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A Hippocratic Oath for life scientists

A Hippocratic-style oath in the life sciences could help to educate researchers about the dangers of dual-use research

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During the final phase of a three-year-long programme to enhance the Biological and Toxin Weapons Convention (BTWC), representatives of the States Parties met twice in 2005 "to discuss and promote common understanding and effective action on the content, promulgation, and adoption of codes of conduct for scientists" (United Nations, 2005b). The issue of codes of conduct is becoming increasingly important in the twenty-first century because, as the life sciences continue to advance rapidly, scientists need to be more aware of concerns over the misuse of science and technology. In the words of the Interacademy Panel on International Issues, "…scientific research has created new and unexpected knowledge and technologies that offer unprecedented opportunities to improve human and animal health and environmental conditions. But some science and technology can be used for destructive purposes as well as for constructive purposes. Scientists have a special responsibility when it comes to problems of 'dual use' and the misuse of science and technology" (IAP, 2005). After the conclusion of the States Parties' Meeting in December 2005, the BTWC Secretariat stated: "States Parties recognised that codes of conduct can support the [BTWC] in combating present and future threats posed by biological and toxin weapons. States Parties noted that a range of different approaches exist to develop codes of conduct in view of differences in national requirements and circumstances", and added that "Codes were considered to be most effective if they and their underlying principles are widely known and understood" (United Nations, 2005b).

This latter point mirrors one issue on which the States Parties reached an implicit consensus at the previous experts meeting in June 2005. As the Secretariat's press release from June 2005 stated, "Many experts agreed on the general need to raise awareness and increase education amongst the scientific community and the public at large on biological weapons issues" (United Nations, 2005a). Several nations, including the UK, Iran, the USA and Japan, referred to the need to raise awareness, which is increasingly becoming an area of significance for scientists and society alike. Accordingly, in this article, we discuss various means to raise awareness among scientists, specifically focusing on the potential of a Hippocratic Oath in the life sciences as a first step to educating life scientists about the dangers posed by some research.

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There are several ways to raise awareness of dual-use concerns. An ideal solution would be to develop and implement an ethical element in all life-science-related curricula. According to Willmott and colleagues (2004), this is already being carried out to some extent in the UK; a reported 69% of undergraduate bioscience programmes include an ethical component. However, such programmes make little, if any, reference to the possible malign misuse of dual-use research from a BTWC perspective. Nonetheless, the existence of such ethics modules is a useful framework for integrating biosafety and biosecurity concerns into academia. The modest extension of existing 'ethical components' to include some form of security-orientated discussion on potentially dangerous experiments, such as mousepox IL-4 (Jackson *et al*, 2001) or botulinum in milk (Wein & Liu, 2005), could be a useful method of making life scientists more aware of such concerns.

Another way is to develop and implement pre-project review systems to include an assessment of BTWC compliance in conjunction with a wider review of health and safety issues. This approach—variations of which have been proposed in Bradford Briefing Paper No 15 (Pearson, 2004), and by the Royal Society (2005), the US National Academy of Sciences (2004), and Elisa Harris and John Steinbruner (2005) at the University of Maryland (Baltimore, MD, USA)—would encourage scientists to consider the ramifications of any experiment before they start, thus forcing them to demonstrate a degree of awareness.

Finally, codes of conduct could raise awareness of both the existence of the BTWC and the dangers of dual-use research. Indeed, not only the BTWC States Parties but also scientists have shown an increasing interest in some form of code. In his acceptance speech for the Nobel Peace Prize in 1995, nuclear physicist Sir Joseph Rotblat claimed that "The time has come to formulate guidelines for the ethical conduct of scientists, perhaps in the form of a voluntary Hippocratic Oath" (Rotblat, 1995), and a

collective of non-governmental organizations have already presented draft recommendations for a code of conduct for biodefence programmes (Federation of American Scientists *et al*, 2002).

Although there is clear support for some form of code of conduct or oath, the open literature from the 2005 BTWC Meeting of Experts shows that there are several codes that could be applied to the life sciences. These can be categorized as 'enforceable codes', 'advisory codes' or 'ethical codes'. Enforceable codes are widely understood to be the strongest form and, unlike aspirational and ethical variants, would require some means of penalizing violations. Although this would surely act as a more explicit deterrence, it still creates problems. First, an enforceable code would require careful and harmonious assimilation into national law and ultimately some form of policing to ensure compliance. Second, this necessitates a legal document, which may distort or divert the focus on a code of conduct for scientists.

