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# Close the biological security education gap

Toward a collaborative,  
collective and integrative  
international biological  
security education

18<sup>th</sup> Vaccine Congress

Lisbon

8-11 September 2024

**Professor Lijun Shang**

Biological Security Research Centre (BSRC)  
London Metropolitan University, UK

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# Background and previous works



Background



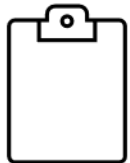
Previous works



Preventing Chemical Weapons (2018)



Cartoons paper



Education Survey Paper



Essentials of Biological Security  
(2024)

# Background

- Addressing the gap in dual-use research within the framework of responsible research under the Biological and Toxin Weapons Convention (BTWC) and the Chemical Weapons Convention (CWC) presents a significant challenge for all stakeholders, particularly within life science communities.
- Awareness raising and education appears to be the key means to close the gap in biosecurity.
- While biosecurity education has long been recognized as a key strategy to address this issue, its effective implementation remains crucial.

# Biological and Toxin Weapons Convention (BTWC)

**Biosecurity:** The protection, control, and accountability measures implemented to prevent the loss, theft, misuse, diversion or intentional release of biological agents and toxins, and related resources as well as unauthorized access to, retention, or transfer of such materials.

# BTWC General Purpose Criterion and Dual-Use Research

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

- (1) Microbial or other biological agents, or **toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes.**”

“Dual use research of concern is life sciences research that, based on current understanding, has the **potential** to provide knowledge, information, products or technologies that could be **directly misapplied** to create a **significant threat** with potential consequences to public health and safety, agricultural species and other plants, animals, and the environment.” ([WHO 2020](#))

