

# Disincentivizing Bioweapons

• Theory & Policy •  
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EXECUTIVE SUMMARY



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The Nuclear Threat Initiative is a nonprofit, nonpartisan global security organization focused on reducing nuclear, biological, and emerging technology threats imperiling humanity.

# Disincentivizing Bioweapons

• Theory & Policy •  
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## • Introduction

*By Nathan A. Paxton and Jaime M. Yassif*

**A**lthough development and use of biological weapons have been prohibited under the Biological Weapons Convention (BWC) since its entry into force in 1975, the world continues to face significant risks that such weapons could be deliberately used or accidentally released, with catastrophic global consequences. The special dual-use nature of much of modern bioscience and the BWC's lack of monitoring and enforcement mechanisms have made it very difficult to know what activities occur in the world's countries and whether the activities are for legitimate or illegitimate purposes.

Over the course of more than a century, there has been clear evidence that countries have developed bioweapons or created bioweapons programs, but it has been exceedingly difficult to identify known or probable bioweapons developers with certainty. The most comprehensive, unclassified, peer-reviewed study concluded that since 1915, 44 countries have been suspected of pursuing bioweapons. Of these 44, it is likely that 18 never had a bioweapons program, three only considered developing such a program, and 23 had or likely had a bioweapons program at some point.<sup>1</sup> Even though most of the latter countries abandoned their programs by the time they signed on to the BWC, some BWC States-Parties continue to suspect one other of developing bioweapons or at least bioweapons-relevant capabilities.

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<sup>1</sup> W. Seth Carus, "A Century of Biological-Weapons Programs (1915–2015): Reviewing the Evidence," *Nonproliferation Review* 24, no. 1–2 (January 2, 2017): 142, [doi.org/10.1080/10736700.2017.1385765](https://doi.org/10.1080/10736700.2017.1385765).

Given the significant financial resources available to many states, along with the dual-use nature of bioscience research and development today, preventing states from gaining bioweapons capabilities through controls on materials or knowledge will likely prove challenging. That is why this essay collection focuses on understanding and shaping incentives. To address the urgent risks posed by biological weapons, disincentivizing states from developing bioweapons is crucial, and the discussion around how to do that is underdeveloped. While the analogous literature on nuclear weapons disincentives and deterrence is broad and deep—with engagement from think tanks, policymakers, and academic researchers—there is limited rigorous discourse on making bioweapons development unattractive.

To address this challenge, NTI | bio seeks to support a cross-disciplinary *epistemic community*, which political scientist Peter Haas defined as “a network of professionals with recognized expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain.”<sup>2</sup>

This essay collection is designed to encourage the exploration and identification of potential solutions to disincentivize states from developing or using biological weapons. Policy solutions to problems such as bioweapons proliferation do not develop in isolation, and a failure to think deeply and analytically about complex challenges can prevent the emergence of effective solutions. Establishing a strong community with the time and resources to examine the range of current and future threats and to develop forward-leaning solutions is critical.

The goal of this collection is to bridge theory and practical policy-relevant approaches in order to develop new approaches to invigorate international efforts to reduce biological threats. This essay collection represents an introductory effort to kick-start better bioweapons research and policy. While we do not expect to create an epistemic community solely based on this collection, we hope it will advance that goal.

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<sup>2</sup> Peter M. Haas, “Introduction: Epistemic Communities and International Policy Coordination,” *International Organization* 46, no. 1 (1992): 3, doi.org/10.1017/S0020818300001442.

