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Looking at the formulation of national biosecurity education action plans

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Abstract

In order for states to be assured of their compliance with the requirements of the Biological and Toxin Weapons Convention, it is necessary that all those science and policy stakeholders working within that state should be aware of their responsibilities under the Convention. This can only be achieved through a comprehensive national biosecurity education programme. We propose that each state should produce a national biosecurity action plan, with accompanying resources and materials to achieve this. A number of resources are already available online to support states in this challenge. We present a model for a national biosecurity action plan and propose a number of ways in which this may be achieved.

Keywords

biosafety; Biological Weapons Convention; life science; international law; professional development; international security

The need for biosecurity education

In order for a state to achieve a position of compliance with the requirements of the Biological and Toxin Weapons Convention (BWC), it is necessary for the various articles and prohibitions of the BWC to be widely known, understood and implemented by members of the scientific community within that state. So far, 164 states have ratified the BWC, a further 13 states have signatory status and 19 states have neither signed nor ratified the Convention (United Nations 2011).

Despite wide recognition of the value of the BWC at state level, research in recent years among life scientists has clearly shown that although many states hold membership of the Convention, there is a significant lack of awareness of the nature and scope of it among scientists within such countries, including even a lack of awareness of the existence of the BWC (Dando and Rappert 2005). Further, there is a clear lack of awareness on the part of scientists and life science educators (principally in universities) of the potential for their work to be used for malign purposes – the problem of dual-use (Dando and Rappert 2005).

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The critically important recognition of the dividing line between beneficial and malign uses of life science is notably lacking.

The General Purpose Criterion of Article 1 of the BWC states:

Each State Party to this Convention undertakes never in any circumstances to develop, produce, stockpile or otherwise acquire or retain:

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 ...

Clearly, those best responsible for making decisions as to the potential use of biological agents and toxins are scientists themselves. But what kind of education is available to scientists to assist and guide them in making such decisions?

Since the second (five-yearly) review conference of the BWC in 1986, numerous statements have appeared in final declarations emphasizing the importance of education for scientists. The most recent of these statements was made in the final document of the Meeting of States Parties in December 2008, in which States Parties called for:

... formal requirements for seminars, modules or courses ... in relevant scientific ... training programmes and continuing professional education in raising awareness and implementing the convention. (United Nations 2008, para. 26)

States Parties agreed on the value of education and awareness programmes ... being integrated into existing efforts at the international, regional and national levels. (United Nations 2008, para. 27)

Numerous accounts of the need for educational resources to support scientists and science educators have been disseminated recently (Dando and Rappert 2005), along with consideration of codes of conduct to assist in the process. Movement is already underway towards the development of educational resources and support systems, particularly following two recent international meetings which focused on this issue in November 2009 and July 2010 (National Research Council 2010, Sture and Minehata 2010a).

These innovations include Bradford Disarmament Research Centre's (BDRC) development of an online education resource module (University of Bradford 2010a), a train-the-trainer online course (University of Bradford 2010b), the state-specific national series (University of Bradford 2012) and proposals for a set of regional networks around the world to support both educators and practicing scientists as they engage with dual-use issues. Much of the research cited here indicates that it is necessary to show scientists how their benign work may be at risk of dual-use application; our experience in presenting a range of real-life scenarios that clearly show how dual-use risk can be identified and addressed shows that this is an effective method of teaching. It was also clear from the discussions at a meeting in Bradford in July 2010, based on the experiences of the delegates and on research reported at the meeting, that the delivery and framing of biosecurity education can be introduced and managed within existing provision covering biosafety and bioethics in university life science programmes (Sture and Minehata 2010a).

A formalized national action plan

However, along with the development and launch of biosecurity-related educational resources and support, we need to consider a broader perspective through an action plan to guide and coordinate efforts to define and implement a coherent educational strategy. As each state has its own scientific and technological interests, industrial profile and university science focus, each action plan should be drawn up on a national basis, rather than on a regional or a global 'one size fits all' model. In addition, this national approach can be tailored to the requirements of the BWC through implementation under national legislation and other civil society guidelines that are appropriate to that state.