# Elements of Responsible Conduct in the Life Sciences

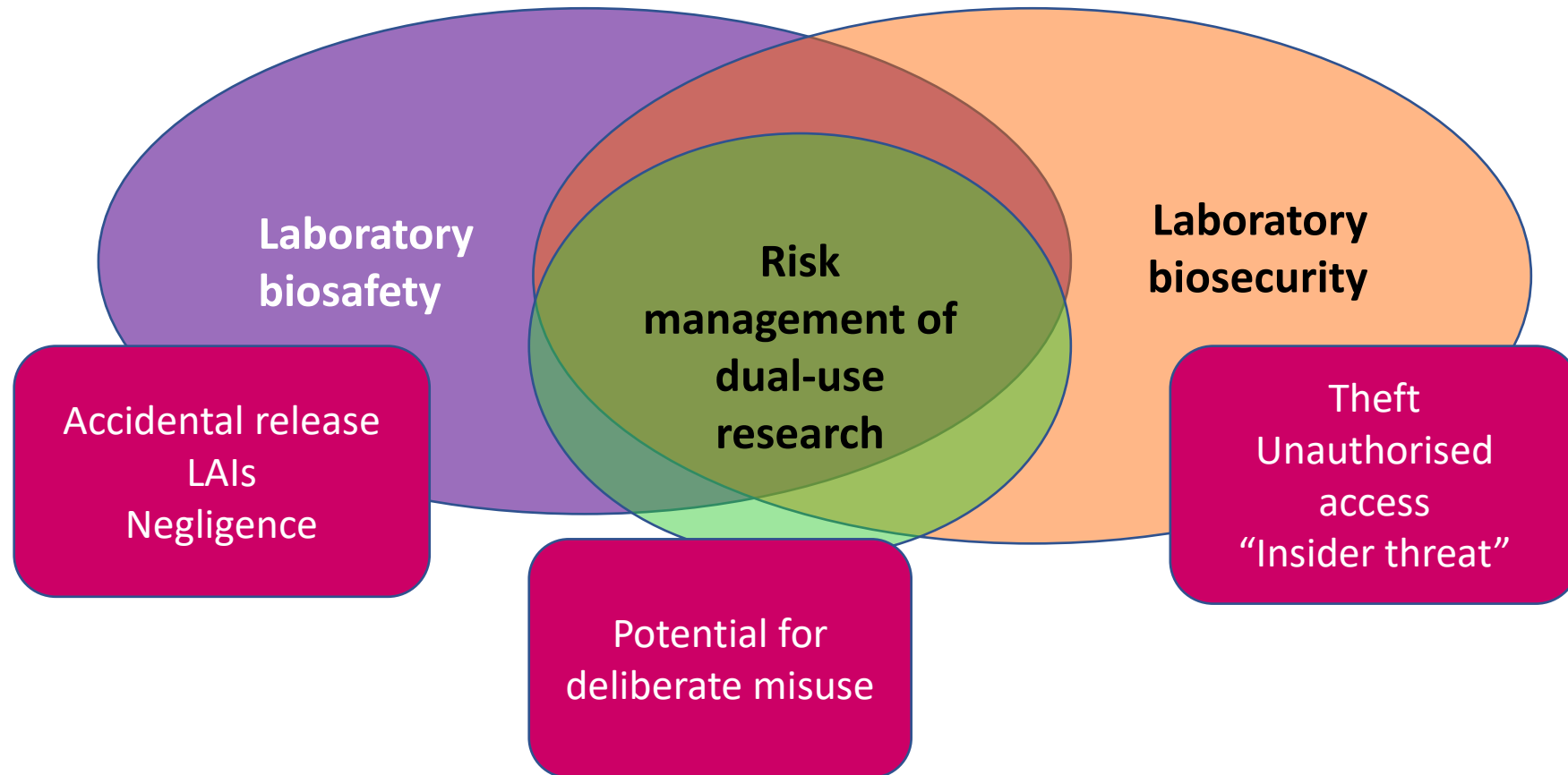


Figure credit: T. Novosiolova

# Trends in Life Science Research and Innovation

- **Pace of science and technology developments** – e.g. rapid progress in both the availability and power of enabling technologies that underpin life science research, including computational and communication resources.
- **Diffusion of research and capacity** – e.g. possible to conduct life science research outside traditional research institutions; de-skilling.
- **Integration of life sciences with other disciplines** – e.g. life science research draws upon expertise in biology, chemistry, engineering, mathematics, computer science; impact of technological convergence.

National Research Council (NRC). [\*Life Sciences and Related Fields: Trends Relevant to the Biological Weapons Convention\*](#). Washington, DC: The National Academies Press, 2011.

# Governance of Dual-Use Life Science Research

Engaging a range of expertise within the science community – from academia, industry, and government – can contribute to efforts to both monitor and assess the implications of science and technology developments for the scope and operations of the BTWC ([NRC 2011](#)).

States Parties note the value of **national implementation measures** to:

- “(b) encourage the consideration of development of **appropriate arrangements** to promote **awareness** among relevant professionals in the **private** and **public** sectors [...];
- (c) promote amongst those working in the biological sciences **awareness** of the **obligations** of States Parties under **the Convention** [...];
- (d) promote the **development of training and education programmes** for those granted access to biological agents and toxins relevant to the Convention [...];
- (e) encourage the promotion of **a culture of responsibility** amongst relevant national professionals and the **voluntary development, adoption and promulgation** of codes of conduct;”  
[emphases added]



# Professional Codes

- Voluntary self-governance mechanisms that establish a set of common principles, practices, and modes of behaviour which professional communities agree to abide by.

Types of codes according to their purpose (Rappert 2004):

- Aspirational codes – e.g. codes of ethics.
- Educational / advisory codes – e.g. codes of conduct.
- Enforceable codes – e.g. codes of practice.

B. Rappert, [\*Towards a Life Sciences Code: Countering the Threats from Biological Weapons\*](#), BTWC Briefing Paper 2<sup>nd</sup> Series No 13, 2004.

# the InterAcademy Partnership (IAP) Statement on Biosecurity, 2005

- **Awareness** – responsibility to take into consideration the reasonably foreseeable consequences of science activities.
- **Safety and Security** – responsibility to use good, safe and secure laboratory procedures, whether codified by law or common practice.
- **Education and Information** – responsibility to be aware of, disseminate information about and teach national and international laws and regulations, as well as policies and principles aimed at preventing the misuse of biological research.
- **Accountability** – responsibility to report possible violations of the BTWC or international customary law to appropriate people, authorities and agencies.
- **Oversight** – responsibility to promote adherence to these principles and act as role models in this regard. ([IAP 2005](#))

# Tianjin Biosecurity Guidelines for Codes of Conduct

- Set out **10 elements** that are intended to inform the development of codes of conduct and national and institutional practices and processes for preventing the misuse of life science research without stifling innovation.
- The Guidelines are aimed at practitioners engaged in work that includes biological science, including those involved in funding, education, and training; research and development (in public and private sectors); project planning, management, dissemination, and oversight.
- Endorsed by the Inter-Academy Partnership and recommended for endorsement to the 9<sup>th</sup> Review Conference of the BTWC.

[Tianjin Biosecurity Guidelines for Codes of Conduct for Scientists](#), 2021.  
China and Pakistan, [BWC/MSP/2020/MX.2/WP.6](#), 23 August 2021.

# Development and Implementation of Codes of Conduct

- The effectiveness of codes of conduct depends on the extent to which codified ethical principles are internalised and embedded in professional practice in the form of tacit standards for appreciation and judgment, that is, until they become professional norms.

T. Novosiolova, '[Enhancing the Utility of Codes of Conduct for Chemical and Biological Security through Active Learning](#)', *ACS Chemical Health and Safety*, 23 July 2021.

- The idea that biotechnologists could *intentionally* facilitate the development of biological and chemical weapons is alien to the majority of those engaged in the life and chemical sciences. This in turn presupposes that they may not readily recognise the issue of dual use as a problem that requires attention. In other words, their appreciative systems are not attuned to the extensive, malign potential of their work. [emphasis as original]

T. Novosiolova et al. '[Altering an Appreciative System: Lessons from Incorporating Dual-Use Concerns into the Responsible Science Education of Biotechnologists](#)', *Futures*, vol. 108 (2019), pp. 53-60.

