# AVOIDING CATASTROPHE FROM MISUSE OF BIOLOGY



### GLOBAL CATASTROPHIC BIOLOGICAL RISKS

"Those events in which biological agents – whether naturally emerging or re-emerging, deliberately created or released, or laboratory engineered and escaped – could lead to sudden, extraordinary, widespread disaster beyond the capability of national and international governments and the private sector to control.

If unchecked, GCBRs would lead to great suffering, loss of life, and sustained damage to national governments, international relationships, economies, societal stability, or global security"

(Schoch-Spana et al, 2017, Health Security, 15(4): 323-328)



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**Figure 1.1** Major arms control and disarmament treaties limiting BW (top) and known offensive BW programs (bottom) since 1945.



Addressing Security Council, Secretary-General Calls for Recommitment to Eradicating Weapons of Mass Destruction 'Once and for All'

SG/SM/17996-SC/12486-DC/3647

23 AUGUST 2016

"I call on all States to focus on one overriding truth: the only sure way to prevent the human, environmental and existential destruction these weapons can cause, is by eradicating them once and for all.

Technological advances have made means of production and methods of delivery for chemical, biological, radiological and nuclear materials cheaper, easier and more accessible. Vicious non-State actors that target civilians for carnage are actively seeking chemical, biological and nuclear weapons.

I am extremely concerned that the international community is not adequately prepared to prevent or respond to a biological attack."

### PROBLEMS: ADVANCES IN SCIENCE AND TECHNOLOGY AND THEIR IMPACTS

### The Biological and Toxin Weapons Convention

Implications of advances in science and technology

the global network of science academies

Recent advances could also facilitate almost every step of a biological weapons programme, and technological barriers to acquiring and using a biological weapon have been conspicuously eroded since the Seventh Review Conference.

Many of these advances are at the leading edge of current capabilities. They are expensive and complicated to acquire and deploy successfully. Making use of them for prohibited purposes would probably currently require the resources of a state but this situation may change in future, reinforcing the need for on-going efforts to review relevant developments in science and technology.

# Point of View: A Transatlantic Perspective on 20 Emerging Issues in Biological Engineering

### Intersection of information security and bio-automation

These could include tampering with digital DNA sequences leading to production of harmful organisms by researchers who are unaware of the malicious changes; sabotaging vaccine and drug production through attacks on critical DNA sequence databases or equipment; using DNA as a 'Trojan horse' to carry out a digital attack.

### PROBLEMS: ADVANCES IN SCIENCE AND TECHNOLOGY AND THEIR IMPACTS



# **Dual Use Research of Concern**

Dual Use Research of Concern (DURC) is life sciences research that, based on current understanding, can be reasonably anticipated to provide knowledge, information, products, or technologies that could be directly misapplied to pose a significant threat with broad potential consequences to public health and safety, agricultural crops and other plants, animals, the environment, materiel, or national security. Information Hazards: A Typology of Potential Harms from Knowledge https://www.nickbostrom.com/information-hazards.pdf

"Information hazards are risks that arise from the dissemination or the potential dissemination of true information that may cause harm or enable some agent to cause harm. Such hazards are often subtler than direct physical threats, and, as a consequence, are easily overlooked."

#### Information Hazards in Biotechnology

Lewis, G. et al, Risk Analysis, 39(5), 2019.

"With the advance of biotechnology, biological information, rather than biological materials is increasingly the object of principal security concern. We argue that both in theory and in practice, existing security approaches in biology are poorly suited to manage hazardous biological information."

#### **KEY QUESTIONS**

- How to identify life sciences research activities of concern?
- How to assess benefits against risks? Based on which criteria?
- How to address the potential risks posed by accidents or deliberate misuse of life sciences research activities?
- How to foresee the implications of research?
- Would legislation or self-regulation be more effective to manage these risks?
- What is expected from the researchers, the publishers, funding bodies and the authorities?
- Is there a need to be concerned? Is it a priority?
- Is it a global issue? Are there global solutions? What are they?
- Are developed and developing countries similarly concerned?
- Are there any best practices from existing approaches?
- Are there any assessments of different models and comparisons of approaches?
- What are the costs and benefits of different policy options?

