Coding Ethical Behaviour: The Challenges of Biological Weapons

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ABSTRACT: *Since 11 September 2001 and the anthrax attacks that followed in the US, public and policy concerns about the security threats posed by biological weapons have increased significantly. With this has come an expansion of those activities in civil society deemed as potential sites for applying security controls. This paper examines the assumptions and implications of national and international efforts in one such area: how a balance or integration can take place between security and openness in civilian biomedical research through devising professional codes of conduct for scientists. Future attempts to establish such codes must find a way of reconciling or at least addressing dilemmatic and tension-ridden issues about the appropriateness of research; a topic that raises fundamental questions about the position of science within society.*

Introduction

> *"Every step change in science has opened up new and more terrifying methods of killing and incapacitating; and in turn made more urgent that these means be subject to internationally enforceable control."*
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> –2002 UK Green Paper *Strengthening the Biological and Toxin Weapons Convention*[1]

As acknowledged in this recent British government report, science has long provided the basis for more sophisticated weapons. Since 11 September 2001 and the anthrax attacks that followed in the US, attention has increased significantly across many countries regarding the potential threats of biological weapons. With this have come

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calls from diverse scientific, policy and public quarters to undertake new responsive measures. As part of this, the responsibilities of those in science – from funding bodies to professional societies to rank-and-file researchers – are being re-examined.

In international forum and informal discussions, the potential for codes of conduct are being favourably forwarded as one way of establishing and policing responsibilities and thereby reducing threats associated with malign misuse of science, particularly areas associated with modern biotechnology. Although it is far from clear what such codes will entail at this time, it is apparent that there is growing concern about the implications of research across the life sciences and demands for researchers to become more responsible for the potential implications of their work. This paper examines the prospects and problems associated with formulating international codes of conduct vis-à-vis bioweapon threats. In doing so it seeks to situate current and initial discussions within recurring debates about the place of science in society. The possibility of incorporating security considerations within the practices of researchers raises dilemmatic questions about the desirability and feasibility of controls as well as who should make such determinations.

Bioweapons Threats

It is often remarked that in the post-Cold War era, and particularly after 11 September 2001, a 'new security environment' has emerged; one characterized by transnational threats to Western countries, numerous failing states, an abundance of armaments and the know-how to manufacture them, and an unparalleled societal openness in many nations. All of these issues intersect in relation to the threats of 'weapons of mass destruction'. Indeed, the danger posed by such weapons has been identified as 'the key issue facing the world community'.[2]

Much of the international attention to weapons of mass destruction has focused on the potential for biological agents and toxins to inflict mass casualties and trigger social disruptions. Well before the events of 2001, the United Kingdom Ministry of Defence[3] argued that the contemporary threat from biological weapons to national security was greater than that from nuclear ones. The main reasons identified for this were the higher casualty potential associated with biological weapons than almost any other weaponry combined with the relatively low levels of resources and expertise required to produce them. However, in the near term, others have cast doubt on the feasibility of anyone devising effective biological weapons outside of intensive state sponsored programmes.[4]

Another reason for concern with biological weapons though is not so much the threat they pose today but the one they will do in the not so distant future. Otherwise beneficial advances in immunology, virology and genetics could be used to enhance a bacterial bioweapon to make it more resistant to antibiotics, modify the pathogenicity of agents, increase the survivability of bacterium across a range of environmental conditions, artificially synthesize viruses, and reduce the ability of the body's defence system to identify pathogens.[5,6,7] The fear is that such developments may, within the span of years or decades (perhaps not too many), enable states, terrorists or even sociopaths to produce bioweapons with the potential for mass disruption if not mass casualties.[8] Such dangers gained a fairly widespread airing in 2001-2 because of two prominent experiments: first, the insertion of the interleukin-4 gene into the mousepox virus that substantially improved its virulence and vaccine resistance.[9] Here the fear was that this experiment might serve as a model for how to manipulate smallpox to make it resistant to current vaccines. Second, the artificial synthesis of the poliovirus by configuring DNA segments bought by mail order and arranged according to sequence information freely available from the Internet.[10]