At the Bradford meeting (supported by the UK's Economic and Social Research Council and the Japan Society for the Promotion of Science) in 2010, a dialogue was initiated about the development of such national education action plans. Discussions began around the question 'What would a national dual-use and biosecurity education action plan look like?' (Sture and Minehata 2010b). We proposed that an action plan should include the 12 points listed in Figure 1.

The applicability of the first seven points to the industrial, as well as to the university sector, make this template a useful tool also for both continuing professional development programmes and the university sector; it is crucial that industry be included in any national biosecurity education plan.

Academic/industry and CPD-driven activities

The first seven points are relatively easily achievable at grass-roots level in the academic and industrial sectors. The first three are low- or no-cost activities that rely principally on a willingness to engage with the topic by interested, aware individuals and groups. Acknowledgement by a state's scientific community of the need for a dual-use education plan for the present and future is a crucial starting point, requiring either a critical mass of grass-roots individuals in support of it, or at least a powerful individual in a position to move the plan forward. Unless there is open recognition and discussion of the problem of dual-use and biosecurity, then educational responses will not emerge or be taken up if offered. However, even bearing in mind current low levels of awareness, it is still possible to see some encouraging signs. Evidence shows that once the subject of biosecurity has been discussed in a particular country, especially through the use of real-life dual-use case studies, then considerable interest in it can be awoken, leading to requests for resources and support in the learning and teaching of biosecurity issues. A key avenue for individuals and groups to influence their colleagues is to utilize existing frameworks for information-sharing and policy-making, such as institutional research boards, ethics committees and professional association meetings.

By identifying what is currently taught in a state's education and industrial sectors through surveys, it is possible to map current knowledge and teaching around biosafety and bioethics, even in the absence of biosecurity provision. The widespread nature of biosafety and bioethics teaching offers opportunities to implant biosecurity teaching into these programmes without having to devise whole new courses. A national survey also allows

identification of the location of experts and potentially-interested individuals and other expertise, which facilitates networking.

The development of a network of interested lecturers and others who can act as champions in the implementation of biosecurity education in their own institutions is the next step. This is a key action point; at the 2010 meeting in Bradford several colleagues reported pockets of awareness and interest in dual-use issues within many national life science communities, all of which resulted from either a single motivated individual or the work of motivated NGOs within a state (Sture and Minehata 2010a).

The next stage is to develop appropriate content for relevant biosecurity courses. States all face a range of natural as well as manufactured biothreats and it is inappropriate to try to apply a one-size-fits-all set of courses globally. In order to meet such diverse needs, BDRC's educational module resource (University of Bradford 2011a) has been devised as a comprehensive foundation on which to build biosecurity training and awareness-raising in any state, providing a background to biosecurity issues and the history of the BWC. Being freely available online, it is accessible around the world at any time and can be adapted to suit local needs. BDRC's train-the-trainer course (University of Bradford 2011b) is also available as a starting point, and work is ongoing in Bradford on the national series (University of Bradford 2012), a collection of nationally-focused modules that allow interested stakeholders and others to access a five-lecture overview of the biosecurity issues affecting their own country (in all the UN official languages and in some others). National champions and other interested stakeholders can build further on these by developing their own specific, appropriate materials over time.

Implementation of pilot courses is the next stage. Whether this is done on an institution-by-institution basis or at a national level would be for a state to decide for itself. Largely, this would depend on the state's profile of institutions, its scientific and technological activities and the availability of tutors. It is likely that materials will need to be quite discipline-focused, to enhance uptake among students, scientists and other stakeholders by motivating them to engage with the subject.

Monitoring and evaluation of courses will follow the implementation stage. Through these activities, it should be relatively easy to elucidate best practice (what is most effective in achieving professional and community-level changes in behaviour in the recognition and active management of biorisk in life science research and practice), as long as effective communication channels are in place to allow this to emerge. Monitoring and evaluation activities may consist of a national annual meeting of biosecurity educators, scientists and other stakeholders, a national website acting as a forum for discussion and a repository of materials and evaluations, or other nationally-appropriate methods of sharing practice. Such activities will also highlight what pitfalls to avoid as well as strengths to enhance further. Another highly recommended option would be for professional associations to coordinate such activities, and this could have the added effect of enhancing discussion of codes of conduct over time, or at least the development of biosecurity awareness guidelines for stakeholders. Professional association involvement would also be useful to aggregate national best practice with that of neighbouring countries or with those who share similar

science and technology profiles in order to build a regional approach to biosecurity education – the trans-national nature of professional associations lends itself to this role especially well. Such national and trans-national activities could certainly enhance compliance with the BWC and other internationally-mandated regimes, such as the International Health Regulations (IHRs) (World Health Organization 2005) and UN Security Council Resolution 1540 (2004).