## Content of This Collection

**N**TI commissioned this collection of essays from leading thinkers and practitioners in biosecurity, national security, international affairs, and diplomacy. We asked the writers to think through tactics and opportunities to disincentivize bioweapons development and use in the context of strengthening the norms of the Biological Weapons Convention and the more general anti-bioweapons regime and to consider the international context for disincentivizing bioweapons. This collection follows a workshop that NTI convened in November 2023 to begin a discussion with thought leaders and policymakers about effective ways to disincentivize bioweapons use by states. The collection is organized into three sections:

### Section 1:

A Tactical Framework to Shape Intention and Disincentivize State Biological Weapon Development and Use

### Section 2:

Disincentivization Challenges That Require Further Attention

### Section 3:

Potential Tools and Narratives for Dissuasion and Deterrence

## Section 1: A Tactical Framework to Shape Intention and Disincentivize State Biological Weapon Development and Use

The first set of essays contains the tactical framework for shaping state intention that structured our discussion at the November 2023 workshop, as well as critiques and extensions of that framework.

Jaime M. Yassif, Shayna Korol, and Angela Kane’s article from *Health Security* (reprinted in this volume) delineates a three-tactic strategy to shape a state’s cost–benefit analysis of whether to pursue bioweapons. They argue that enhanced transparency, more robust attribution capability, and better-defined accountability will help international regimes prevent bioweapons proliferation.

Clarisse Bertherat, Jaroslav Krasny, Louison Mazeaud, and James Revill consider the specific role of transparency. They argue that transparency is a necessary but not sufficient measure for reducing biological arms-racing tendencies. Transparency can contribute to greater confidence that states are abiding by their BWC commitments and therefore can strengthen that component of the anti-bioweapons regime. Exploring alternative approaches to transparency, they consider what further aspects of transparency measures would disincentivize bioweapons.

Gregory Lewis, in thinking through the challenges of attribution, similarly finds transparency necessary but not sufficient to support a better regime of anti-proliferation. Focusing specifically on attribution of “deliberate misuse,” Lewis teases out how attribution might be used as a (partial) deterrent strategy to discourage a “crime” that (as the BWC defines it) is “repugnant to the conscience of mankind.”<sup>3</sup>

Amanda Moodie Muldowney examines the unique challenges of “penalizing” those who violate the biological weapons regime and norm. Drawing specifically on a seminal nuclear theory of detection, Moodie Muldowney notes that attribution poses real costs for violator, victim, and the international community and it will likely take long, concerted, and deliberate action to put an accountability regime with real force into place. Moodie Muldowney considers several options within and alongside the existing anti-bioweapons regime.

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<sup>3</sup> “Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction,” opened for signature April 10, 1972, United Nations Office for Disarmament Affairs Treaty Database, <https://treaties.unoda.org/t/bwc>.

## Section 2: Disincentivization Challenges That Require Further Attention

Inspired by the transparency, attribution, and accountability framework in the first section, the second set of essays addresses a set of disincentivization challenges that exist prior to and outside the initial framework. Drawing on philosophy, political science, and international affairs, these authors follow St. Thomas Aquinas’s advice to “always distinguish”—that is, the authors work to clarify the concepts and ideas we use to discuss bioweapons in service of making clearer what can or cannot be known and done to halt bioweapons acquisition.

Sonia Ben Ouagrham-Gormley questions the idea of “deterrence by denial.” The world cannot disincentivize international actors by trying to persuade would-be malcontents that their work would be futile because of good biodefense. Ben Ouagrham-Gormley notes that bioweapons defense is generally weak. Combining weak defense with a primary policy of deterrence by denial may have the opposite of the intended effect, incentivizing states and terror groups to go after these weapons. She instead proposes more focus on the adverse cost-to-benefit of trying to obtain these weapons.

Drawing on recently published research, Michelle Bentley argues for much greater focus on the “taboo” norm against biological weapons. Bentley advances the idea that international policymakers have largely ignored norms as an important component of an anti-bioweapons regime. Centering the taboo within the regime would allow for measures that “recognize, formalize, and codify” the real repulsion that these weapons invoke in human beings, and she offers suggestions for the specific types of policy that might accomplish this centering.