With such high profile cases and others, across both scientific and national security communities, questions are being asked about how openly research should be communicated and whether some lines of investigation are too contentious to pursue.[11,12,13] The long time assumption in relation to civilian scientific research vis-à-vis biological weapons – that national security is best served by unfettered research in the expectation that this would serve more to protect against rather than enable bioweapons – is increasing coming under question as the life sciences are told to 'lose their innocence'[14] before controls are devised for them.[15] Of course, throughout the 20th century there were attempts to place national security controls on research.[16] Yet, such measures in the past have been enacted predominantly in applied areas of physics or cryptography and, as a result, analyses of secrecy and science have focused on such areas.[17,18] In contrast, many argue that it is the fundamental knowledge gained about the biological processes today that is essential for the production of bioweapons. Thus any controls involving classification, limiting publication and communication of research, or curtailing lines of inquiry would have extensive implications beyond those areas associated with weaponizing traditional dangerous agents.

There are now active international deliberations about what, if any, restrictions should be placed on the openness of research and how those might compromise the character and the quality of science.[19,20] For instance, though withdrawn after much complaint from the scientific community, the US Department of Defense has attempted to insert pre-publication review clauses into contracts for fundamental research.[21, 22] A brief consideration of some of the basic issues reveals the complicated considerations in debates about what should be done. As suggested above, techniques and knowledge from areas of advanced research certainly have the potential to enhance the destructiveness and feasibility of biological weapons. Yet, the same advances in microbiology and other fields that could enable the production of novel bioweapons can also be used to set up countermeasures against them. Placing restrictions on what information is known or what research should be conducted would have implications, of course, not only for the possibility of devising defensive measures but also for general attempts to derive therapeutic health interventions for known and pressing health problems. Even limiting controls to activities directly involving the manipulation of widely recognized dangerous viruses, bacteria or toxins (which, as suggested above, would fail to capture many areas of concern) would be of questionable worth since such agents are often naturally occurring and inflict significant injury on humans and animals. From a practical point of view, it is likely the effectiveness of any controls would be undermined unless they were fairly standardized across funding bodies, research institutions and journals across a wide range of countries. Whether framed in terms of a co-operative integration of security into research or in terms of a more zero-sum balancing of security and openness though, the acceptability of carrying on as pre-11 September 2001 is portrayed as increasing unviable.

In short, there are dilemmas associated with acting or not acting in relation to the threats of biological weapons. It is against this backdrop that in November 2001 the US President George Bush[23] announced a series of initiatives to try and strengthen the 1972 Biological and Toxin Weapons Convention (BTWC), the cornerstone of international efforts to limit the production and proliferation of biological weapons. This included a proposal to 'devise a solid framework for bioscientists in the form of a code of ethical conduct that would have universal recognition'. In late 2002 as part of the Fifth Review Conference of the BTWC, State Parties agreed to establish yearly meetings with the intent to 'promote common understanding and effective action' regarding key issues associated with the control of biological weapons. In 2005, the topic will be 'the content, promulgation, and adoption of codes of conduct for scientists.'

Coding Conflicts

Of course, irrespective of concerns about biological weapons, the creation of codes of conduct has long been a key mechanism for establishing notions of professionalism across many areas of work. The content of such codes varies significantly and includes everything from legal stipulations, to aspirations to informal prohibitions. Social science analysis of professional codes offer contrasting appraisals of their utility against varied objectives as well as whether they encourage or deflect social responsibility.[24] Ladd[25] regarded codes of conduct as little more than public relations activities that typically diverted attention from structural and societal questions about the place and power of professions in favour of giving unrealistic rules that generally increase moral and ethical confusion (and thereby decrease moral obligations). Others concur, at least in part, by noting how codes are open to numerous meanings – such as official, context-specific, and individual interpretations.[26]

Certainly the long history of the contribution of scientists and medics to the production of biological weapons would suggest something of the difficulty of ensuring scientists refrain from contributing to such capabilities. Despite international efforts through the BTWC and other worldwide forums; for reasons of patriotism, professionalism and profit, bioscientists have been willing to go along with substantial covert state-sponsored programmes in countries such as Iraq, South Africa as well as the Soviet Union.[27,28] Such examples would seem to support the initial assessment that ethical codes devoid of binding enforcement procedures can do little good because those that act ethically do not need them and scientists in state sponsored programmes, let alone bioterrorists, will not be deterred by them.

