After COVID-19: Time to Agree A Biosecurity Code of Conduct Under the Biological and Toxin Weapons Convention*

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Summary

The devastating COVID-19 disease outbreak of 2020 is likely to cause a profound rethink of how national and international communities deal with such outbreaks whether they are caused naturally, accidentally or deliberately. This paper suggests that now is the time to build on two decades of work within the BTWC and for States Parties to agree on a Biosecurity Code of Conduct under the Convention as proposed by China. Over the past two decades, as part of their attempts to strengthen the BTWC and thereby to help prevent the development of biological and toxin weapons, States Parties have given considerable attention to the potential utility of Codes of Conduct for life and associated scientists. This paper reviews these debates about this novel dual-use ethical challenge within the Convention and concludes that a Code of Conduct should be agreed at the 2021 Review Conference, but that radical reorientation of the mandatory education of such scientists will also be needed to make the agreed code effective.

I. Introduction

Largely out of sight of most people, States Parties to the Biological and Toxin Weapons Convention (BTWC) have been meeting at the United Nations in Geneva over the last two decades trying to find ways to strengthen the Convention following the failure to agree on a Protocol during the 1990s. Given the application of developments in science in the major offensive military biological warfare programmes of the Twentieth Century, where viruses, toxins, bacteria and fungi had been weaponised[1], one major concern for the States has been the impact of rapid advances in the life sciences on the potential ease with which novel and very dangerous biological and toxin weapons could be developed by States, Non-State Actors, or even individuals.[2] The devastating COVID-19 disease outbreak in early 2020 is likely to cause a major rethink about the dangers of natural, accidental and deliberate disease outbreaks in humans, animals and plants when the outbreak is eventually brought under control[3]. As part of that rethink, it should be possible now, 45 years after the Convention entered into force[4], to bring the protracted discussions on a Code of Conduct under the Convention to a successful conclusion at the 2021 9th Five-Year Review Conference of the BTWC. This would make a major contribution to the prevention of further such outbreaks by engaging life scientists effectively for the first time in support of the prohibition of biological weapons that are embodied in the BTWC.

The problem that concerns States Parties to the BTWC was set out at the turn of the century in 2000 by Matthew Meselson, Professor of Molecular Biology at Harvard University when he questioned whether, as all previous scientific and technological

revolutions had been applied in major ways to hostile purposes, it was probable that the same would happen to the revolution in civil biotechnology unless we found ways to prevent that happening. He also thought that this would be a long drawn out struggle, stating that:[5]

> "…During the century ahead, as our ability to modify fundamental life processes continues its rapid advance, we will be able not only to devise additional ways to destroy life but will also become able to manipulate it – including the processes of cognition, development, reproduction and inheritance….Therein could lie unprecedented opportunities for violence, coercion, repression, or subjugation…"

And he pointed out that dangerous capabilities could be available to a much wider range of actors than were available in relation to nuclear weapons:

> "…Unlike the technologies of conventional or even nuclear weapons, biotechnology has the potential to place mass destructive capabilities in a multitude of hands and, in coming decades, to reach deeply into what we are and how we regard ourselves. It should be evident that any intensive exploitation of biotechnology for hostile purposes could take humanity down a particularly undesirable path."

In the following two decades these concerns were illustrated by a series of publications of experiments by civil scientists that caused increasing consternation amongst the security analysts about the possibility of their facilitating the development of novel biological weapons, and this led to a series of major meetings and reports about this *problem of dual use* – the fact that benignly-intended civil research might later be used by others for hostile purposes. It became clear during these two decades that a range of different means applied at various levels in a "Web of Prevention"[6] would be required in order to minimize the potential for the biotechnology revolution to be misapplied for hostile purposes.[7] This paper examines the evolution of the idea of a Code of Conduct under the Convention being a useful part of that web in meetings of the States Parties to the Biological and Toxin Weapons Convention (BTWC) during the past two decades.

Following the failure to bring the decade-long efforts to strengthen the Convention to a successful conclusion at the 2001 5th Review Conference the UK, as one of the three Depositary States for the Convention, produced a summary (a Green Paper) of the available options for developing the Convention in the run up to the recommencement of the meeting in late 2002. A review of this paper[8] noted that one option was "codes of conduct for professional bodies" but also noted that "[W]hile there would be benefits from such an international code of ethics, the Green Paper says nothing as to how such a code might be developed or implemented." Nevertheless, at the meeting in Geneva States Parties to the BTWC agreed that as part of the new Intersessional Process of annual meetings at Expert (MX) level (in the summer) and State Parties (MSP) level (later in the year) the content, promulgation, and adoption of codes of conduct for scientists would be the subject for the meetings in 2005.[9] These annual meetings in 2003, 2004 and 2005 would be used to discuss, and promote common understanding and effective actions to support the Convention.