# The WHO Global Framework

- *“A chronic and fundamental challenge in biorisk management is a widespread lack of awareness that work in the area of the life sciences could be conducted or misused in ways that result in health and security risks to the public. The lack of awareness is unsurprising, given that biorisks are often overlooked or underemphasized in both educational curricula and on-the-job training. If they are unaware of the potential for misuse and potential malicious application, stakeholders cannot accurately weigh the risks and benefits of proposed research or order. Lack of awareness can also mean that stakeholders are unprepared when new technologies are being introduced as diagnostics, treatments or vaccines...”* (Emphasis added)

# Preventing Chemical Weapons Book (2018)

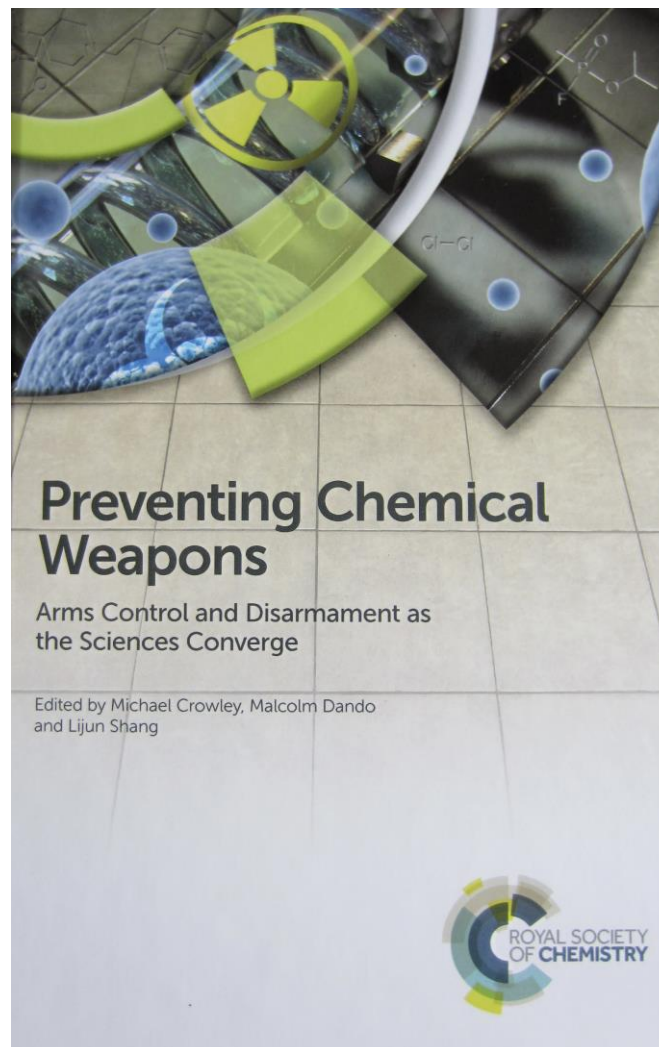
**Section I:** Introduction

**Section II:** The Chemical and Biological Weapons Prevention and Disarmament Regime Today

**Section III:** Advances in Chemistry and Biology

**Section IV:** Implications for Arms Control and Disarmament

**Section V:** The Role of Civil Society



## Themes

1. The **CWC and BTWC** need to be considered together
2. **Scientific and Technological** change is critical
3. **Civil Society** has an important role to play in support of the regime

# Series of cartoons: Innovation Required

- Series of **cartoons** explaining the issue of dual-use and the role of the BTWC and CWC
- Issues of **translation** and the necessity to make the information available in different languages



# Biosecurity Education Survey: Data Required

- Biosecurity Education survey using 21 closed and open questions **to assess the biosecurity education projects** carried out in the last two decades
  1. **Elements required to implement the Tianjin Guidelines missing**

Scientists largely unaware of the dangers of dual use
  2. The **biosecurity education projects are uncoordinated**

A variety of projects carried out but not coordinated
  3. These **deficiencies could be efficiently addressed and remedied**

IBSEN and OPCW/ABEO provide models of ways forward



# Promoting Biological Security Education

- A two-part educational resource comprising a guide and training manual with practical exercises; developed by the University of Bradford, UK.
- *Preventing Biological Threats: What You Can Do* – examines concepts of relevance to biological security organised in five thematic sections.

S.Whitby et al. [Preventing Biological Threats: What You Can Do](#), University of Bradford, 2015.

- *Biological Security Education Handbook: The Power of Team-Based Learning* – uses the Team-Based Learning format to facilitate consideration and critical reflection on biological security concepts.

T. Novossiolovala, [Biological Security Education Handbook: The Power of Team-Based Learning](#), University of Bradford, 2016.