By contrast, 'advisory codes', developed by scientific societies or concerned organizations, could provide guidelines on how to behave (Rappert, 2004). Detailed advisory guidelines, such as *From Ethics and Law to Best Practice* from the International Committee of the Red Cross (ICRC, 2004) or guidance booklets from the UK General Medical Council (GMC), could provide a basis for drafting similar guidelines for biologists. Although not codes *per se*, these could give advice on how to behave in general areas and how to respond to specific incidents. They could certainly prove useful in raising awareness and guiding life scientists in the future. However, unlike enforceable codes, advisory codes would not be directly linked to any form of punishment and hence could be viewed as a weaker obstruction to the malign exploitation of biology. Thus, there is some skepticism about the efficacy of such codes in influencing behaviour (Rappert, 2004). A second problem with advisory codes is that they would require a comprehensive set of guidelines covering an extensive range of ethical dilemmas that can or might emerge. This could be both divisive and time-consuming to develop and, moreover, the emphasis on specificity might remove any 'punch' from advisory codes and leave the key principles "suffocated by detail" (Bowman, 2000).

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Finally, an ethical code would be "a short aspirational code, containing general principles and referring to ethical norms", according to the Australian delegation to the BTWC (BTWC, 2005b). However, without any form of punishment for violations or more detailed guidelines on how to behave, codes of ethics are widely regarded as the least potent means of regulation and are therefore also viewed with skepticism. Nonetheless, there are several advantages to using ethical codes. First, ethical codes would be comparatively easy to draft compared with enforceable or advisory codes because of their brevity. Second, a short ethical code enables greater flexibility in implementation and could be taken either as a signed statement or orally as an oath. Finally, in circumstances in which the distinction between acceptable and prohibited research is not clearly defined (BTWC, 2005b), the implementation of a code of ethics could function as a first step in raising awareness and encourage scientists to distinguish between acceptable and prohibited research.

Although the suggestion of using ethical codes can be met with skepticism, short codes of ethics, pledged orally, such as the 1948 Declaration of Geneva—developed by the World Medical Association after the Second World War—and the Hippocratic Oath, have a long history in the medical profession and are generally adhered to, although they are devoid of any real power.

Moreover, spoken codes would not need to be constructed entirely *de novo*. Various universities and organizations, including some chapters of Student Pugwash (Washington, DC, USA), already require students to take some form of pledge. To gain a better understanding of the efficacy of oaths as part of medical graduation ceremonies, we devised a small study among young practising physicians in the UK. Questionnaires were distributed to 25 Pre-Registered House Officers (PRHOs), selected on the basis of their accessibility in the West Yorkshire region of the UK. These PRHOs were just beginning to work independently with patients. In the first section of the questionnaire, they were asked which sources they felt were most influential in making ethical decisions and whether they considered the Declaration of Geneva—taken as part of graduation ceremonies—a significant tool in making ethical decisions, and if so, why. Participants were asked whether they thought an oath was necessary professionally and whether it was appropriate to take an oath at graduation ceremonies. They were also encouraged to elaborate on their answers in the written section of the questionnaire. Finally, participants were asked how they felt that taking an oath has affected them both professionally and personally.

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With 19 respondents, the limited scale of this study means it cannot be broadly extrapolated, but the results are interesting. With respect to the greatest influence on ethical decision-making, seven participants cited GMC guidelines; five cited 'consultation with senior'; four selected 'peer discussion'; and two selected 'other'. Notably, only one participant cited the Declaration of Geneva as being the most important source for ethical decision-making.

Given these answers, one could assume that the Declaration of Geneva has failed to influence the behaviour of most PRHOs in the Yorkshire region. However, in response to the question "Do you consider the Declaration of Geneva a significant tool in making ethical decisions?", 11 participants asserted that it was significant and, when asked why, several participants referred to the Declaration as a "good summary" of the principles governing medical ethics. The other respondents who contended that the Declaration was not significant explained that there were better alternatives available. One participant argued that the Declaration of Geneva was "Not easy to apply to all clinical situations" and that there was "better guidance available from GMC/Medical Protection Society/Seniors" (Revill, 2005).

In response to the question "Do you think an oath is professionally necessary?", 12 participants said that it is, although their

i pledge…
ΟΜΝΥΩ…

…ΕΠΙ ΔΗΛΗΣΕΙ ΔΕ ΚΑΙ ΑΔΙΚΙΗ ΕΙΡΞΕΙΝ.
… will Abstain from harming
or wronging any man by it.

reasoning varied. One respondent stated that it "brings together training and, although not legally binding, confirms your responsibilities", whereas several respondents referred to a 'symbolic', 'bonding' or 'uniting' process. As one participant stated, "Taking the oath is symbolic [of] entering into a body of doctors." By contrast, seven participants felt the oath was not necessary. The reasoning they gave was largely that the ethical training they had received or the GMC regulations negated the need for an oath.