In response, those more supportive of codes in general and specifically for bioscientists vis-à-vis bioweapons have argued for more varied functions than guaranteeing certain forms of behaviour. These include raising awareness, fostering norms, enabling individuals to re-interpret their actions, and establishing ethical standards that provide for moral and professional condemnation.[29,30]

These competing claims about the merits of codes would suggest their potential should be thought about carefully by assessing them in relation to the specific ends that they are proposed to accomplish. Despite the agreement to discuss codes as part of the BTWC and supportive statements about the merits of such action,[31] there is little articulation so far of what purposes they should and should not serve. Strict codes that sought to police specific do's and don't for researchers would no doubt prove more contentious than codes that merely stated principles for aspiration and awareness raising.[32]

The uncertainties about what the codes should be for are compounded by alternative assessments of the urgency of the issues and the proper vehicle for taking discussions forward. The UK and other governments have identified the BTWC as the forum for coming to collective agreement about ethical standards in relation to bioweapons. In contrast, the US administration has adopted an increasingly vigorous and unilateral approach in pursuing codes or re-categorizations of research as 'sensitive but unclassified' outside of the BTWC review process in the hopes others will follow.[33] The BTWC, as the major multilateral process for controlling bioweapons, has been increasingly marginalized in US policy since late 2001 when it withdrew from attempts to put in place verification procedures as part of the Convention. This has resulted in many concerned organizations and individuals in the US to regard the BTWC as irrelevant vis-à-vis future American policy. As an indication of this, on 9 January 2003, the US National Academy of Sciences and the Center for Strategic and International Studies sponsored a conference entitled 'National Security and Research in the Life Sciences' to bring together top-level policy, security and scientific communities to debate possible next steps. There was no mention of the Convention; this despite the Bush Administration's initial suggestion in 2001 that codes be established under the BTWC.[1,a]

Potential problems with codes extend beyond the sort of considerations mentioned above about what rules should be in place, how they ought to be established and then enforced. By way of fleshing out some of the significant dilemmas associated with codes, four areas are examined. These include the practices of science; the responsibilities of scientists; the acceptability of bioweapons related activity; and the importance of international exchange in and benefit from science. Excluded from discussion below is the relevance of codes for matters of biosecurity ─ this meaning the physical control of dangerous pathogens. While future international codes of conduct might comment on this important topic, the focus below is on matters related directly to professional ethical standards.

a. The only exception being a question by the author asked in the final session inquiring why the BTWC had not been mentioned.

Models of Science

The points raised in the previous paragraphs highlight the importance of the model of science implicit or explicit within discussions about the appropriateness of codes. Existing policy and national security deliberations typically characterize the biosciences as value-neutral practices based on an open exchange of materials and information in a free 'marketplace of ideas' where the free flow of information ensures the validation of knowledge through the replication of research and peer review.[34,35] While such idealized sentiments might provide an 'Ideal' for science,[36] they have been thoroughly critiqued by empirical examinations of research practices.[37,38,39]

Take the matter of scientific openness. Much of the concern about national security controls is whether they will comprise the existing openness of science. For instance, in relation to the availability of gene sequences for microbial agents through existing international databases, it has been argued that any limitations on such information would comprise both the ability to devise defensive measures and the normal operation of research in producing public goods.[40,41] In such arguments, the issues at stake are framed in terms of whether research should remain open or have restrictions placed upon it that will make it more 'private' in character. The wider strategic choice at stake is either to carry on attempting to stay ahead of bioweapon threats by innovating faster (which requires being open) or to shut down knowledge exchange and perhaps lines of research altogether in particular areas (e.g., the sequencing of dangerous pathogens) in the hopes that this will interfere and ultimately sabotage others' efforts to misuse nucleic acid sequences to facilitate novel bioweapons.

In contrast to assuming that the knowledge produced in universities or other such settings should be presumed to be a public good that is freely available, many empirical examinations have argued that such a status cannot be assumed. Rather it has to be established, and not merely 'once and for all', but on a *continuing* basis. Both in relation to direct commercial pressures and general academic competitiveness, Hilgartner[42] argues the specifics of what genomics sequencing data is given to whom and under what conditions of access are often matters of contention. Historically, a delicate balance of ownership incentives and penalties for non-disclosure has had to be found in a way that balances openness and secrecy concerns of sequencing researchers, material producers, and end users in order for scientists to share information relatively freely.