# Biological Security Cartoon Series

- **Goal:** to promote deliberation on key concepts related to biological security.
- **Available in multiple languages:** Arabic, Armenian, Chinese, English, French, German, Greek, Italian, Japanese, Russian, Spanish, Ukrainian, and Urdu.
- **Funding:** UK Research and Innovation Strategic Priorities Fund and HEIF Rescaling Fund through LMU



Content authors: T. Novossiolova, M. Dando, and L. Shang  
Cartoon artists: M. Gkiouli and D. Efstratiadis  
London Metropolitan University, [Cartoon Series](#), 2021.

# Fostering a Biological Security Culture

- “The **responsibility** for the identification, assessment and management of **dual-use implications** rests to differing degrees across **many stakeholders** throughout the **research life cycle**” including researchers and their host institutions, grant and contract funders, companies, educators, scientific publishers and other communicators of research, and regulatory authorities. ([OIE 2019](#)) [emphases added]
- Managing dual-use life science research requires “an enhanced **culture of trust**, personal **responsibility, accountability** and **transparency** in laboratories. [...] **Periodic trainings** that emphasise risk-based safety and dual-use research potential should be recommended for **all stakeholders**, including scientists, academics and regulatory officers in order to increase awareness and understanding of new and emerging threats to biosafety and biosecurity.” ([WHO 2020](#)) [emphases added]

# Management of Dual-Use Risks

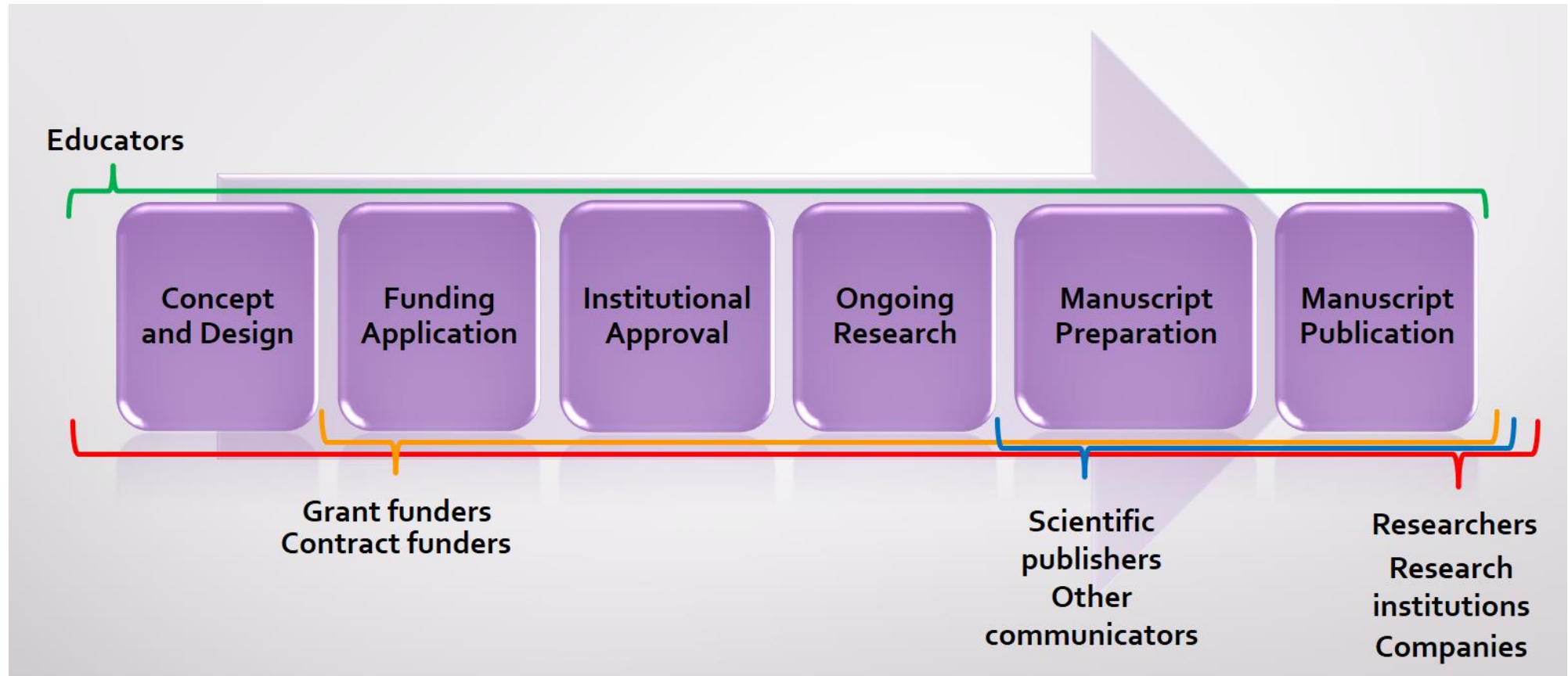


Figure based on NSABB, [Proposed Framework for the Oversight of Dual Use Life Sciences Research](#), 2007  
OIE [Guidelines for Responsible Research in Veterinary Settings](#), 2019. Figure credit: T. Novossiolo

