Conclusion: Lessons for Moving Ahead

BRIAN RAPPERT AND LOUISE BEZUIDENHOUT

If we are to avoid the life sciences becoming the death sciences — as has happened in so many fields of knowledge — then concerted thought and action is required. *Education and Ethics in the Life Sciences* has attended to one aspect of the 'web'[1] of measures necessary to avert this prospect. The need for greater education and awareness about the security–science link was one of the reasons motivating this volume. Its contributions have supported this starting impetus and elaborated the contours. The authors have examined a variety of emerging efforts to attend to the possibility that the life sciences might aid in the spread of disease; most of which addressed issues far beyond sturdy locks on laboratory doors. An aim has been to share experiences, models and resources with readers.

Experiences: Selgelid, Sture, Johnson, and Barr and Zhang have asked how ethics — and particularly ethics training — has been and could be brought to bear on dealing with so-called dual-use concerns. Each of these contributors, as well as others, have cautioned against thinking that the destructive use of science could be addressed by simply requiring budding researchers-to-be to sit in general ethics modules during their university degrees. Whether because of the hidden curricula that often frustrate teaching leading to principled outcomes, the skewed past priorities of bioethics, the need for ongoing and workplace-relevant instruction, or the resistance given to formal ethical instruction, many of the authors have detailed the vital importance of measured and context-sensitive interventions. As argued by Barr and Zhang in particular, despite the international character of much of the life sciences, the national structures in place for research and bioethics are of major significance. Not only do research cultures differ, but the pressures on the individual scientist can also vary dramatically between countries and research communities. It is therefore of marked importance that dual-use education not only address the ethical background of scientists, but also the social and cultural context in which they are operating. In developing countries, for example, considerations such

1 See Rappert, B. and McLeish, C. (eds) 2007, *A Web of prevention: Biological weapons, life sciences and the governance of researc*h, London: Earthscan.

as limited resources, governmental and social expectations, as well as cultural norms may affect the way in which ethical education is internalised and applied (see below).

Models: The chapters — particularly those in Part 2 — outlined a range of possible rationales, strategies and methods for bringing in educational measures. The inter-related chapters of Minehata and Shinomiya and Mancini and Revill showed how a process of 'survey-contact-network-assist-resurvey' provided a basis for building national understanding and interest. Enemark described a series of regional workshops in Australia conducted by members of the National Centre for Biosecurity. Drawing on past experiences elsewhere, the Centre members were able to complement renewed concern about the control of sensitive agents and devise an agenda for required future activities. Because of their long-term engagement with biosecurity-related issues, Connell and McCluskey suggested a number of routes for introducing attention to the misuse of science into a university setting: 'Responsible Conduct of Research' training, institutional biosafety committees, laboratory-safety training, a biodefence certificate, and an institutionally based 'train-the-trainer' system. As they argue at the end of their chapter, the strengths, limitations and prospects for each of these approaches needs to be seen against the consuming time demands placed on those associated with the life sciences. At the level of national governments, Garraux gave a work-in-progress account of the implementation of an awareness-raising project in Switzerland; one that suggests how those inside and outside of government can work together in mutually beneficial ways. His lessons outline paths for sustaining long-term outreach to both academic circles and first responders. Finally, Friedman detailed the most 'top-down' example of an education development given in this book. The Israeli case illustrates how science and security organisations can work together to establish a national structure for advancing education. Despite focusing on particular initiatives associated with their own work, each of the authors suggested that a multi-level approach is needed to address biosecurity education.