More generally, the continued emphasis in many countries on the commercial exploitation of research and the importance of academic-commercial links has imposed varied restrictions on the manner and type of knowledge and material exchanges between scientists.[43,44] In response, Callon[45] proposes moving away from traditional distinctions about the public or private status of research that derive from whether it is publicly or privately funded in favour of asking whether such research takes place in extended or tightly bound networks. Following such a suggestion, Cambrosio and Keating[46] highlighted the importance of the complex infrastructure that was required before monoclonal antibodies become routinely available tools for research (i.e. public goods).

Much of the discussion about codes and bioweapons is pitched in terms of public sector research where professional norms of openness are presumed to dominate. Excluded from consideration is the substantial amount of fundamental and applied research undertaken in the private sector where employer-employed relations dominate. But just as empirical studies of research practices would suggest public sector research should not necessarily be equated with openness and the production of public goods, so too the private sector should not be equated with secrecy and private goods. For instance, pharmaceutical and biotech companies do publish and have at least some incentives for sharing information and materials.[47]

Taken together, the research mentioned in the last few paragraphs would suggest that homogenizing designations of research as public if undertaken by academics or private if undertaken by those in commercial settings are unhelpful. Certainly few would argue that distinctions between the two have no relevance, but the framing of current debates about controls in terms of stark dichotomies where wide-range presumptions of openness or secrecy are made obscures the already negotiated status of research and therefore the wisdom and feasibility of restrictions on the agendas and communication of researchers.

Determinations of Responsibility

Another area of importance for the formulation and interpretation of codes is the responsibility of scientists for the ultimate implications of their research. The general topic of scientists' responsibility has generated a considerable amount of attention.[48] In one valuable contribution to this debate, Grunwald[49] convincingly argues that responsibilities of technical professionals should not be understood as universal and constant duties that simply must be borne. Rather, as techniques and knowledge are developed that challenge previous ways of acting and societal distributions of risks and benefits, just who ought to be responsible for what is often a matter of much contention. As such:

> Responsibility is not a quasi-ontological predicate, nor is it a 'natural object', but is always "constructive", the *result of an act of ascription*. The passive expression, *Who bears which responsibility?* is, therefore, too narrow, and is reduced to a purely descriptive statement: the ascription of responsibility is itself an act which takes place for purposes of and in relation to *rules of ascription*. These rules of ascription are themselves in need of justification, to the extent that they, for instance, limit the group of individuals able to accept responsibility and formulate criteria stating which conditions must apply in order to determine which individuals are held responsible and accountable.[49(p.422)]

Grunwald argues that approaching responsibility as constructed in this way means that ascriptions have descriptive (how responsibility is actually ascribed) and normative aspects (how this should be done). To say determinations of responsibility are constructed does not mean they are arbitrary. Ascriptions depend on notions of intentionality and causal responsibility. For the latter, the knowledge and skills of engineers will be important basis for thinking about their specific responsibilities compared to others.

Grunwald builds from these points to argue that engineers should have fairly limited conceptions of their responsibility; such as ensuring regulations are properly enforced and areas of insufficient regulation are amended. Engineers cannot be expected to develop a guiding ethos for technological development, but rather use their specialist knowledge to ensure existing rules and procedures are implemented and necessary additional steps are identified. What problems cannot be solved through these circumscribed measures are deemed society's responsibility.

It is not certain in the case of bioweapons whether scientists' responsibility should be limited to such well-trodden professional ground. Examining the contribution of bioscience research to bioweapons challenges the possibility let alone the wisdom of ascribing limited duties through a neat demarcation. In many respects, scientists themselves are the ones that in practice define (and are seen as the ones who should define) the nature of the problem with research.