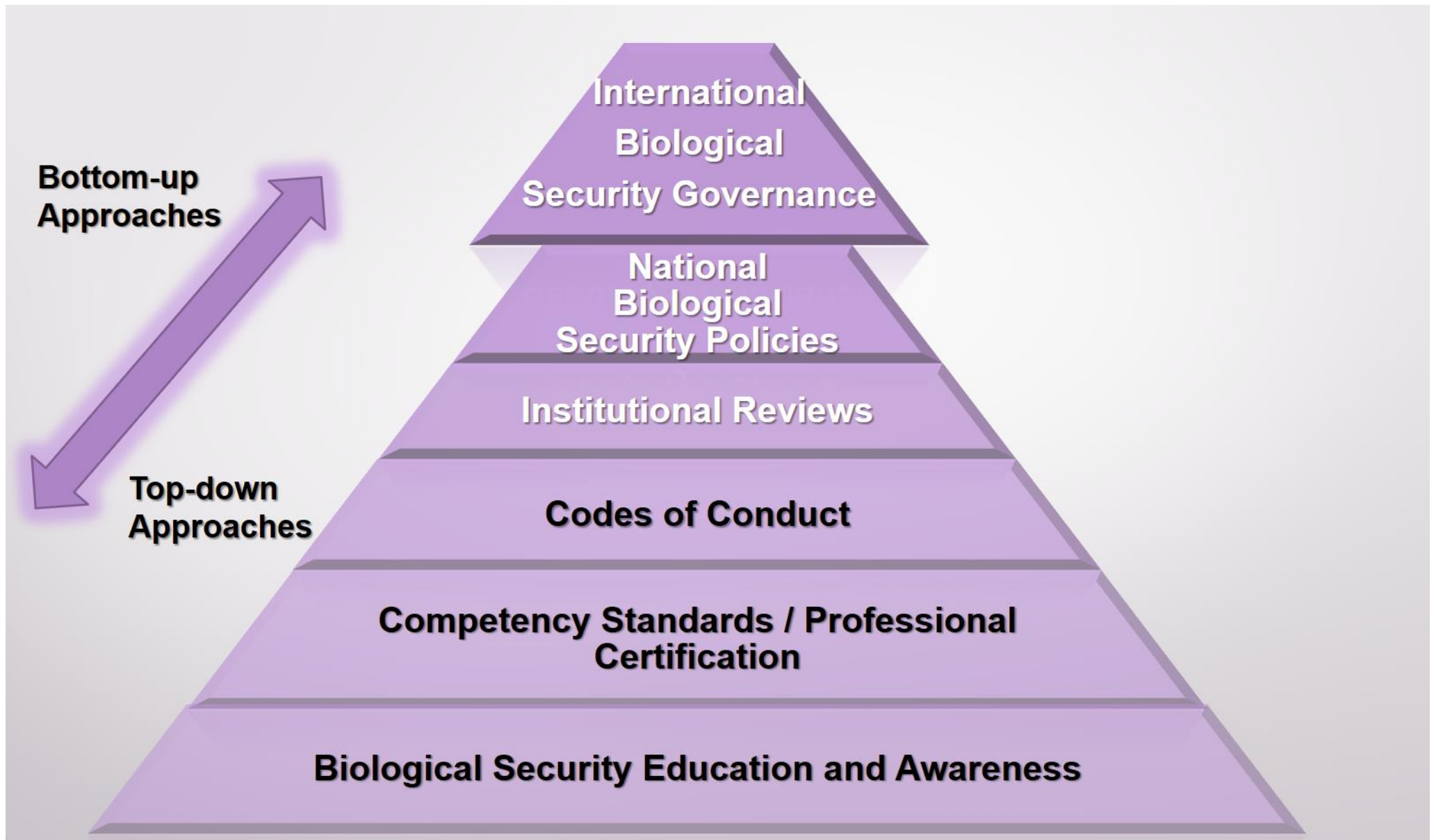


Figure source: [T. Novossioloova and M. Dando, 2021](#)

# Education Tools: Active Learning Required

- **Team-based-learning (TBL)**

- TBL Handbook (*Biological Security Education Handbook: The Power of Team-Based Learning*, Tatyana Novossioloa)

- **Threshold concepts:**

- Transformative, Troublesome, Irreversible, Integrative, Bounded  
Discursive, Reconstitutive, Liminality