Government or advisory body-driven activities

Top-down activities play a role in developing guidance, codes of conduct, appropriate legislation where necessary and stipulating official educational requirements. We suggest that all of these should both require and support the implementation of biosecurity education in each particular state.

This level of activity requires that decisions be taken at national and international levels, by those bodies that have the power to make and implement policy and influence or actually direct scientific activity. For example, national governments should develop appropriate legislation to suit their own scientific needs, while professional associations, often being trans-national in nature, should develop technical, ethical and responsible-research standards, possibly in the form of binding codes of conduct that are applicable to their own disciplinary needs. Such regulations need not involve the imposition of a new level of bureaucracy adding to the burden already shouldered by scientists; rather, they should enhance the dissemination of biosecurity awareness and education among the scientific community wherever possible through existing channels and support systems that will enable countries to comply with their responsibilities under the BWC. For example, an existing professional code of conduct in a particular professional group could simply be adapted to include a section on biosecurity competency, rather than devising a separate code for biosecurity issues.

A further key stage is the establishment of clear, active links between academic institutions teaching biosecurity issues and other stakeholders in the national biosecurity sector. These would include relevant industrial partners, defence agencies, import/export control agencies and others associated with scientific activity within a country. National biosecurity stakeholders would therefore be brought together in meaningful relationships allowing open discussion, negotiation and resolution of biosecurity issues that emerge within that country's experience. Membership of such stakeholder groups ought also to include, even though it would be on a trans-national basis, the funders of research and scientific journal editors. In addition, once biosecurity education has been established in universities, it should be passed on through professional associations and industrial communities. This can be achieved via mechanisms such as continued professional development programmes and through dissemination of information and practices in journals and at conferences. Obviously, interpersonal communication between scientists, students and educators also plays a key part in the propagation of biosecurity awareness. Another option would be to begin with biosecurity education initiatives in industry; this would have a direct effect on what is taught in universities, as industrial employers would require a certain level of biosecurity competency in their new graduate intakes. Given that industry is likely to begin to consider

insurance cover to protect itself against biosecurity events in the future, the ‘industry first’ approach may actually be the more powerful route.

Building on the establishment of stakeholder groups, and in collaboration with neighbouring countries, or those with whom a country shares commercial or scientific interests, it will be possible to develop international, either regional or global, networks to share best practice between countries and scientific communities. By sharing best practice, states will be able to learn from the experience of others and implement them in relevant forms ‘at home’. The sharing of best practice will also make significant contributions to compliance with the requirements of the BWC and other regimes.

Ideally, biosecurity education should be made mandatory. Until it is formally or legally required, many in the life science community are not likely to participate willingly. As mentioned above, this scenario is possibly avoidable by the implementation of biosecurity education in industry either prior to or alongside university initiatives, driving the content of university courses. As long as the scientific community is not engaged with its biosecurity responsibilities, a state cannot be satisfied that it is in compliance with the BWC.

Whether biosecurity education is made mandatory or not, it is vital that monitoring of the consequential growth of sensible codes and oversight systems takes place. The explosion of biotechnology capability and capacity that is current around the world demands that any new education policy has built-in evaluation and monitoring processes that will enable it to adapt regularly as scientific advances demand a response. Clearly, scientists are the key people to lead this process; if they do not, it is likely that non-scientists in positions of power and authority will take on the role, leading to decisions being taken that are insufficiently informed by the scientific community. Oversight and monitoring could relatively easily be set up and managed by stakeholders in the education and professional fields. Higher education networks and professional associations could also work together to track the effectiveness of education from the undergraduate to the continuing professional development stages of scientists’ careers. The key point of monitoring is, of course, to seek evidence of changes in behaviour in the life science community. Ultimately, if scientists are educated about biosecurity but do not subsequently make any changes in their behaviour or decision-making processes as a result of it, then the educational provision needs revision.