Consider the basic issue of what findings, techniques or materials should be controlled as part of national security efforts. Despite much talk about the need for something to be done, those in the national security communities have exhibited little interest in imposing restrictions or even offering possible ones about the acceptability of particular lines of research.[34] The legitimacy and ultimate effectiveness of controls and criteria that do not emanate from 'the scientific community' are considered highly problematic. As of yet, however, there is little consensus on what research should be controlled or even how to make such decisions within relevant scientific communities. Initial debate would suggest it is unlikely any controls would have wide scale acceptance because some justifications can be offered for nearly any experiment. Take the case of the artificial synthesis of poliovirus through assembling DNA strands according to publicly available sequence information that was mentioned above. The authors claimed that the possibility of synthesising viruses in this manner was obvious to all of those with the relevant specialized expertise.[50] As such, the experiment did not reveal any information that would not be apparent to those with the necessary skills to produce bioweapons. In other respects though, the experiment was highly significant because it proved 'proof of principle' and served to inform society about future technical possibilities. While synthesizing virus today was laborious and only possible for the smallest of viruses, as technology develops this process will become easier and easier.

Any controls on research then would both not deter those determined and knowledgeable but would certainly serve to limit the public's understanding of threats, constrain attempts to enact necessary responsive measures, and result in forgoing knowledge gained from experimentation.[b] The underlying logic here is the importance

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b. In this case, for instance, the researchers contented that small DNA sequence variations in the artificial poliovirus resulted in substantial decreases in its pathogenicity as compared to natural 'wild types'.

of standing ahead of inevitable threats posed by the development of science and technology through rapid innovation. This, in turn, requires the free exchange of information and unfettered research. Where the threat is greatest, so too is the need for innovation and thus the importance of no restrictions. Any controls that might limit research by codes through preliminary assessments of its usefulness or some other such criteria,[51] are likely to be deemed ill-advised by many, given the above framing to the issues.

The way the poliovirus case highlights how determinations of proper responses are bound up with determinations of what is predictable is a topic worth elaborating. When particular findings are deemed obvious, there is likely to be little justification for placing limits on related research. That much of scientific research is said to generate fairly unexceptional findings has led some to suggest that controls to hold back information might best be limited to work that generates novel, unexpected discontinuities.[52] Yet, just what is predictable or novel though, is itself a contested matter. In the case of the mousepox gene insertion that resulted in enhanced viral virulence and vaccine resistance, for instance, it was argued that researchers had 'stumbled' across this possibility.[53] Others have disagreed by reviewing relevant existing literature[54] and suggesting that the results should have been evident. Of course, some may counter that everything is obvious after the fact. Irrespective of questions about who was 'right' or 'wrong' in this case, the dispute raises important points both with respect to how scientific expertise will be central to determinations about the acceptability of research and the basis for imposing controls. To what extent science is portrayed as involving continuities or discontinuities affects how codes are approached. If the results of research are seen as generally predictable, then codes of conduct or other such regulation devices can be devised on the basis of the intent, purpose, and foreseeable consequences of action. To the extent research can and does routinely raise unexpected findings the relevance of codes devised around intent and foreseeable results is challenged.

The difficulties associated with predictability are intertwined with questions about the possibility for new regulations given appeals to the incremental nature of scientific advances. Where collective understanding is slowly built up over time, trying to establish just where lines of acceptability ought to be place and what actions should be somehow restricted is problematic. So, in the case of the insertion of the interluekin-4 gene into the mousepox virus, it has been argued that even after the event, trying to formulate where limits on research or access could be placed is problematic.[50] On the one hand, to limit research about the discovery and function of interluekin-4 gene would entail halting the study of basic mechanisms in immunology. Seeking controls about the effects of interluekin-4 gene in a vaccinia model would likewise be inappropriate because it was in such a model that knowledge of interluekin-4 first developed. On the other hand, limiting the actual result of the insertion of the interluekin-4 gene into the mousepox virus would do little good because, as argued above at least by some, that those skilled in immunology and virology could have foreseen the results anyway. In short, restrictions would either be highly disruptive of the intellectual fabric of science or be ineffective.

The attempt is made here to have it both ways: experiments such as the mousepox one are simultaneously deemed significant intellectual advances which merit publication despite possible contention but also insignificant achievements due to previous work in the area. There are two dynamics at work here, one whereby facts get built up and another whereby attribution of responsibility and contribution for producing facts are allocated.[55] The two acting together enable individual scientists to be portrayed simultaneously as both players and pawns regarding the consequences of research.