- **Training-the-trainer methodology possible**

- **Podcast demonstration available**

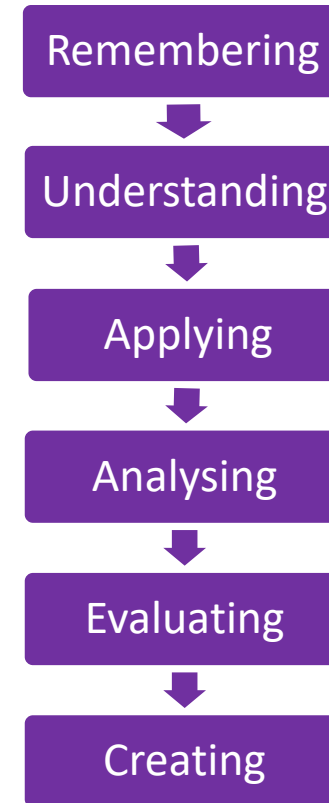
# Value of Active Learning Strategies

- “**Effective** strategies to create organised and distinctive knowledge structures encourage learners to **go beyond** the **explicit** material by elaborating and to enrich their mental representation of information by calling up and **applying** it in various contexts.”
- “Motivation to learn is fostered for learners of all ages when they perceive the school or learning environment is a place where they “**belong**” and when the environment promotes their **sense of agency** and purpose.”
- “A growing body of research supports adopting an asset model of education [...] through which learning experiences and opportunities from **various settings** are **leveraged** for each learner.” [emphases added]

NASEM, [\*How People Learn II: Learners, Contexts, and Cultures\*](#). Washington DC: NAP, 2018.

# The Team-Based Learning Format

1. Pre-Reading Activity
2. Individual Readiness Assurance Test (iRAT)
3. Team Readiness Assurance Test (tRAT)
4. iRAT and tRAT Feedback Session
5. First Team-Based Application Exercise
6. Second Team-Based Application Exercise



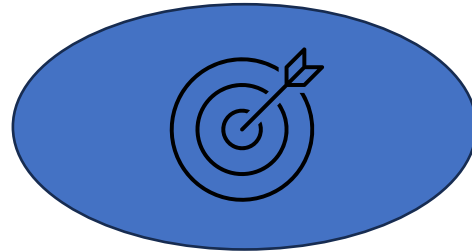
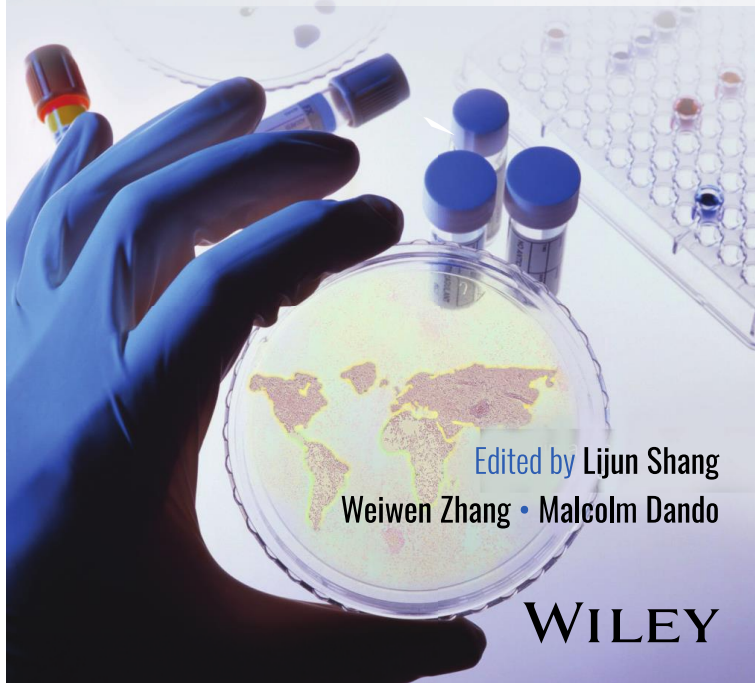
[Team-Based Learning](#), 2021. Figure based on P. Armstrong, [Bloom's Taxonomy](#), 2010.



# Essentials of Biological Security I: Textbook Required

## Essentials of Biological Security

A Global Perspective



### Objective

**To rapidly produce a one-stop-shop resource to help people teach biological security in support of the Tianjin Guidelines.**