There are significant differences between the medical profession and life scientists. First, in the UK there is no life-science counterpart to the GMC. Achieving widespread consensus on a meaningful equivalent to the GMC's 'Guidances' might be difficult, if it is not clear where to draw the line between prohibited and accepted research and, more significantly, if life scientists do not recognize that their work contributes to biological security threats (Dando & Rappert, 2005). Second, the current ethics education in life-science courses in the UK differs considerably from the education of medical students, in which ethics comprise a significant component of the minimum five years of medical education before taking any form of oath; indeed, the GMC (2003) recommends that the principles set out in *Good Medical Practice* (GMC, 2001), a booklet describing the duties and responsibilities of doctors, "are at the centre of undergraduate education". Third, whereas the medical practitioner's primary responsibility is to the patient (Williams, 2005), the responsibilities of life scientists are more diffuse and involve a wider public.

Although the first two factors suggest that awareness of relevant ethical issues may be less advanced in the life-science community than in the medical community, the latter point suggests that, as biotechnology advances, there will be a pressing need to create awareness among life scientists of their increasing responsibility to the public. In this context, taking an oath may be a useful first step. Moreover, despite the seemingly limited utility of publicly declared ethical codes in directly affecting behaviour, the doctors' emphasis on the symbolic bonding process, exemplified in the responses "belonging to a profession" or "united as a profession", presents significant implications when juxtaposed with psychological research into the concept of "identity-driven decision-making" (Torpman, 2004).

To demonstrate the significance of this concept, it is necessary to engage with theories of identity and normative behaviour and, on this basis, the work of Terry and colleagues (1999) is a useful starting point. They posit that "according to the theory of reasoned action […] behaviour can best be predicted from a person's intention, or willingness to perform that behaviour". They define 'intention' as the product of two elements: an 'attitudinal component', which is conceived as being the individual's evaluation of the pros and cons, and a 'normative component', which "refers to people's perception of the extent to which others who are important to them think they should perform the behaviour" (Terry *et al*, 1999).

Traditionally, support for the normative component has been subsidiary to the emphasis on the attitudinal component; however, such sentiments are changing in the wake of recent research into the normative component that emphasizes the influence of the broad social *milieu* on an individual's behaviour. Indeed, the relatively new concept of 'social identity theory' posits that the concept of 'self' is derived from 'group membership' with two processes acting on a person's identity: 'categorization', which reinforces differentiation between the 'in' group and the 'out' group; and 'self-enhancement', which, because the self is defined in terms of group membership, seeks behaviourally and perceptually to favour the 'in' group (Terry *et al*, 1999).

Hence, one's social identity can be perceived as the cumulative influences of the multifaceted groups one identifies with, which can include "gender, sexual orientation, nationality or ethnicity, and social class" (Giddens, 2001), as well as professional identification. Each group identity is likely to have, either implicitly or explicitly, some set of norms of behaviour or "group-prototypical behaviour", as Jaques (2004) stated. "Every group has a set of norms: a code of conduct about what is acceptable behaviour," and these group identity norms are assimilated by the individual cumulatively forming his or her 'morality'.

Notably, not all the group norms will be strictly adhered to, and the individual choice of whether or not to assimilate a specific norm depends largely on the level of identification that the individual feels towards the group. Prototypical behaviours are believed to have an impact on the individual, particularly when they are categorized as being a 'high identifier', that is, one who identifies strongly with the group. Terry and colleagues have shown this empirically through a longitudinal study of 143 community residents' recycling behaviour, which concluded that group standards of normative behaviour had a degree of impact on the behaviour of those individuals who were 'high identifiers'. "There was evidence that in the face of a pro-recycling group norm, the strength of the group norm and self-identity were correlated for high identifiers" (Terry *et al*, 1999).

The conclusions from this investigation concurred with those of others (Torpman, 2004; Stets & Burke, 2000; Terry *et al*, 2000; Jenkins, 1996) and underline the importance of group norms in predicting behaviour for high identifiers. This is particularly significant if the process of taking a graduation ceremony oath reinforces group identities; as Torpman (2004) claims, "the awareness of membership as a particular role makes it possible to define conditions for membership."