2. The Initial Meeting on Codes of Conduct in 2005

By the time of the 2005 Meeting of Experts, the difficulties encountered in the later stages of the attempt to negotiate a verification system during the 1990s had reduced and there was certainly an attempt to deal seriously with the issue of codes of conduct

with large numbers of papers being produced for the meetings in 2005 (Table 1).

Table 1: Papers produced for the 2005 Meeting on Codes of Conduct*

Background Papers Four Papers by the SecretariatOne Presentation by the United States
State Working Papers (Total 35) Argentina 1, Canada 7, UK 4, Germany 6, Russia 2, China 1, Japan 2, India 1, Indonesia 1, South Africa 1, Iran 1, Australia 4, Cuba 2, Korea 1, Italy 1
Additional Working Papers at the MSP India 1, Russia 1

*Data from the UN website in Geneva under Biological Weapons Convention/Meetings and Documents.

The papers[10] by the Secretariat covered codes that referred to the BTWC, codes relevant to the life sciences that did not refer to the BTWC, elements of codes from other fields and relevant organisation, associations, professional bodies and institutions which could serve as sources of guidance in the formulation of codes of conduct. The presentation by the United States was a wide-ranging review of relevant codes in the United States.[11] It began by asking some basic questions about codes of conduct (Table 2).

Table 2: Some Basic Questions about Codes of Conduct*

What is a "Code of Conduct"? • Formal statement of values and professional practices of a group of individuals with a common focus, either an occupation, academic field, or social doctrine. • Defines the expectations and directs the actions of a group.
Examples of Codes of Conduct for the Life Science • The Nuremberg Code • The Belmont Report • American Society of Microbiology (ASM) Code of Conduct • Code of Ethics for the Life Sciences
What is a "Code of Conduct"? • Government cannot oversee all scientists and experiments across the nation. • Offers greatest opportunity for improving security of research at the level of individual scientists: • Increases understanding of biosecurity; • Persistent reminder of moral and ethical responsibilities: • Creates a "culture of responsibility and accountability." • Sets professional standards that may have legal implications.

*From BWC/MSP/2005/MX/MISC.4.

Canada similarly submitted a series of papers on common elements codes used in government, professional associations, academia and biodefence together with separate papers on the overlap between codes of conduct and legislation and on the functions of codes of conduct. However, the paper on the functions of codes also considered their possible weaknesses noting, for example, that:[12]

> "False or unrealistic expectations can damn the best of ideas. The creation of code of conduct that will make for a safer, happier, more productive work environment is a lofty goal, but one that will be doomed to failure if the code is ignored.... In addition, an ambitious code of conduct can be derailed by individuals who decide that they do not wish to follow its provisions, with no perceptible consequences to them. This is a key problem with virtually all codes of conduct that lack the power of applying sanctions to violators. Even a code that may have the backing of a financial, professional or legislative sanction may succumb to the pitfalls of disillusionment if not properly constructed."

A related point of particular interest here was raised by Australia in its Working Paper 29.[13] This stated that:

> "1. Amongst the Australian scientific community, there is a low level of awareness of the risk of misuse of the biological sciences to assist in the development of biological or chemical weapons. Many scientists working in 'dual-use' areas simply do not consider the possibility that their work could inadvertently assist in a biological or chemical weapons programme. *For most of these researchers, biological weapons issues may seem irrelevant and therefore strong advocacy is required to overcome natural resistance or ignorance...*" (emphasis added)

The paper therefore continued by reasoning it followed that"

> "... Introducing Codes of Conduct that highlight these issues is an important step in raising awareness. *However, it is not enough simply to put such Codes in place. Without effective measures to educate scientists about the existence and importance of such Codes, attitudes and awareness will remain largely unchanged."* (emphasis added).

Brian Rappert and Malcolm Dando had reported just before the Meeting of Experts on the results of a series of seminars that they had conducted at life science departments in universities in the UK. They concluded that:[14]

> "There was little evidence from our seminars that participants:
>
> a. Regarded bioterrorism or bioweapons as a substantial threat;
>
> b. Considered that developments in the life sciences research contributed to biothreats;
>
> c. Were aware of the current debates and concerns about dual-use research; or
>
> d. Were familiar with the BTWC." (original emphasis).

These authors were therefore in agreement with the Australian position. Moreover, in a further paper before the Sixth Review Conference in 2006, they reported very similar findings from seminars in five other countries.[15] The need for education of life scientists was reiterated by the Russian Federation in a paper for the Meeting of States Parties later in 2005.[16] Russia supported the idea of a code and gave it as the first core element that scientists should

"[B]e well informed of, and apply in their practice, international and national regulatory legal instruments on the prohibition of biological and toxin weapons." So even in 2005 just introducing a code of conduct was not seen to be sufficient to deal with the problem of the potential misuse of research by some of the States Parties.

3. The Meeting on Codes of Conduct in 2008

Given this level of interest it was unsurprising that the 6th Review Conference in 2006 decided that in 2008 during the Second Intersessional Process States Parties would focus on two topics, the second of which being:[17]

> "...Oversight, education, awareness raising, and adoption and/or development of codes of conduct with the aim of preventing misuse in the context of advances in bio-science and bio-technology research with the potential of use for purposes prohibited by the Convention."