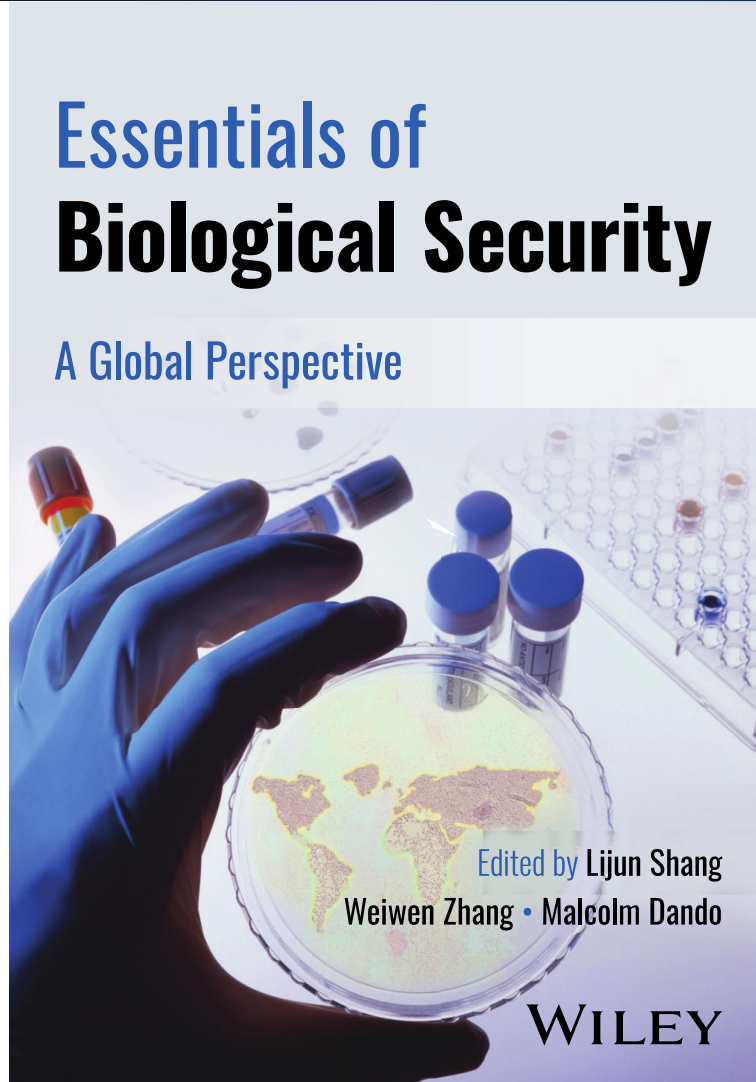
### Design

Authors asked to keep a very tight schedule of outline, first draft, and final draft so as to have a book published within a year.

Five sections and 20 chapters. All chapters short (5,000 word suggested limit) with key points, summary and few references (5 suggested limit and key ones starred).

**Aim to enable translations into multiple languages and to engage authors from around the world.**

# Essentials of Biological Security II: Sections of the Textbook



The book is divided into 20 chapters in five sections:

- 1. Introduction and Overview (1 Chapter)**
- 2. The Threat (7 Chapters)**
- 3. The International Response (4 Chapters)**
- 4. The Role of Scientists (6 Chapters)**
- 5. The Future (2 Chapters)**

WILEY

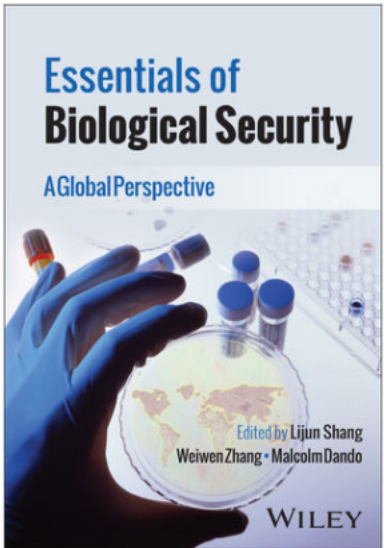
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# Essentials of Biological Security: A Global Perspective

Lijun Shang (Editor), Weiwen Zhang (Editor), Malcolm Dando (Editor)

ISBN: 978-1-394-18903-8 | February 2024 | 320 Pages

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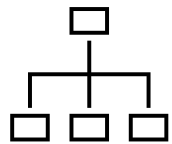
## DESCRIPTION

### Essentials of Biological Security

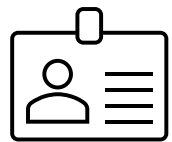
A guide to minimizing the threat of misusing benignly intended and dual-use biological research

EN

# IBSEN Project



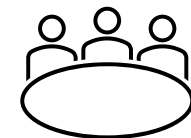
Structure



Contact Database



Website



Coordination meeting

# Structure of the IBSEN I

**Professor Lijun Shang**

Director BRSC,  
London Metropolitan  
University

**Professor Malcolm  
Dando**

Bradford University &  
London Metropolitan Uni

**Iris Magne**

Research Assistant,  
London Metropolitan  
University

**8 International Oversight Board Members** representing a broad geographic coverage

# Structure of the IBSEN II – The International Oversight Board

Dr Maria J. Espona

- Director of Argentina Information Quality (ArgIQ)

Prof Zabta K Shinwari

- Vice Chancellor of the Federal Urdu University of Arts, Science and Technology

Dr Dana Perkins

- Senior Science Advisor, Administration for Strategic Preparedness and Response (ASPR) U.S. Department of Health and Human Services