On the basis of this analysis, publicly declaring an oath *en masse* during a graduation ceremony might have several advantages as a first step to raising awareness among life scientists. First, if an oath were taken by all graduating life-science students, it is likely to have a greater numerical catchment than codes used in professional societies, because the majority of students attend their graduation ceremony. Furthermore, given that the average age of graduation, at least in the UK, is likely to be between 21 and 24 years (HESA, 2003), the graduation ceremony typically occurs during a formative stage of the individual's development. Moreover, such conscious acknowledgement is made in front of significant others—such as relatives and peers—who are most likely to attend graduation ceremonies. The annual nature of graduation ceremonies further necessitates that subsequent generations would take the oath, and this could contribute significantly to the creation and maintenance of a culture of awareness and responsibility in the future.

Second, as Rappert (2004) has argued, the process of developing a code of conduct for the life sciences might generate awareness and facilitate further discussion on what is permissible and what is outlawed. This process of debate is fundamental in resolving the difficult issue of differentiating between prohibited and permissible research. The existence of an oath could therefore become the first step in defining grey areas for future scientists.

Third, an orally proclaimed code of ethics may prove less burdensome both to scientists, who often feel over-regulated, and to universities or institutions with few resources. Finally, as the study of PRHOs suggests, taking an oath might reinforce identities; in response to the penultimate survey question, which asked for reasons to take an oath, several participants identified some form of initiation or process of "entering into a body of doctors" as being one of the reasons why they supported oath taking. This group-identity reinforcement is conducive to increasing the level of identification of the individual; therefore, low identifiers taking an oath *en masse* might be encouraged to connect more readily with the life-science group and thus adhere to, or at least become aware of, the group's norms.

Cumulatively, these advantages clearly suggest that a publicly stated oath could have great potential in raising awareness. Here, we build on the idea of taking such an oath and develop the arguments presented at the BTWC, as some of these issues are likely to reflect the nature of wider discussions on this topic. In particular, the following sections of this article discuss the debate on content versus universality, the means by which an oath could be promulgated internationally, and methods of facilitating the adoption of an oath.

The issue of a code of conduct's 'universality' became significant at the BTWC Experts Meeting in June 2005, which seemingly divided States Parties into what can be termed the Universalists—those in favour of a universal code of conduct—and the Nationalist-Institutionalists, who argued that "there is no 'one size fits all' approach" (Mahley, 2005). Clearly, there are advantages to the Universalist approach as, if a code were effective, it could mitigate against both state and non-state actors using third-party nations to circumvent international laws and conduct research on their behalf. Thus, a universal process could contribute to reinforcing the global norm against the development and use of biological weapons at the level of the scientist.

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However, those who argued against one universal code presented a series of cogent reasons why there is no 'one size fits all' approach. These reasons largely related to the issue of a code's compatibility with national legislation and regulatory control or concerns over cultural compatibility. Yet, they should not be seen as negating the possibility that key principles for an international oath could be agreed on by the States Parties, which indeed recognized that codes would be most effective if "they, and their underlying principles, are widely known and understood" (United Nations, 2005b). These key principles could then form the basis of an international framework for national or institutional graduation oaths. Such building blocks need only provide a brief outline of the key aspirations and, in this context, are likely to satisfy the States Parties' emphasis on codes being both "broad in scope" and "simple, clear and easily understandable both to scientists and to wider civil society" (United Nations, 2005b).

Although the promulgation of any code framework should initially be top-down to generate sufficient momentum, the construction and, when necessary, revision of a code should be the responsibility of the relevant national, scientific and educational institutions taking into account such building blocks. The proposed type of oath would thus be compatible with national legislation and regulations, and would contribute to national implementation measures. This is fundamental in achieving a consensus and encouraging more senior life scientists to engage with the issue of awareness, which is important if a code is to avoid alienating those it seeks to guide. Beyerstein (1993) contends that the functions of a code can be fulfilled only if the code is the product of a consensus, as this might lead to the articulation of internal morality of the life science profession (UNESCO, 2003). The same argument is likely to apply to an oath and

moreover, this process would enable an oath or code to be embedded in cultural, linguistic and religious contexts.

The successful adoption of oaths depends significantly on gaining a consensus in the scientific community and, as Australia has suggested, "…win[ning] the 'hearts and minds' of the relevant scientific communities…" (BTWC, 2005b). The use of the bottom-up approach in finalizing oaths would allow scientists to retain a degree of ownership. However, to further encourage support for oaths in the scientific community, one approach could be to applaud those whom an oath would seek to guide in the preambular paragraph. Indeed, the graduation ceremony context suggests that oath-taking should acknowledge the achievements of students in addition to encouraging them to consider their future responsibilities.