Again in 2008, there were two contributions by the Implementation Support Unit on Codes of Conduct, Education and Awareness-Raising and a further eight Working Papers by States Parties, including by China,[18] on these topics. The most significant contribution was by the Netherlands. Their Working Paper stated that:[19]

> "A code is a set of principles and instructions that are binding on members of a particular group in a profession or industry....Moreover, *codes can be classified into different types. Brian Rappert developed this typology..."* (emphasis added).

Brian Rappert, as a Sociologist, had suggested the typology that the Working Paper then set out. This typology can be summarised as follows:

- Aspirational Codes (Set Standards);
- Advisory Codes (Provide Guidelines)
- Enforceable Codes (Make Legal Requirements)

Today, a decade and a half after Rappert's original 2004 paper, it is well worth reading, particularly his summary of the state of the discussions about codes of conduct at that stage:[20]

> "There is a renewed interest in codes to apply to the scientific and industrial life sciences community. Despite the extent and varied interest in a code or codes, there is a lack of detailed proposals about just what such a code or codes would entail. A close reading of the initial proposals shows that there are different concepts about who should devise codes; whether they should be voluntary or enforceable; what purpose they might serve (e.g., raise awareness, proscribe specific actions); what issues they should cover; by what mechanisms they could be agreed; whether a new code is necessary or existing ones should be augmented; and whether there should be a single universal code or various local ones..."

Rappert also argued that it could be very confusing if different people were discussing different types of codes. It has become clear that the discussions in Geneva are best related to an *Aspirational Code* that could be agreed at this international level and then implemented in a variety of codes to fit the different requirements in various countries.

What it is important to understand is that in 2008 it was widely thought that developing a code could be a means to raise awareness of the problem of dual use amongst scientists. This idea was in direct contradiction to the view put forward in 2005 by Australia. As was quite clearly stated in the Netherlands paper as *"[T]he*

main aim of the Dutch Code of Conduct on Biosecurity is to be seen as a contribution to awareness raising." The code developed by the Netherlands was widely circulated for example by the InterAcademy Panel, but while the need for education was noted in the code there was no requirement for it to be in place to support the code. The impact of the lack of education was illustrated by the account given by Koos van der Bruggen of the surprise, among the young researchers in the Netherlands who researched on the airborne transmission of highly pathogenic avian influenza in 2011, at the consternation caused by the submission of their work for publication. According to this account, one of the researchers said that:[21]

> "…he never imagined that the paper would get a red light from the NSABB [National Science Advisory Board for Biosecurity in the United States] and become the focus of a heated international debate about the limits of academic freedom. Watching the flood of news coverage, 'it was strange to think that we had created all of that in our lab'…"

That in regard to an experiment that many security analysts would see as raising very obvious dual-use concerns.

Nevertheless, progress was being made in the development of educational material linked to the BTWC for life scientists. For example, at the 2008 Meeting of Experts Professor Norihiko Yamada made a Statement in the Non-Government Organisations section on a joint Japan/UK project on the development of an Educational Module for Life Scientists. The module is still available on the website of the Federation of American Scientists and consists of lecture slides, references and question topics for 21 lectures in five sections: Introduction; The Threat of Biological Warfare, Biological Terrorism and the International Prohibition Regime; The Dual-Use Dilemma and the Responsibilities of Scientists; National Implementation of the BTWC; and Building an Effective Web of Prevention to Ensure Benign Development.

4. Developing Ideas on Education in Support of Codes of Conduct

This lack of education about dual use was again brought to the attention of States Parties in a contribution by Japan in a joint Working Paper titled *Possible approaches to education and awareness-raising among life scientists* by Australia, Canada, Japan, New Zealand, Republic of Korea, Switzerland, Kenya, Sweden, Ukraine, United Kingdom and the United States at the Seventh Review Conference in 2011. Japan's contribution stated that:[22]

> "…the National Defense Medical College (NDMC) in Japan and the University of Bradford in the UK conducted collaborative research to analyse the current state of biosecurity education in Japan. The research found that there was a lack of educational topics on biosecurity despite a certain level of presence of dual-use references, mainly due to an absence of space in the existing curricula, an absence of time and resources to develop new curricula, an absence of expertise as well as doubt about the need for biosecurity education…"

The paper also noted that "[P]arallel to this survey, the NDMC and the University of Bradford also jointly developed an online learning module in applied dual-use biosecurity education." Moreover, given that level of interest in the topic amongst States Parties it was not surprising that the Review Conference decided that, under the Standing Agenda on developments in the field of science and technology related to the Convention, the Third Intersessional Process would consider:[23]

(d) voluntary codes of conduct and other measures to encourage responsible conduct by scientists, academia and industry;

(e) education and awareness-raising about risks and benefits of life sciences and biotechnology…"

Thus, the Meeting of States Parties in 2015 concluded that:[24]

> "To further address education and awareness-raising about risks and benefits of life sciences and biotechnology, States Parties recognized that the continuous and accelerating rate of progress in scientific knowledge requires the necessity of deepening a culture of responsible use of this knowledge, which takes into account the object and purpose of the Convention without undermining peaceful uses. In order to further efforts on education and awareness-raising about risks and benefits of life sciences and biotechnology, States Parties discussed the need to share information and knowledge on these developments, including dual-use research of concern."

