BWC alongside the proposal to set up an international advisory panel. It would require the States Parties to work towards defining an agreed code and to demonstrate their commitment through the setting up of the processes to ensure compliance. In moving towards this objective it would be worth examining the existing legal constraints relating specifically to biological weapons development both nationally and internationally and considering what needs to be done to strengthen such laws and how they can be built in to an enforceable code of practice.

6 Related Royal Society policy documents

The Royal Society has produced the following policy reports and submissions relating to the scientific aspects of international security. All of these documents are available online at www.royalsoc.ac.uk.

- Making the UK safer: detecting and decontaminating chemical and biological agents (due to be published 21 April 2004)
- Response to the House of Lords Science & Technology committee inquiry into science and international agreements (January 2004)
- Response to the House of Commons Science & Technology select committee inquiry into the scientific response to terrorism (February 2003)
- Response to UK Foreign & Commonwealth Office Green Paper on strengthening the Biological Weapons Convention (November 2002)
- Joint statement from the Presidents of the US National Academy of Sciences & the Royal Society, Bruce Alberts & Lord May, '*Scientist support for Biological Weapons Controls*' (November 2002)
- The health hazards of depleted uranium munitions Part II (March 2002)
- Royal Society Foreign Secretary Sir Brian Heap's editorial in Science, '*Scientists Against Biological Weapons*' (16 November 2001)
- The health hazards of depleted uranium munitions Part I (May 2001)
- Measures for controlling the threat from biological weapons (July 2000)
- Management of separated plutonium (February 1998)
- Scientific aspects of control of biological weapons (July 1994)

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