Prof Xue Yang

- Professor at Law School and a Senior Fellow at the Center for Biosafety Research and Strategy (CBRS), Tianjin University

Prof Brian Balmer

- Professor of Science Policy Studies at UCL

Prof Kathryn Nixdorff

- Professor in the Department of Microbiology and Genetics, Darmstadt University of Technology

Prof Halima Benbouza

- Director for Science and Technology at the National Council of Scientific Research and Technologies, Algeria

Dr Samira Senouci

- First Vice-President of the Moroccan Biosafety Association (MOBSA) and manager at LabSolutions

# The IBSEN Website

- The IBSEN website is **live since March 2024**.
- It will host the *Quarterly Newsletter* and the educational tools developed as part of the project.
- It is the **essential tool to engage with an academic community and policymakers** and raise awareness about the work of the IBSEN.



QR code to the IBSEN website

# IBSEN Contact Database

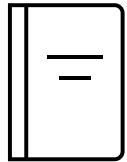
- *Objective:* create a **database of scholars, academics and policymakers who are interested in IBSEN** and have a background in biosecurity education.
- *Format:* The database is divided in **4 categories** to include High Schools, Universities, Continuing Professional Education, Government and International Organisations. It aims to have a **global coverage** to adapt the educational tools developed to different audiences and regions.
- *Current stage:* It currently has 100 contacts and aims to reach 200 by May 2024.



# First coordination meeting

- Policy Workshop 16 March *'Toward a collaborative, collective and integrative international CBRN security education: Coordination of International Policy Initiatives on Biosecurity Education'*.
- Participants included national and international experts from academic institutions, civil society and international organisations (UNIDIR, CWC ABEO, BWC ISU, IAEA/INSEN).
- **Regular dedicated workshops for further coordination seem vital to strengthening global and regional biosecurity education.**

# THE FUTURE



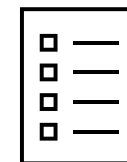
Book Launch



Quarterly Newsletters



Next Coordination and BWC meetings



Future Grants

# IBSEN Book Launch

- *Essentials of Biological Security: A Global Perspective*
- Book launch in **London in May/June**
- Book launch **later in Tianjin**
  - Sub-project to obtain **multiple reviews of the book**
  - Sub-project to **facilitate translations of the book**
- Development Possibilities
  - Sub-project to produce chapters as **Team-Based Learning Exercises**
  - Sub-project to produce **cartoons/animations**

# IBSEN Quarterly Newsletter

- *Quarterly Newsletters* over two years will be **the main means of engaging a large number of interested people.**
- First Newsletter set for publication in **May 2024** and the main article will be on the **International Nuclear Security Education Network (INSEN).**
- Second Newsletter will be published in the autumn and the main article will hopefully be on **the work of the ABEO.**
- Publication **mainly on the website and Newsletter to be sent via email to the contact database.**

# IBSEN Report to Geneva BWC meeting

- Reporting IBSEN developments to the meetings of the BTWC States Parties in Geneva is central to consolidating the network.
- Essential to stress the link to the effective and efficient implementation of the **Tianjin Guidelines**.
- Will have three people at the meeting and will make an effort to see as many delegations as possible to add to the contacts database.
- Hope to have a **Side Event** with a State Party sponsor.
- Will make a **Statement** if that is possible.
- Will have hard copies of the first **Quarterly Newsletter** for distribution.

# Second IBSEN Quarterly Newsletter

- Second Quarterly Newsletter hopefully with a main article on the structure and function of the **Advisory Board on Education and Outreach**.
- Publication probably in **September 2024** and available for the meeting of the CWC in the autumn and the BTWC meeting in December.
- Probable sections
  - Main article
  - Report on the IBSEN activities at the **August BTWC meeting**
  - Short reports on **other IBSEN activities**, for example in different regions
  - **Key new literature** notes
  - **Invitation to join the contacts database**

# Next coordination meeting

- Regular coordinated meeting will be arranged across the year (in person and online), 2<sup>nd</sup> one is scheduled in late 2024
- Will focus on 1) developing education curriculum and exchanges of regional practical excellence with a starting focus on selected countries such as Argentina, Pakistan, Japan and China
- 2) developing and collaborating with other initiatives from CWC, IAEA, etc with focus on developing collaborating grants and addressing common practical issues
- 3) developing communication strategy to attract fundings from State Parties and others for further development of education network

# Other IBSEN-Linked Grants

- **British Association** grant obtained to focus on preparation for a **Horizon EU Project application** on *'Prevention, detection, response and mitigation of chemical, biological and radiological threats to agricultural production, feed and food processing, distribution and consumption'* **through enhanced biosecurity education.**
- Organising **two specific workshops**: one to be held at the Biological Security Research Centre (BSRC) at London Metropolitan University, and second in partnership with the Dutch Defense Academy.
- Seeking long term support from various funding routes



## Acknowledgements

Thanks to various grant funders

Our collaborators around the world

Thank you!