Then in 2016 at the Preparatory Committee for the Seventh Review Conference, China and Pakistan put forward a significant proposal for the development of a template for a code of conduct. Their Working Paper stated that:[25]

> "With the aim to prevent abuse and misuse of bioscience and technology, fulfil the aims and objectives of the Convention and strengthen global biosecurity governance, China has proposed the development of a template of biological scientist code of conduct within the framework of the Convention in December 2015…"

The paper went on to point out that many States had indicated support for the idea and provided suggestions. The elements of the proposed code are set out in Table 3A. The Working Paper proposed that States Parties should "[F]ully exchange views on the issue 'the development of the template of biological scientist code of conduct under the framework of the BWC' under relevant agenda of the Eighth Review Conference."

Table 3A: Elements of the 2015 China/ Pakistan Draft Model Code of Conduct for Biological Scientists*

1. Ethical Benchmark
2. Legal Restraint
3. Research Integrity
4. Respect for the Object of Research
5. Applying Science Research and its Relevant Process
6. Constraint on the Spread of Research
7. Popularizing Science and Technology
8. Organisation's Role
9. international Exchange

* From BWC/CONF.VIII/WP.30

At the Review Conference itself Ukraine and the UK, reflecting on their joint studies and research, pressed the case for serious attention to be given to the education of scientists given the current lack of awareness of the Convention and its implications. Their joint Working Paper argued that:[26]

> "18. The Conference should therefore adopt the following language in the Final Declaration text for Article IV:
>
> The Conference stresses the critical importance of biosecurity education and awareness-raising in achieving effective implementation of the Convention, which should be put into effect through national implementation measures, as appropriate, in accordance with the constitutional process and practices of each State Party.

19. The Conference notes that such measures could include…

(c) promoting the development and implementation of training and education programmes as well as training guides, handbooks and course materials, including raising awareness of the implications of dual use research and technology, for those granted access to biological agents and toxins relevant to the Convention, and especially for those with the knowledge or capacity to modify such agents and toxins…"

Ukraine, Japan and the UK again pressed the case for serious attention to be given to education at the 2017 Meeting of States Parties in a Working Paper on *Recent Developments in Education*. The joint paper suggested that:[27]

"19. There are a number of key points that States Parties might draw from these experiences, taking into account what is most appropriate given their own national structures and organisations:

> The need to reach out and engage with stakeholders over a period, obtain their interest and support, and build networks; it is especially important to engage with staff who will deliver the teaching, and students who will study the materials, to ensure that learning will be effective.
>
> The need to develop appropriate teaching materials, adapting what is already available for their own national circumstances and developing complementary material where necessary.
>
> The benefits of international collaboration and shared experience and expertise.
>
> The benefits of using websites and online techniques to facilitate communication and learning.
>
> The importance of continuing efforts to ensure sustainability."

Finally, China and Pakistan made a clear-cut proposal for bringing this long period of development to a conclusion at the Ninth Review Conference in 2021. At the 2018 Meeting of Experts, they presented a Working Paper that included a draft *Model Code of Conduct for Biological Scientists* (Table 3B).

Table 3B: Elements of the 2018 China Draft Model Code of Conduct for Biological Scientists*

1. Ethical Standard
2. Research Integrity
3. Respect for the Object of Research
4. Process Management for Science Research
5. Constraint on the Spread of Research Outcome
6. Popularisation of Science and Technology
7. Institution's Role
8. Education and Training
9. Awareness and Engagement
10. International Exchanges

*From reference 24

Crucially, China's Working Paper stated:[28]

"9. Hereby, we propose to:

> Continue in-depth discussion on the topic of 'development of a model code of conduct for biological scientists', with a view to reaching consensus on the content of the model code of conduct.
>
> Facilitate the approval of the model code of conduct for biological scientists by the Ninth Review Conference, as well as the authorization by the Review Conference to work on implementation and promotion of the model code of conduct in the future inter-sessional process."

The presentation at the Meeting of Experts had been preceded by an international conference in Tianjin, China on *Building a Global Community of Shared Future for Biosecurity: Development of a Code of Conduct for Biological Scientists* at which China's ideas for the code were discussed in detail by a range of 28 experts from 14 different countries, 6 experts from international organisations and a large host delegation from China itself. The elements of the Code as set out in Table 3B.