Resources: The Education Module Resource (EMR) described by Dando and Whitby presents easily accessible, electronic-support material that can be used to raise awareness. By avoiding the 'one-size-fits-all' approach, this resource is available for lecturers to fit into existing programmes (as further discussed by Revill and Mancini). Dando and Whitby also forwarded an expert-level distance-learning programme that makes use of innovative electronic online technologies that facilitate outreach on a worldwide basis. In her essay on teaching ethics to science students, Johnson not only highlighted the importance of pedagogy

and dedicated teaching of ethics for science students, but also gave an outline of innovative methods such as role-playing which make ethics more accessible to students.[2]

So in summary, *Education and Ethics in the Life Sciences* has indicated possible guiding philosophies, strategies, enabling mechanisms, techniques and materials. But just as the contributors have detailed the importance of context-sensitive tuition, it needs to be recognised that the achievements documented in this volume cannot be reproduced elsewhere by a simple mechanical duplication. The arguments offered are given in the spirit of providing a springboard for creative thinking and action. Their relevance should be interpreted in different ways across varied situations, a point taken up shortly.

The need for active questioning of the significance of lessons from this volume (and elsewhere) is underscored by a point made by Dando and Whitby: while it is possible to demonstrate how some forms of education and ethics training help further specific teaching objectives, there is little in the way of agreed standards for evaluating the significance of ethics teaching on future behaviour.[3] Moreover, as Connell and McCluskey note, studies that have been done of major ethics-related training requirements — such as those associated with the US National Institute of Health's (NIH) Responsible Conduct of Research initiative — indicate only modest accomplishments in relation to the criteria used to measure them. Therefore, caution is prudent in thinking about what works and what can work.

Arguably, these points also allude to a fundamental question that has reappeared throughout this book; that being: 'What must be done and by whom?' As included in the Introduction, what counts as appropriate education in areas such as biosecurity is often contested because what is considered suitable by the way of education in general is often debated. In her chapter, for example, Johnson wrote of the basic divide between virtues and skill ethics, as well as the complications of philosophers teaching science students. More generally, notions about proper education are inextricably bound with the exercise of authority and expertise. As such, various types of education are not just different ways of achieving the same goal, but themselves are tied to alternative answers to the aforementioned question.

The scope for contention is all the greater in relation to matters central to *Education and Ethics in the Life Sciences*. As with other aspects of security, just

2 As considered as well in Rappert, B., Chevrier, M. and Dando, M. 2006, *In-depth implementation of the BTWC: Education and outreach*, Bradford Review Conference Paper No. 18, available: http://www.brad.ac.uk/acad/sbtwc/ [viewed 1 April 2010]; and see: http://projects.exeter.ac.uk/codesofconduct/BiosecuritySeminar/Education/index.htm.

3 Derived from a reading of National Academies 2009, *Ethics education and scientific and engineering research: What's been learned? What should be done*? Washington, DC: National Academies Press.

what 'biosecurity' should mean and how it can be achieved are matters on which individuals differ. Security, for whom and from what, are only some of the topics leading to division. Today, much of the government-level interest in biological weapons relates to sub-state terrorist groups. While some of those in this volume expressed concern in this regard, others did not. Indeed, many of the senior contributors have been working on bioweapon issues long before the recent upturn in attention to them. Much of the scepticism about the terrorist threat derives from doubts about the ease of inflicting mass casualties through disease. Attention is directed instead towards maintaining the resilience of the existing stigma and prohibition against the deliberate spread of disease into the future — whatever that future brings by the way of new technological possibilities and security environments.

Here, as elsewhere in matters of public policy, the 'process of formulating the problem and of conceiving a solution (or re-solution) are identical, since every specification of the problem is a specification of the direction in which a treatment is considered'.[4] In this regard, it is worth noting that discussions to date about what needs to be done to prevent the destructive application of the life sciences have overwhelmingly been couched within traditional national-security frameworks. Such contexts have stressed the importance of limiting access to materials, agents, findings, equipment, and techniques.[5] However, it could be argued instead that the question at hand should be one of how modern overall science can be entrusted to improve societal wellbeing and security — rather than control them, the focus would be with making science relevant to societal needs. Tackling this would require addressing how social trust is engendered in science and its institutions. That, in turn, is not a matter for technical or policy experts only. Rather, it requires a much more inclusive societal discussion.