On the basis of this analysis, an oath could begin with: "Knowledge of the life sciences is a privilege and with such privilege comes responsibility. In entering into the community of life scientists, I pledge…". Expanding the focus beyond the context of biological weapons could further increase the value of such an oath. Analysis of previous codes and oaths (American Medical Association, 2001; Australian Society for Microbiology, 2004; Institute of Biology, 2004) has revealed several internal ethical obligations to which the life-science community adheres. These can be categorized as: integrity—to instil a sense of honesty; objectivity—to remain impartial in professional and business judgements; competence—to act with skill and care and not undertake work beyond one's capability; and professionalism—to demonstrate diligence and regard for standards of safety.

The inclusion of these elements can increase the value of any oath from the perspective of the scientific community. Moreover, encouraging emerging generations of life scientists to give proper regard to the safety and security of dangerous agents contributes further to the underlying aims of any oath from the BTWC perspective. However, careful consideration should be given to the language used in codifying these elements if the intention is both to generate sufficient support among life scientists and to ensure that the document is meaningful. In attempting to codify the integrity element, one way to proceed would be to include the words 'honest', 'fair' and 'open' as aspirations. Thus, the first stipulation could state: "To be honest, fair and as open as possible in my work…"

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This leads to the issue of competence, a key internal aspiration that any oath must impress on its target population. In the UK, the Institute of Biology requires members to exercise "due skill, care, diligence and expedition with proper regard for the health and safety, technical and professional standards expected of a member" (Institute of Biology, 2004) and building on this, one stipulation could be a pledge "To act with due skill and diligence in all scientific work…" However, scientists in the UK also have a responsibility under the 1974 UK Health and Safety at Work Act "to make further provision for securing the health, safety and welfare of persons at work, for protecting others against risks to health or safety in connection with the activities of persons at work, for controlling the keeping and use and preventing the unlawful acquisition, possession and use of dangerous substances…" (HMSO, 1974). Thus, one could include the proviso "To ensure that the agents and equipment used in dangerous work are kept safe…"

Although expounding the life-science communities' internal ethics could be important in increasing the value of an oath, the main focus, from a BTWC perspective, should be on raising awareness of the dual-use problem and the BTWC's prohibitions. Significantly, this must do more than just inspire individuals not to make biological weapons. Nonetheless, a pledge not to make biological weapons is a clear starting point, particularly if the stipulation refers to the BTWC or 'International Law' to raise awareness of such legislation. Thus, including the following statement might prove useful: "Not knowingly to engage in the development and production of biological and toxin weapons prohibited by international law…" To avoid individuals or groups exploiting the term 'knowingly', the inclusion of a stipulation encouraging scientists to consider the ramification of their work might prove useful: "To give consideration to the potentially negative ramifications of my work, particularly before commencement and prior to publication…"

Finally, given the current difficulty in identifying the negative ramifications of work and distinguishing between permissible and prohibited research (BTWC, 2005a), and the fundamental need to include scientists in any such discussion, it would be necessary to include a stipulation encouraging scientists to contribute to the development of regulations that, *inter alia*, support the aims of the BTWC. The following statement could facilitate the move to a sustainable culture of awareness and responsibility: "To contribute to the development of safeguards and oversight mechanisms…"

On the basis of these principles or building blocks, a Hippocratic-style oath could therefore take the following form:

> Knowledge of the life sciences is a privilege and with such privilege comes responsibility, as the life sciences can be used for both benign and malign purposes. In entering into the community of life scientists, I pledge: to be honest, fair and as open as possible in my work; to act with due skill and diligence in all scientific work; to ensure that the agents and equipment used in dangerous work are kept safe; not knowingly to engage in the development and production of biological and toxin weapons prohibited by international law; to give consideration to the potentially negative ramifications of my work, particularly before commencement and prior to publication; and to contribute to the development of safeguards and oversight mechanisms.

The implementation of such an oath for life scientists would fulfil many of the aspects of codes that the States Parties felt were important at the BTWC meetings in December 2005. Indeed, a Hippocratic Oath for life scientists would: be more compatible with national control; contribute to national security measures; be simple, clear and easily understandable both to scientists and to wider civil society; be relevant, helpful and effective for decision-making and taking action in accordance with the purposes and objectives of the BTWC; and be sufficiently broad in scope. Finally, given its brevity, the oath could be regularly reviewed, evaluated for effectiveness and revised as necessary. Furthermore, such an approach would enable a sustainable, proactive awareness-raising process among life scientists at a formative age. It could thus function, among other things, as the first step in strengthening the norms related to the prohibition of the development, production, stockpiling or otherwise acquiring or retaining biological or toxin weapons, ultimately protecting both science and society in the future.

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