It will be noted that there was a significant change in the elements of the code after the Tianjin meeting. As emphasised in Table 3B the elements 8 and 9 were added to the previous version of the code shown in Table 3A. The envisaged code of conduct now clearly had a key element (8) concerned with emplacement of an effective system of education for scientists which stated that:

> "8. (*Education and training*) Scientific community and professional associations should play an active role in education and training. Increase public awareness of the Convention, and *establish a safety education and training system for all parties involved in biotechnology research.* Biological scientists should be encouraged to engage in dialogue and cooperation with social scientists, philosophers and anthropologists, so as to have a better understanding of the possible ethical and social implication of relevant biological research and its outcome." (emphasis added)

It also had element 9 devoted to awareness-raising and engagement of scientists that stated:

> "9. (*Awareness and engagement*) *Biological scientists should be fully aware of the potential threats of dual-use research to human society, ecological environment and economic security.* It is advocated to promote the peaceful application of biological research achievements, to prevent the abuse and misuse of biological products, scientific knowledge, technology and equipment, and to consciously resist any unethical scientific conducts that are harmful to human society." (emphases added)

The new version of the code retained element 10 on the kind of international cooperation that will be needed for example to deal with threats of the kind illustrated by the present COVID-19 outbreak.

Then in his report of the meeting, the Chair of the MX2 Session on science and technology concluded that such a code of conduct would be one of the elements that had the most chance of being agreed at the Ninth Review Conference:[29]

> "...It is the Chair's view that...activities of the ISP should focus on issues that achieved greater commonality of approaches among delegations. In this regard, two areas could be explored: (i) risk assessment and management, and (ii) a voluntary code of conduct for biological scientists and relevant personnel."
>
> "The Chair sees the two topics above as those that could lead to a meaningful discussion during the remaining meetings of the ISP, in 2019 and 2020. They seem to present the best prospect for an agreed outcome on S&T [Science and Technology] issues in the 2021 Review Conference of the BWC..."

How this plays out will depend on how well meetings of the BTWC succeed in 2020 and 2021 in the lead up to the decision making 9th Review Conference. However, China's attitude to the misuse of biotechnology became very clear at the end of 2019 when the scientist who used CRISPR/Cas technology to edit the genomes of three human babies was sentenced to 3 years in jail and a large fine by a court in Shenzhen for illegal medical practice.[30]

5. International Comparisons

Of course, biological weapons are just one of the three types of generally acknowledged weapons of mass destruction and it is therefore not surprising that similar discussions have taken place in regard to chemical and nuclear weapons. The Organisation for the Prohibition of Chemical Weapons (OPCW) that implements the Chemical Weapons Convention (CWC) produced the *Hague Ethical Guidelines*, essentially an Aspirational Code of Conduct, in applying the norms of the practice of chemistry to support the CWC in 2015 (Table 4). There clearly exist differences between the code proposed by China for the BTWC (Table 3B) from that agreed for the CWC (Table 4). For example, the biological code necessarily has more emphasis on respect for the subjects of research as much more of the experimentation involves living organisms, but the clear prominence given to education and awareness-raising is obvious in both.

*** Table 4: Core Elements of The Hague Ethical Guidelines**

1. Sustainability
2. Education
3. Awareness and Engagement
4. Ethics
5. Safety and Security
6. Accountability
7. Oversight
8. Exchange of Information

* From the OPCW Website

The newly established Advisory Board for Education and Outreach (ABEO) of the OPCW produced a major report in 2018 that emphasised the importance of active learning in engaging practicing scientists in maintaining and developing the prohibition to prevent the re-emergence of chemical weapons. The report stated that:[31]

> "One of the most important implications of this research is that 'active learning' methods, as opposed to traditional, lecture-based instruction in which students are passive recipients, produce better and longer lasting results. The results hold for factual information and for more fundamental concepts. The methods can be applied in many settings, including the classroom, the laboratory, or the field."

These developments related to the CWC have been reported by the OPCW in detail to meetings of the BTWC States Parties in recent years.[32] It is to be expected that the OPCW will over the coming years pursue a robust programme of education in support of the *Hague Ethical Guidelines*. Similarly, major developments have taken place in relation to nuclear security education. In 2012 it was already clear that significant efforts were being made to improve the security education of scientists (and others) connected with the nuclear industry. A Briefing Paper titled *Biosecurity Education for the Life Sciences: Nuclear Security Education Experience as a Model* stated that:[33]

> "The INSEN [International Nuclear Security Education Network] is a partnership between the IAEA and educational and research institutions, and competent authorities. Its mission is *'to enhance global nuclear security by developing, sharing and promoting excellence in nuclear security education'*. In order to achieve its main objective, namely to foster and support the implementation of nuclear security education, the Network has identified a set of key areas and activities for collaboration..." (original emphasis).

The text continued by setting out some of these key areas as follows:

-"Development of peer-reviewed textbooks, computer-based teaching tools and instructional material, including exercises and materials for laboratory work;

-Faculty assignment and development in the different areas of nuclear security through mutual faculty exchanges and/or joint development and implementation of in-depth nuclear security training programmes or school....