As suggested above, the active support of 'the international scientific community' in the adoption and interpretation of controls is taken as necessary and prudent in establishing them – indeed, it would be difficult to image a situation in which such support was not sought and vital. However, the crunch comes in also accepting the argument that with this support determinations of the appropriateness of specific research should be established through expert assessments of the origins of research and the predictability of events. While there have been calls from varied quarters that any limitations on research should be based on clear, easily understandable and explicit criteria,[56,57] the previous paragraphs would suggest any criteria or stipulations that might provide a basis for codes of conduct are likely to be questioned and, importantly, that scientists will both be the ones seeking to be define themselves as the proper individuals to make decisions because of their expertise and disagreeing because of that expertise. The foreseeable consequences of state of the art research are, by definition, not likely to be matters of unanimity.

Thus there is unlikely to be an easy separation between the descriptive aspects of scientific responsibility (how responsibility is actually ascribed) and normative ones (how it should be done). *Contra* Grunwald, it is not enough to think of responsibility as a matter of ensuring regulations are properly enforced and areas of insufficient regulations are amended, with the rest being left up to society. 'Society' is routinely denied a legitimate voice to comment on controls in present discussions (i.e., it is not a credible determiner of ascription rules because of the role accorded to specialized knowledge). That situation may change, of course, but for now scientists are centrally placed as definers of what is significant and what should be done vis-à-vis research.

The Acceptability of Bioweapons

Public discussions about the potential of bioscience codes today typically presume unanimity regarding the abhorrence of biological weapons as force options. The focus then is on finding ways to raise awareness about dangers and reinforce the unacceptability of employing biological agents to deliberately target humans, plants or animals. As a result, much of the attention centres on the mal-intent of certain groups who pursue these universally condemned weapons. The deficiencies of codes are then thought about in terms of whether they can serve as an effective tool towards reinforcing the given abhorrence of biological weapons. This characterization, however, simplifies the issues at stake and ignores past and present areas of negotiation about the acceptable biological weapons related activities.

Attempts to make biological weapons a category morally distant from conventional weapons were actively challenged in the 20th century.[c,58] While arguably some degree of moral repugnance toward biological weapons helped constrain their past use by countries such as the United States, the United Kingdom, Germany, France and Canada in World War I and II,[59] the appropriateness of such designations has been called into question also – not least by biologists and other scientific experts. Various grounds have offered to counter accusations of the abhorrence of bioweapons: their moral status as killing technologies is no different to that of 'conventional' weapons; as opposed to many other options, biological weapons give their victims a 'fighting chance' to recover; and any restrictions on the means of warfare would have the practical result of extending the period of conflict (thereby increasing suffering) by making the means for resolving it less decisive.[60] The number and size of *offensive* weapons programmes in Europe, North America and Asia in the past testifies to the salience of such arguments in official government circles.

Despite past agreements to restrict the use of biological weapons in warfare (such as the 1925 Geneva Protocol that banned their *first* use against *other Protocol states*) it was not until the 1972 Biological and Toxin Weapons Convention (BTWC) that significant international prohibitions were placed on the malign purposes of biology. Article I states:

> Each State Party to this Convention undertakes never in any circumstances to develop, produce or stockpile or otherwise acquire or retain:
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> 1. Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes.
> 2. Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.

Given the nearly universal adoption of the Convention by countries, its basic tenants could provide a basis for professional codes of conduct by proscribing scientists from partaking in or facilitating activities for purposes other than prophylactic, protective or other peaceful ones.[d]

While the BTWC would at first glance appear to establish seemingly categorical and definitive limits on the actions of scientists and others, this is not necessarily the case. Arguably in the recent and current clandestine programmes in the Middle East and elsewhere, biological weapons were and are generally not regarded as especially abhorrent. Rather they are one form of destructive weapon that might serve, for instance, as a deterrent against attack.[61] Herein the Western condemnation of the

c. This has also been the case for chemical weapons. In a historical analysis of the taboo against chemical weapons, Price[58] examined how particular categorizations of such weapons helped naturalize or delegitimize acts of violence and into doing so in turn helped secure an understanding of the moral status of those involved.

d. As in the UK Biological Weapons Act 1974.

possession of chemical and biological weapons, with nuclear arsenals excluded from such condemnation, only serves to testify to the double standards prevalent in international relations regarding the acceptability of 'weapons of mass destruction'.[62]