### DARPA Enlists Insects to Protect Agricultural Food Supply

New program aims for insect delivery of protective genes to modify mature plants within a single growing season

OUTREACH@DARPA.MIL 10/19/2016



UNHEALTHY CROP

INSECT-MEDIATED TRANSMISSION OF MODIFIED GENES INTO MATURE PLANTS HEALTHY CROP

www.darpa.mil > Program Information 💌

#### Insect Allies - Darpa

4 Oct 2018 - The **Insect Allies** program is pursuing scalable, readily deployable, and generalizable countermeasures against potential natural and ...

www.sciencemag.org > news > 2018/10 > crop-protecting-insects-coul... ▼

#### Crop-protecting insects could be turned into bioweapons ...

4 Oct 2018 - Funded by the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Virginia, Insect Allies aims to use insects such as aphids ...

web.evolbio.mpg.de > HEGAAs > journalist-faqs 💌

#### Journalist FAQs Insect Allies aims

It is also a request for the funder of the **Insect Allies** program to answer how its stated routine agricultural aims can be achieved without a much earlier substantial ...

www.mpg.de > Homepage > Newsroom > Research News 💌

#### A step towards biological warfare with insects? | Max-Planck ...

4 Oct 2018 - The programme called 'Insect Allies' intends for insects to be used for ... with potential for dual use: scientists fear that the Insect Ally program by ...

www.vice.com > en\_us > article > scientists-fear-darpas-insects-allies-... \*

#### Scientists Fear DARPA's 'Insect Allies' Will Attack Global Food ...

5 Oct 2018 - The **Insect Allies** program is a collaboration between the Defense Advanced Research Projects Agency (DARPA), Environmental Protection Agency, US Army, and other

# PROBLEMS: INTERNATIONAL COMMUNITY'S RESPONSE TO THE THREAT



SECRETARY-GENERAL > STATEMENTS AND MESSAGES

### Addressing Security Council, Secretary-General Calls for Recommitment to Eradicating Weapons of Mass Destruction 'Once and for All'

The impact and consequences of a biological attack on a civilian target could far exceed those of a chemical or radiological attack. But investment in the international architecture for dealing with these different types of WMD is not commensurate with their possible effects. For example, there is no multilateral prevention and verification agency for biological weapons...

# PROBLEMS: INTERNATIONAL COMMUNITY'S RESPONSE TO THE THREAT





### FINDINGS AND RECOMMENDATIONS

- National health security is fundamentally weak around the world. No country is fully prepared for epidemics or pandemics, and every country has important gaps to address.
- 2. Countries are not prepared for a globally catastrophic biological event.
- 3. There is little evidence that most countries have tested important health security capacities or shown that they would be functional in a crisis.
- 4. Most countries have not allocated funding from national budgets to fill identified preparedness gaps.
- 5. More than half of countries face major political and security risks that could undermine national capability to counter biological threats.

### PROBLEMS: GLOBAL JUSTICE ISSUES

- Inequalities in health and health systems
- Persistent inequalities in scientific and technological capacities
- Different levels of concern about different areas of biological risk and valuing of some lives over others
- Undermine international cooperation generally, which may well be compounded in crises
- Unrealised commitments are destructive of trust
- Undermines incentives to participate in international efforts to manage emerging technologies
- Weakens global capacities for preparedness, surveillance, response, etc.
- A potential motivation for 'bad actors'

#### ARTICLE X

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

(2) This Convention shall be implemented in a manner designed to avoid hampering the economic or technological development of States Parties to the Convention or international co-operation in the field of peaceful bacteriological (biological) activities, including the international exchange of bacteriological (biological) agents and toxins and equipment for the processing, use or production of bacteriological (biological) agents and toxins for peaceful purposes in accordance with the provisions of the Convention.

# RESPONSES

- Strengthen the Biological Weapons Convention
  - Implementation Support Unit
  - Science and technology review process
  - Verification?
  - Article X
- Strengthen and sustain health systems worldwide and scientific and technological capabilities to improve endogenous capacity to develop e.g. low-cost diagnostics.
- Broader, meaningful efforts to address inequalities
- Better understanding of societal responses and how these might be guided toward appropriateness and efficacy

# CONTRIBUTIONS OF SCIENTISTS

- Promote government activity to strengthen the Biological Weapons Convention and related components of international governance
- Participate in science advisory and review processes
- Other contributions to evidence-based policy making
- Participate in capacity building activities
- Uphold norms against misuse
- Awareness of and responsibility for safety and security
- Join discussions about how to handle information hazards and dual use research of concern

### Preventing Biological Threats: What You Can Do



#### Editors

Simon Whitby, Tatyana Novossiolova Gerald Walther and Malcolm Dando

A Guide to Biological Security Issues and How to Address Them

Responsible life sciences research for global health security A GUIDANCE

DOCUMENT







The most effective and sustainable way to protect against threats from deliberate and accidental releases of animal pathogens is:

- to strengthen existing systems for surveillance, early on-farm detection and rapid response,
- and for biosafety and biosecurity, to foster scientific networks that work towards altruistic goals.

This approach has multiple collateral benefits for animal health, agriculture, public health, poverty alleviation, food security, animal welfare and economies.