Finally, the reporting of national progress to government bodies, meetings of the BWC and scientific associations is desirable. This will not only strengthen each state’s engagement with biosecurity issues, but will enhance the sharing of best practice and the uptake of education by more states. The international nature of professional associations provides a unique channel for ideas to percolate up and down the profession and around the world. In a peer-managed setting, there are prospects for open debate on a range of issues raised by scientists, and opportunities for the making of informed decisions among experts. Through such mechanisms, scientists place themselves in a position to influence policy affecting their work. Crucially, by reporting to the BWC on a national basis, states can demonstrate their compliance with the requirements of the Convention; by working on a national level, taking into consideration the specific needs and patterns of education, sharing of best practice and monitoring in each individual state, scientists and policy-makers can work in ways that suit

them and allow effective and meaningful compliance with the Convention. There is already an opportunity in place to report on such activities to the BWC under the confidence building measures mechanism, and such an approach is recommended.

Mapping national reports

This can be done at two levels. Nationally, universities, industry bodies and government departments can contribute where appropriate, in order to track national progress in the provision and uptake of biosecurity education. Internationally, this can be achieved by professional associations and by the BWC, allowing comparison between states while highlighting those which need to improve their performance. Publication by the BWC, or even by a professional association, of a simple cross-tabulation chart showing the compliance of each country with the 12 points of the education model will serve as a monitoring tool, a reinforcement of the need for education and an encouragement to those states lagging behind others in progress.

A policy trend map

In a similar way, once national education, monitoring and reporting is underway, it will be possible to develop a comparative policy trend map, illustrating developments within states. These policy developments would include a range of activities that build on the existing biosecurity education programmes that countries have implemented.

An initial and far-reaching policy change would be to amend the evaluation criteria by which university and industry programmes are currently assessed. Just as ethics is now a criterion that must be addressed by institutions at the corporate level in order to receive funding or to be approved as an education provider, biosecurity education should be adopted as an approval criterion. Institutions, and the programmes offered by them, should be required to show how they are addressing biosecurity education, and preferably demonstrate what systems are in place to respond to identified risks. Through such a requirement, stakeholders will be able to see at a glance the position held by an institution in relation to its biosecurity responsibilities.

An educational resource for codes of conduct would be desirable, and this could, of course, be led by scientific associations and universities alongside government where necessary. A number of initiatives relating to codes of conduct have been instituted since the Fink Report (National Research Council 2004), including a statement by the Inter-Academy Panel (IAP 2005); the adoption of codes by two major science unions (National Research Council 2010); codes of conduct produced by the Science Council of Japan (2006) and KNAW (the Royal Netherlands Academy of Arts and Sciences) in 2007 and currently (2011), consultations are ongoing by the Indonesian Biorisk Association for a code of conduct for Indonesian scientists (Sudoyo 2010). It is worth pointing out that codes do not in themselves cause culture change; they must be supported or pre-empted by education programmes, and they must be developed by the people who will be using them in order to achieve 'buy-in' from the grassroots-level upwards.

In order to sustain education and achieve an ongoing commitment to a biosecurity education policy, it is important to develop capacity-building programmes among the science community. Here, resources such as those from BDRC are useful. However, other self-developed nationally-relevant courses are also to be encouraged, allowing stakeholders in individual states to focus on biosecurity issues that are most relevant to them. International awareness of biosecurity threats in other countries will, of course, be disseminated through ongoing collaboration and communication between scientists in their capacity as members of trans-national professional associations.

It would also be highly advantageous to the uptake to biosecurity education and practice if funders were to change their evaluation criteria to require consideration of dual-use and biosecurity potential in all grant bids. This has been implemented in regard to research ethics in recent decades, with ethics now being high on the agenda in research proposals. Such a change in funding policy would highlight the need to consider biosecurity risks and necessitate the provision of appropriate education to provide scientists with skills with which to make such judgments and propose resolutions.

Similarly, were the editors of scientific journals to demand consideration of biosecurity risks as a pre-requisite to publication of research, scientists would be prompted to engage with the issue from the conception of the research up to publication, and of course, beyond this. This particular aspect of policy change is perhaps one of the most crucial in the debate, given the vital importance of publication to the scientific method and to the argument of academic freedom.