Another site of negotiation that codes will comment on (whether directly or by its absence) is the acceptability of varied forms of biological weapons. If the abhorrence of biological weapons derives from their properties (such as being indiscriminate and uncontrollable[63]), then if these characteristics can be altered bioweapons may be deemed acceptable – at least for some. Along these lines, for some time there has been interest in developing bioweapons with the stated intent of incapacitating. Both the UK and the US in the 1950s and 1960s had active programs to test the properties of various psycho-chemicals intended to target the mental state of opponents for the purposes of incapacitating or calming.[64,65] In the 1950s the US Chemical Corps experimented with the disabling qualities of LSD, mescaline and marijuana. On the basis of initial American efforts, the UK began LSD research in the 1950s. Ultimately it was deemed unworkable because of problems with dispersing it, the large quantities required for ensuring its effectiveness in battlefield conditions, its illegal status, and its highly variable effects. The US Chemical Corps continued its research about disabling weapons including the psychotropic drug BZ (3-quinuclidinyl benzilate). Such efforts failed though, largely because the effects proved highly variable and unpredictable.[66]

Such scientific investigations took place along side of policy initiatives. As part of attempts to make such weapons palatable internationally, in the 1960s the US government suggested Geneva Protocol only banned the first use of *lethal* biological weapons.[67] Such sentiments have been backed up by scientific associations whose purpose it is to establish professional standards. In 1970, at the height of tension in the US about the acceptability of chemical and biological weapons, the president of the American Society for Microbiologists argued in support of continuing biological warfare research; one justification being 'research into BW could lead to more types of incapacitating (humane) rather than lethal weapons'.[68]

With the end of the Cold War has come significant efforts to shift the boundaries of the acceptability of biological weapons again because of a rekindled interest in force options for conflicts such as peacekeeping missions and countering insurgencies.[69] Under the heading of non-lethal weapons, incapacitating agents that straddle the divide between chemical and biological weapons are being researched to alter body temperature, consciousness, and hormone release.[70] Novel dissemination techniques (such as microencapsulation) would reportedly move capabilities beyond the properties of the fentanyl gas (an opium-based narcotic) used in October 2002 in the Moscow siege. A threat with such novel options is that 'the immediate short-term advantages conferred by technological developments could endanger one prohibition regime and ultimately the complete set of arms control regimes that the international community is trying to erect to restrain the proliferation of advanced weaponry'.[71] Should non-lethal weapons be forwarded as valuable means of force, this would radically redefine notions of proper conduct vis-à-vis the BTWC by introducing a distinction between 'good' and 'bad' biological weapons. Certainly such developments undermine the claim that 'it is testament to the strength of the norm against CBW [chemical and biological warfare] that there is little public discussion of its features. The norm is now so strong, at least within the developed world, that it is no longer questioned, and has becomes embedded within public consciousness'.[72]

In short, there is good reason to approach determinations of the acceptability of the use of force with bioweapons as a product of political and historical negotiations about the legitimacy of forms of violence. There are competing and evolving assessments about the acceptability of weaponry that derive from alternative claims about their characteristics, the situations of their use, and the motivation of users.

International Exchange and Benefit

Science is often said to be an international activity that requires the open exchange of knowledge and individuals across national borders. Likewise, it is also commonly said all should share in the benefits of science, particularly modern biotechnology. In this spirit, partially to offset many of the costs of prohibition enforcement and ensure widespread adherence to the terms of the BTWC, Article X of it calls for the promotion of cooperation between countries to promote scientific and technical exchanges for the peaceful use of biological agents and toxins – this particularly between countries of the North and South.[e] Such cooperation could include assistance and exchange activities regarding topics such as disease surveillance networks; the safe handling, storage and transfer of pathogens and toxins; and the safety of human and animal medicinal products. Article X has not received a great deal of attention from countries in the North and this has been a constant source of contention in the history of discussions about the BTWC.