While contributors in this volume have written about the need for ethicists, social scientists, and government officials to re-think their commitments and practices, the majority of attention has been directed towards those associated with the life sciences. In turn, within this diverse group, 'scientists' have been at the centre of the discussion about education. That has been justified largely on the basis of the current lack of professional attention to the hostile use of the life sciences, the need for practitioners to become involved if sensible responses are to be devised, and the potential contribution to maintaining the current prohibition. However, clearly the concerns that motivated *Education and Ethics in the Life Sciences* are not matters for scientists alone.

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4 Rittel, H. and Webber, M. 1973, 'Dilemmas in a general theory of planning', *Policy Sciences*, Vol. 4, pp. 155–69.

5 For further elaboration of the limits of current framing of biosecurity, see McLeish, C. 2007, 'Reflecting on the Problem of Dual Use', in Rappert and McLeish (eds), op. cit.; Vogel, K. 2008, 'Framing biosecurity', *Science and Public Policy*, vol. 35(1), pp. 45–54.

Therefore, it follows from the previous three paragraphs that standards for assessing the significance of teaching can be an issue on which people disagree. Even if relative accord were reached on what has been taken as a central aim in this book — namely, preventing the hostile use of the life sciences — measuring the contribution of any education effort to this goal would be problematic. Although it is possible to use certain metrics for evaluating education (such as improved knowledge and understanding of individuals, and the satisfaction of participants with training), these are very much secondary, proxy measures in relation to this objective. Such points along with others from this chapter suggest the need for vigilance regarding what counts as effective learning.[6]

So, while proposing models and resources for further efforts to extend education, in doing so the contributions to this volume have underscored many areas for work that remain. In closing, it is possible to suggest three of these.

1. Widening Engagement: In their study on bioethics education in China, Barr and Zhang mentioned what they called a 'software' problem, meaning that while the facility design met with the required guidelines, the human element of biosecurity had been neglected. When considering extending engagement with issues of education, it is important to recognise the scenarios in which more attention has been spent on developing the facility security than training the staff within it. This is a particularly pertinent situation for resource-limited countries needing to maximise funding results. Including such countries in science-security debates requires sensitivity towards the potential pressures of limited physical and human resources as well as different social priorities.[7]

While US and European academia heavily influence life-science research around the world, it is important that each country examines its own ethical tradition and how it is unique. Education cannot be merely a case of pushing foreign solutions onto life scientists, but should be sensitive to their pressures and beliefs. Scientists, science students and others related to the life sciences do not present a homogenous group of ethical and cultural affiliations, a fact which should be reflected in online repositories. While lack of previous engagement is an international challenge, it has the potential to be rendered more acute by a lack of culturally appropriate teaching methods and content. Further discussion on innovative teaching methods and contextually appropriate case studies will no doubt strengthen and support pedagogy in developing countries.

In need of further acknowledgement is the recognition that differing access to resources such as the internet (for online learning and discussion groups) may

6 For a consideration of this theme, see Argyris, C. 2003, 'A life full of learning', *Organizational Studies*, vol. 24(7), pp. 1178–92.

7 On the latter, see Gould, C. 2009, 'Conclusion', in Rappert, B. and Gould, C. (eds), *Biosecurity*, London: Palgrave.

affect the ease with which initiatives are accessed and utilised. It is important that international education projects consider the possible limitations of their choice of technology for certain nations. As developing countries are more likely to rely on the efforts of champions than their developed counterparts, the significance of support and training for invested teachers cannot be overemphasised.

Dando and Whitby also suggest the development of national and regional networks that may allow much faster development and uptake of material suitable for different countries and regions. This has the potential to become a very powerful resource, as local networks would allow issues to be discussed against a more similar ethical background. It would also facilitate the development and sharing of educational resources that may reflect topical issues and context-appropriate examples. Networking and collaborative partnerships have been strongly encouraged, for example, to develop science and technological innovation in sub-Saharan Africa, and it is possible that the support and exploitation of existing and future research networks could be a valuable tool for expanding the debate.