-Quality assurance: consistency with IAEA defined terminology described in the IAEA Nuclear Security Glossary, the Fundamentals and the Recommendations documents...

-Performance of surveys on the effectiveness of nuclear security education among students and faculty."

Even in 2012, this was an endeavour of a different order to anything being envisaged in relation to the BTWC even today.

The importance of the INSEN model was emphasised in a major review of the literature on dual use and responsible conduct in 2018. The authors concluding that:[34]

"...We found that while there were discussions in the literature about specific elements of culture (management systems, leadership and/or personnel behavior, beliefs and attitudes, or principles for guiding decisions and behaviors), there was a general lack of integration of these concepts, as well as limited information about specific indicators or metrics and the effectiveness of training or similar interventions. We concluded that life scientists seeking to foster a culture of biosafety and biosecurity should learn from the substantial literature in analogous areas such as nuclear safety and security culture, high-reliability organizations, and the responsible conduct of research, among others."

Then in a follow-up effort to find means of assessing the Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences an attempt has been made to modify the nuclear security approach for the life sciences. The working draft titled *Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences: (Self) Assessment Framework* stated that:[35]

"This tool intends to provide a measure of the organizational culture of biosafety, biosecurity, and responsible conduct to aid in the process of enhancing such culture at the local level through baseline and periodic assessments."

And it pointedly drew upon the nuclear security programme adding that:

"While this is an attempt to adapt the nuclear safety and security culture model to the biological domain, future efforts to holistically integrate characteristics and indicators of an organizational culture across chemical, biological, and radiological/nuclear (CBRN) domains may help establish a framework for holistically assessing the CBRN safety and security culture in laboratories and other related organizations working with such hazardous materials. Such efforts will not be possible without the leadership of major international organizations and the support of professional associations."

In this tool biosafety, biosecurity and responsible is defined as:[36]

"An assembly of beliefs, attitudes, and patterns of behavior of individuals and organizations that can support, complement or enhance operating procedures, rules, and practices as well as professional standards and ethics designed to prevent the loss, theft, misuse, and diversion of biological agents, related materials, technology or equipment, and the unintentional or intentional exposure to (or release of) biological agents."

Then, for a particular laboratory, assessments are made of the management systems in place; the behaviour of the leadership and personnel; the principles for guiding decisions and behaviours; and the beliefs, opinions and attitudes of those involved. For example, in regard to beliefs, opinions and attitudes people carrying out the self-assessment are asked to state the extent that they agree with a series of questions such as those set out in Table 5.

Table 5: Questions about Beliefs, Attitudes and Opinions*

1. There is a risk of bioterrorism or an attack with a biological weapon.
5. Biosafety and/or biosecurity deficiencies or vulnerabilities are corrected with a sense of urgency.
10. I am aware that there are ethical, legal, and societal issues and consequences attached to my research.
13. My organization has a culture that supports and encourages trust, collaboration, consultation, and communication with regard to biosafety and biosecurity.
14. National policy and legislation relevant to the life sciences aim to provide protection against the misuse of science.
17. I have received adequate training on the procedures necessary to conduct my work without compromising safety and security.
19. Scientists have an obligation to do no harm.
20. I do/would/will report my concerns to the appropriate people, authorities, and/or agencies if I become aware of activities that violate the Biological and Toxin Convention, United Nations Security Council resolution 1540, or international customary law

*From reference 31.

Answers to these questions can then be summarized in a colour chart to give a picture of the state of the organization in regard to biosafety, biosecurity and responsible conduct and from that picture suggestions can be made as to how the organization can be improved.

6. Conclusions

When the COVID-19 outbreak is over there will undoubtedly be many investigations about what happened and what should be done to prevent any further outbreaks – natural, accidental or deliberate – in the future. There will be many proposals put forward of various importance and difficulty of implementation. We would suggest that one important proposal should be the agreement of an *Aspirational Code of Conduct* under the BTWC as proposed by China with mandatory education in order to effectively engage life scientists in protecting their work from misuse. After almost 20 years of discussion, the proposal is well understood by many States Parties and could be agreed as a set of principles like the *Hague Ethical Guidelines* and then implemented in national codes of various kinds as fits different national circumstances.

In relation to awareness-raising and education initiatives of the kind that would be needed to underscore understanding of the relevance of such codes, important contributions in this connection have already resulted from the state – academic collaboration with the production by the University of Bradford of a Guide to Biological Security[37] that is accompanied by

a Team-Based-Learning Handbook[38]. The chief objective of the latter is to supplement the former by combining teaching material in biological security with an active learning training approach – Team-Based Learning (TBL) - so as to empower educators, students and practitioners as they begin to engage with biological security. Further to this, the use by Bradford[39] of such techniques in proof of concept continuing professional development training has been undertaken under the auspices of the European Union's Human Brain Project where, in 2017 and 2018, evidence-based training of neuroscience professionals and practitioners at the Karolinska Institutet, Stockholm, demonstrated improvement in the knowledge and understanding of participants through engagement in discussions concerning the ethical, legal and social aspects of biological security.