This long standing situation has been exacerbated by recent US government restrictions on foreign nationals from conducting biological research in the US. For instance, the Department of Agricultural recently announced a halt to applications for *all* work permits for student and researcher foreign nationals.[73] This is combined with somewhat longer standing controls on the ability of individuals from certain countries suspected of supporting terrorism to conduct research with select agents (ones that might be naturally afflicting the population of the country in question). Although a much less formalized system, the UK has recently attempted to strengthen its vetting system for graduate students and researchers at universities. While the precautionary spirit of such measures is evident, they also run counter to the supposed importance of opportunity and freedom in research. From the perspective of political legitimacy, it is likely that future codes of conduct that strive for international acceptance will also have to comment on the desirability of the exchange of expertise. The bind is how to find

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e. The States Parties to this Convention undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials, and scientific and technological information for the use of bacteriological (biological) agents and toxins for peaceful purposes. Parties to the Convention in a position to do so shall also cooperate in contributing individually or together with other States or international organisations to the further development and application of scientific discoveries in the field of bacteriology (biology) for the prevention of disease, or for other peaceful purposes.

ways of facilitating collaborations that serve peaceful purposes, rather than resulting in the transfer of vital technical know-how that will one day be used for the production of bioweapons.

Topics for Future Discussion

The examination above of issues associated with ethical codes for bioscientists in relation to biological weapons raises a number of questions about the positioning of science in society. Any codes will be situated between the dynamics of international politics and deliberations about individual moral conduct, where an understanding of each is likely to be informed by the other. As the prospects, purposes, and possibilities for codes are debated in future national and international forums, the analysis given here suggests a variety of issues meriting close consideration:

- While it is widely agreed that codes should not just be 'ink on paper', it also needs to be acknowledged that the meaning of any proscriptive criteria are likely to be highly negotiated in practice because of alternative assessments made about the implications of research. Scientists can certainly provide advice on dangers associated with bioweapons because of their skills and knowledge. Yet, as suggested above, such competences are not likely to bring unanimity about what needs to be done. Expectations that codes could be fashioned as simple rules for adjudicating on the appropriateness of research are likely to be unrealistic. Following on from these points, it should not be assumed that codes could be applied like straightforward rules. Rather, the analysis above would suggest that codes should be drawn up and implemented in a way that seeks to evoke deliberation about the contexts of implication of research.
- Science is often portrayed as a universal activity and any ethical codes are expected to have the same status. Yet, in this strive for universality, it is necessary to consider how codes across varied bioscience areas inappropriately homogenise diverse research practices.
- Codes are often framed in terms of the foreseeable implications of research and the malicious intent of researchers. However, it is clear in practice these are limited ways of approaching threats associated with biological weapons. The interest in countries such as the US regarding next generation 'non-lethal' incapacitants, notionally intended to reduce injury and death, presents another basis by which contention about 'intent' might undermine controls. This would suggest that codes should move beyond considerations of individuals' intent for actions and instead comment on how funding bodies, professional societies and others can share in trying to resolve the difficulties associated with the purposes and prospects of research.
- Following on from this, there are important questions about the anticipated or reasonably foreseeable implications of research. While the debates about this are troubling enough in terms of codes, a more basic concern is whether it is better to give approval and publicity to experiments that raise bioweapons possibilities

(e.g., the mousepox case mentioned above) in order to assess the potential for malign modifications and bring them into wider professional and public scrutiny or whether (and when) it is better to forgo such activities. While much of the public discussion by top science policy makers stresses the benefits of raising awareness in order to invalidate calls for security constraints on research, that so far has been done in response to limited individual cases. Should scientists in fields such as virology and immunology begin deliberately and actively pursuing lines of research with the purpose of raising awareness of the potential for novel bioweapons? The sheer number of such possibilities would no doubt generate widespread political and public concern about the risks associated with pursuing research.

- The discussion of codes now centres on biological weapons. Outside the Western countries where such technology is held in particular disapproval, there are questions whether it will be acceptable internationally to devise a code just for biological weapons or whether any such effort should comment on the contribution of scientists to all types of weapons of mass destruction. What may be needed is something more wide ranging in scope.[74]

The tensions associated with international codes of ethics in science are thorny and complex. As in other topics where questions about the responsibility of professionals are posed, in this case there are important issues regarding whether and to what extent bioscientists are being asked to be accountable for actions that are outside of their control. This would suggest the need for a wider sense of responsibility from bioscientists in relation to society than just ensuring future derived criteria about acceptable research are implemented. Following Winner's suggestion for engineers, at the very least scientists should take part in attempts to engage with 'others in the difficult work of defining what are the crucial choices that confront technological society and how intelligently to confront them'.[75]

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