The process by which policy is developed in individual countries differs, as do the range of people involved. Furthermore, the level of public participation in policy development varies greatly between nations. Nonetheless, there is an international trend towards developing plans on biosecurity in which scientific communities could play a major role. As mentioned by Christian Enemark in his chapter, 'by becoming more familiar with political and policymaking processes, life scientists might be able to suggest better ways of managing the security risks inherent in some research while minimising scientific opportunity costs'. This is of vital importance to countries with emerging science-research communities. Additionally, with a growing number of collaborations between developing and developed countries it is becoming increasingly important that scientists from the former have a voice not only in their national debates, but also in international research communities. This is necessary in order to have their particular situations recognised and considered.

2. Ethics as a Non-issue: As suggested in the Introduction, one the curiosities of the contemporary discussion about the security dimensions of the life sciences is that while it is often said that any knowledge might be used for destructive ends, in practice it has been extremely rare that benignly intended civilian research has been identified as posing concerns.[8] Arguably this speaks to the conceptually confused manner in which the said 'dual-use' potential of

8 Rappert, B. 2008, 'The risks, benefits, and threats of biotechnology', *Science and Public Policy,* February, vol. 35(1), pp. 37–44.

knowledge is conceived. The chapters in *Education and Ethics in the Life Sciences* have indicated the lack of previous engagement with security-related issues among practitioners across varied national contexts.

This overall situation raises practical and conceptual questions regarding how the security potential of science are and could be assessed. Moving into the future, it would seem highly prudent to better understand how, for whom, between whom, and under what circumstances the implications of research become matters of concern. One way forward along these lines would be to examine why practitioners have not identified the potential for destructive application of research.[9] In other words, what institutional structures, professional preoccupations, or other factors, have rendered concerns about the damaging use of the life science 'non-issues' for so many? Such an approach would presumably inform discussions about what kind of education would be relevant to practitioners.

3. International Leadership: Practically, it is clear that nascent efforts could be strengthened through international co-ordination and leadership. What is needed is a forum for building high-level agreement about what should be done and sharing experiences.

As a key cornerstone of the prohibition and stigmatisation of biological weapons, the Biological and Toxin Weapons Convention (BTWC) could help fulfil such roles in the future. As noted in this volume, education has been identified as an important topic between governments party to the treaty in recent years. Indeed, as Dando and Whitby document, explicit international recognition of the significance of the awareness and education of life scientists runs back to the Second BTWC Review Conference in 1986. However, as they also suggest, this recognition in itself has not been sufficient to deliver adequate concrete measures. Therefore, what is needed is a plan for concerted action. That plan could include mutual targets, deadlines, and milestones; the establishment of international and/or regional co-ordinators; a programme of international workshops; and agreed bilateral and multilateral assistance.

Perhaps what is needed most for the future is a collective vision among states, intergovernmental organisations and members of civilian society. As part of an address to the Meeting of Experts of the BTWC in 2008, one of the authors (Rappert) proposed such elements for a shared vision, including agreeing:

> …all those graduating from higher education in fields associated with the life sciences should be familiar with the international prohibition against biological weapons;

9 Eliasoph, N. 1998, *Avoiding politics*, Cambridge: Cambridge University Press.

> …all those undertaking professional research careers should have received effective training or instruction related to preventing the misuse of their research;
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> …each government should commit itself to initiating a dialogue with their respective national science academies (or other relevant bodies) about how the present low level of awareness can be swiftly corrected.

Regardless of whether or not these elements are proper, current discussions and efforts would do well to organise themselves around such positive shared goals that are subject to joint questioning.

As outlined in the Introduction, if handled properly, concerted attention and action to education in the BTWC could help ensure that conventions remain meaningful and robust moving ahead. The 2011 BTWC Review Conference provides an opportunity to formulate and arrange such a plan; one that should not be lost. The formation of such a shared agenda between governments could open a new chapter of reflection on how to ensure the prohibition of biological weapons.