The world is in the midst of a century of unprecedented change, and the 45-year-old Biological and Toxin Weapons Convention stands on a new starting line. It is to be hoped that the international community will take the commemoration of the 45th anniversary of the entry into force of the Convention as an opportunity to keep pace with the times, comprehensively advance the aims and objectives of the Convention, deepen international cooperation on biosecurity, and actively promote the establishment of a community of biological security for the destiny of mankind.

* A presentation based on an earlier version of this paper was given at a meeting in St Petersburg in December 2019. Dando, M R. and Whitby, S. (2019) *Towards Mandatory Education in Support of Biosecurity Codes of Conduct*. Presentation at the Third Workshop of the Academic Network for European Security Studies, St Petersburg State University, 16 – 17 December.

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Endnotes:

[1] Wheelis, M. *et al* (Eds) (2006) *Deadly Cultures: Biological Weapons Since 1945*. Harvard University Press, Cambridge, Mass.

[2] Dando, M. R. (2001) *The New Biological Weapons: Threat, Proliferation, and Control*. Lynne Rienner, Boulder, Colorado.

[3] How the World Will Look After the Coronavirus Pandemic, Foreign Policy, (2020) By John Allen, Nicholas Burns, Laurie Garrett, Richard N. Haass, G. John Ikenberry, Kishore Mahbubani, Shivshankar Menon, Robin Niblett, Joseph S. Nye Jr., Shannon K. O'Neil, Kori Schake, Stephen M. Walt March 20. Available at: https://foreignpolicy.com/2020/03/20/world-order-after-coroanvirus-pandemic/

[4] Jun Kong, (2020) Comprehensive Strengthening of the Biological Weapons Convention Mechanism: Promoting the Building of a Biosecurity Community of Human Destiny. http://world.people.com.cn/n1/2020/0326/c1002-31648530.html?from=singlemessage&isappinstalled=0 (In Chinese).

[5] Meselson, M. (2000) Averting the hostile exploitation of biotechnology. *The Chemical and Biological Weapons Conventions Bulletin*, 48, 16-19. (page16).

[6] The concept of the 'Web of Prevention' was first proposed in the early 1990s by Graham S. Pearson (1993) Prospects for Chemical and Biological Arms Control: The Web of Deterrence, *Washington Quarterly*", Volume 16, Number 2, Pages: 145-162.

[7] Rappert, B. and McLeish, C. (Eds.) (2007) *A Web of Prevention: Biological Weapons, Life Sciences and the Governance of Research*. Earthscan, London.

[8] Pearson, G. S. (2002) *Return to Geneva: The United Kingdom Green Paper*. Review Conference Paper No. 6. University of Bradford, UK.

[9] United Nations (2002) *Final Report of the Fifth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction*. BWC/CONF.V/17, United Nations, Geneva.

[10] United Nations (2005) BWC/MSP/2005/MX/INF1 – INF.4. United Nations, Geneva

[11] United States (2005) *Presentations Submitted by the United States*. BWC/MSP/2005/MX/MISC.4. United Nations, Geneva.

[12] Canada (2005) *Thoughts on the Functions of Codes of Conduct: Potential Weaknesses and Solutions*. BWC/MSP/2005/MX/WP.6. United Nations, Geneva,

[13] Australia (2005) *Raising Awareness: Approaches and Opportunities for Outreach*. BWC/MSP/MX/WP.29. United Nations, Geneva. April 13 – 27.

[14] Dando, M. R. and Rappert, B. (2005) *Codes of Conduct for the Life Sciences: Some Insights from UK Academia*. Briefing Paper No. 16 (Second Series), University of Bradford, May.

[15] Rappert, B., Chevrier, M. I. and Dando, M. R. (2006) *In-Depth Implementation of the BTWC: Education and Outreach*. Review Conference Paper No. 18, University of Bradford, November.

[16] Russian Federation (2005) *Basic Principles (Core Elements) of the Codes of Conduct of Scientists Majoring in Biosciences*. BWC/MSP/2005/WP.2. United Nations, Geneva.

[17] United Nations (2006) *Final Report of the Sixth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction*. BWC/CONF.VI/6, United Nations, Geneva.

[18] China (2008) *Oversight of Science, Education and Awareness Raising, Coders of Conduct*. BWC/MSP/2008/MX/WP.18, United Nations, Geneva.

[19] Netherlands (2008) *Development of a Code of Conduct on Biosecurity*. BWC/MSP/2008/MX/WP.8, United Nations, Geneva.

[20] Rappert, B. (2004) *Towards a Life Sciences Code: Countering the Threat from Biological Weapons*. Briefing Paper No. 13 (Second Series), University of Bradford, September.