Each state should establish its own national advisory board for biosecurity issues. This is preferable to a single international advisory board attempting to apply a single set of criteria to a varied and substantively different body of countries; an exception to such an international body would be any advisory board set up by a professional association. However, the type of national advisory board suggested here is one that shares authority between government and scientific governance. From this foundation, legislation may emerge, utilizing contributions and expertise from the policy and the technological communities. This board would be responsible for overseeing national biosecurity education policy and implementation, the monitoring and evaluating of it, recording and advising on dual-use and biosecurity risks identified and the actions taken to address them, and reporting up to national government and the BWC.

Finally, the legislation of a national biosecurity act would be an influential outcome of the entire process described here. An effective education policy and the engagement of scientists and policy makers with subsequent activities to reduce the risk of benign science being exploited for malign purposes can only be sustained in the long term if legislation drives it.

Linking the action plan criteria to the statements of the BWC

To enhance national uptake of the 12-point action plan shown in Figure 1, it would be helpful to link the criteria to specific statements made in BWC reports. Some examples are provided here:

Criterion 1, 'Acknowledge the need for a plan for the present and the future' responds to Paragraph 26 of the 2008 Report: 'States Parties noted that formal requirements for [education courses] could assist in raising awareness and in implementing the Convention'. Criterion 4, 'Develop appropriate content for courses', responds to Paragraph 7 of the Report of the MSP 2009: '(ii) Ensure that tools and courses and education materials are available in the native languages of practitioners' and '(iv) Make use of the full range of modern educational tools, including modular approaches, supporting materials, documents and online resources; a focus on practical training, video-assisted training, re-training and professional education' (United Nations 2008, p. 15).

National variation

There is a need to accept a degree of variation in action plans depending on the national conditions in each state. Such conditions include social organization (political, social and cultural patterns); economic status (funds available for biosecurity work); technological status (what type and level are accessible); religious influences (which may permeate society and attitudes); and linguistic styles (how people talk about and conceptualize biosecurity). There are, of course, other models with which to frame national societies, but it is important to acknowledge that each state should implement what works best for it, in its own way.

Support and reporting

A support system is desirable to assist States Parties to the BWC in the production of national reports on their education initiatives and progress, preferably annually, but at least on some regular, meaningful basis. This support system will also vary in terms of each state's needs. Consultation between stakeholders needs to be carried out prior to deciding who is best placed to produce the report, and what form it should take. Once an annual or regular report is instituted, should these reports be monitored in-state and internationally? An alternative would be to simply table reports at annual or regular meetings of appropriate organizations or government bodies, although there is a risk then of reports being buried, resulting in no reflection, learning or action for change. If a monitoring process is adopted to deal with reports, who will carry this out, when and where? And will such a monitoring body have powers to require change as a result of the contents of the report? Consideration must be given to follow-up processes and mechanisms.

Further ideas?

We would be interested to hear of further ideas from colleagues and stakeholders in the biosecurity debate. We want to learn of other suggestions that may help in the development of national education action plans and then include them in future guidance on the development of such strategies. To share work and ideas between colleagues from a range of areas will help the advancement of this issue and the promoting of it regionally and at the BWC over coming years. We look forward to hearing from interested parties.

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1. Acknowledge the need for a plan for education for the present and the future
2. Identify what is currently taught (a survey)
3. Develop a network of interested lecturers
4. Develop appropriate content for courses
5. Implement pilot courses
6. Monitor and evaluate pilot courses
7. Identify and elucidate best practice
8. Institute clear, active links between industrial partners/associates, defence agencies and academic institutions teaching biosecurity
9. Develop or participate in an international network to share best practice
10. Make dual-use/biosecurity education mandatory
11. Monitor consequential growth of sensible codes and oversight systems
12. Report on progress to BWC meetings and to appropriate meetings of scientific associations.

Figure 1.
A national biosecurity action plan.

1. Developing an educational resource for codes of conduct,
2. Developing capacity-building programmes,
3. Changing evaluation criteria of funding bodies or review criteria of scientific journal,
4. Changing evaluation criteria on higher education institutions,
5. Establishing a national advisory board, and
6. Legislating a biosecurity act.

Figure 2.
Existing policies to promote biosecurity education.