[21] van der Bruggen, K. *(2005)* Gain-of-Function Experiments*, Chapter 2* (Box 2.3: Young scientists who did the job) in S. Whitby *et al* (Eds) *Preventing Biological Threats What You Can Do*, University of Bradford, UK. See also Schuurbiers, D. *et al* (2009) Implementing the Netherlands code of conduct for scientific practice – a cased study. *Sci Eng Ethics*, **15**(2), 213 -231.

[22] Australia *et al* (2011) *Possible Approaches to Education and Awareness-Raising Among Life Scientists*. BWC/CONF/VII/WP.20/Rev.1, United Nations, Geneva.

[23] United Nations (2011) *Final Report of the Seventh Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction*. BWC/CONF.VII/7/ Corr.1, United Nations, Geneva.

[24] United Nations (2015) *Report of the Meeting of States Parties*. BWC/MSP/2015/6, United Nations, Geneva.

[25] China and Pakistan (2016) *Proposal for the Development of the Template of Biological Scientist Code of Conduct under the Framework of Biological Weapons Convention*. BWC/CONF.VIII/PC/WP.31, United Nations, Geneva.

[26] Ukraine and UK (2016) *Awareness-raising, Education, Outreach: An Example of Best Practice*. BWC/CONF.VIII/WP.10, United Nations, Geneva.

[27] Ukraine, Japan and the UK (2017) *Awareness-Raising, Education and Outreach: Recent Developments*. BWC/MSP/2017/WP.22, United Nations, Geneva.

[28] China and Pakistan (2018) *Proposal for the development of a model code of conduct for biological scientists under the Biological Weapons Convention*. BWC/MSP/2018/MX.2/WP.9, United Nations Geneva.

[29] United Nations (2018) *Chair's Report on MX2*. BWC/MSP/2018/CRP.3, United Nations, Geneva.

[30] Sample, I. (2019) Chinese scientist who edited babies' genes jailed for three years. *The Guardian*, London, 31 December.

[31] Advisory Board on Education and Outreach (2018) *Report on the Role of Education and Outreach in Preventing the Re-Emergence of Chemical Weapons*. AEBO-5/1. OPCW, The Hague, 12 February.

[32] See, for example, Tang, C. and Foreman, J.E. (2018) *Development of the Hague Ethical Guidelines*, OPCW Presentation at the MX2 Experts Meeting, 9th August. United Nations, Geneva; Tang, C. (2019) *Update on The Hague Ethical Guidelines*, Presentation by the Chair of the OPCW Scientific Advisory Board to the MX2 Experts Meeting, August. United Nations, Geneva.

[33] Novossiolova, T. and Pearson, G. S. (2012) *Biosecurity Education for the Life Sciences: Nuclear Security Education Experience as a Model*. Briefing Paper No. 5 (Third Series), University of Bradford, October.

[34] Perkins, D. et al (2018) The Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences. *Applied Biosafety*, 1 – 12. DOI: 10.1177/1535676018778538

[35] International Working Group on Strengthening the Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences (2020) *Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences: (Self) Assessment Framework*. January 2020 Working Draft.

[36] *A Guide to Training and Information Resources on the Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences*, 2019, developed by the International Working Group [formerly known as the Federal Experts Security Advisory Panel (FESAP) Working Group] on Strengthening the Culture of Biosafety, Biosecurity, and Responsible Conduct in the Life Sciences. Available online at: https://absa.org/wp-content/uploads/2019/04/CULTURE_TRAINING_CATALOGUE.pdf.

[37] Whitby S, Novossiolova T, Walther G and Dando M (2015) Preventing Biological Threats: What You Can Do. A Guide to Biological Security Issues and How to Address Them. University of Bradford, Bradford Disarmament Research Centre. 446p.URI: http://hdl.handle.net/10454/7821. This publication was funded through the Department of Foreign Affairs, Trade and Development (DFATD) Canada and the United Kingdom Ministry of Defence (MOD).

[38] Novossiolova T (2016) Biological Security Education Handbook: The Power of Team-Based Learning. University of Bradford, Bradford Disarmament Research Centre. ISBN: 9781851432783. 85p.URI: http://hdl.handle.net/10454/7822.

[39] Shamin Patel, Linnaeus University, Sweden, Tutors: Malcolm Dando, and Simon Whitby, University of Bradford, UK. Team Based Learning Exerecise - Social, ethical and legal responsibilities of life sciences 1st HBP Curriculum Workshop Series - Research, ethics and Societal Impact. Karolinska Institutet, Stockholm, Sweden. 10-12 July 2017. Video recorded by the Human Brain Project Education Office - https://youtu.be/EFvraNKU1UE. And, Tutors: Malcolm Dando, Simon Whitby, Bradford University, UK Team-Based Learning Exercise - Social, ethical and legal responsibilities of life scientists. 2nd HBP Curriculum Workshop Series - Research, ethics and Societal Impact 15-17 November 2018. Karolinska Institutet, Stockholm, Sweden. Video recorded by the Human Brain Project Education Office - https://youtu.be/vQ_Dfm3jJp0.