Nathan A. Paxton takes on the question of “intent.” If one goal of this epistemic community is disincentivizing proliferation, it would help to understand what drives a state’s intent to get bioweapons. The bioweapons community lacks a grounded understanding of why states pursue—or do not pursue—this class of weapons, and the community has not developed very effective means by which to discern a state’s intent. Drawing on a recent model from nuclear proliferation policy, Paxton encourages bioweapons thinkers to consider how revealed bioweapons strategy may derive from intent and provide a guide to that intent.

Tristan A. Volpe thinks through the dual-use dilemma and the prospects for international cooperation to manage biological arms control. Employing original research, Volpe finds that—like several other technologies—biotechnology is highly integrated within the civilian and military economies, and it is also hard to distinguish military from civilian uses of this technology. This falls in a “dead zone” for verifiable international cooperation, and so Volpe draws lessons for bioweapons from alternative arms control for other dead-zone technologies.

Alex John London addresses the conceptual ambiguity in describing artificial intelligence (AI) systems as possessing or demonstrating “emergent abilities.” Many have claimed that AI systems show signs of capabilities that could produce new threats, which would be strategically destabilizing. London explores these claims through a precise and thoughtful elaboration of what “revolutionary leaps in cognition” could consist of. This precision will help policymakers better understand the implications of new technology that could facilitate bioweapons proliferation and perhaps lead to better balancing of decisions that “impact the rights and well-being of large numbers of people.”

### Section 3: Potential Tools and Narratives for Dissuasion and Deterrence

The third section of the collection turns to applied responses. In the section’s sole essay, Emma J. Curran and Nir Eyal outline a “simple tool” for disincentivizing bioweapons. They argue that pathogens with enhanced pandemic potential (PEPP) are so transmissible and uncontrollable as to have no utility as an offensive or deterrent weapon. They consider objections but ultimately conclude that PEPP weapons have no upside, only risk.

## Conclusion

This collection of essays presents a broad range of ideas. Whether readers agree or disagree with what they find here, we invite them to engage with these ideas through further writing and analysis or by crafting policy initiatives. By producing, organizing, and structuring new thinking about present and future approaches to disincentivize the development, acquisition, and use of biological weapons by states, the collection aims to provide a foundational resource for the development of a bioweapons epistemic community. Although short, the collection will, we hope, be mighty and contribute to making the world safer from the threat of state-sponsored bioweapons and their consequences.



# Section 1: A Tactical Framework to Shape Intention and Disincentivize State Biological Weapon Development and Use

- Guarding Against Catastrophic Biological Risks: Preventing State Biological Weapon Development and Use by Shaping Intentions

**Jaime M. Yassif**

*Vice President,  
Global Biological  
Policy and Programs,  
Nuclear Threat Initiative*

**Shayna Korol**

*Former Program Associate,  
Global Biological  
Policy and Programs,  
Nuclear Threat Initiative*

**Angela Kane**

*Former Senior Advisor,  
Nuclear Threat Initiative*

## SUMMARY

This essay outlines three key elements to effectively shape intentions and disincentivize bioweapons development and use by state actors: enhancing transparency, improving attribution, and fostering accountability for violating the global norm against bioweapons development and use. The COVID-19 pandemic underscored global vulnerabilities to high-consequence biological events, revealing an alarming lack of preparedness for such crises. As the risk of biological threats escalates, a robust strategy for prevention, early detection, and rapid response to global catastrophic biological risk (GCBR)-scale events, as well as for preventing the development and use of biological weapons by states and nonstate actors, is crucial.

Nonstate actors, driven by apocalyptic ideologies, can be thwarted by limiting their access to necessary resources and expertise. However, states, with their substantial resources and capabilities, pose a more complex challenge. Effective strategies must make bioweapons development economically and politically untenable by enhancing transparency, strengthening attribution, and building accountability measures. The current global biosecurity architecture, including the under-resourced Biological Weapons Convention, needs significant strengthening. By addressing the gaps and by fostering international cooperation, we can disincentivize bioweapons development and ensure a safer future, mitigating the threats posed by potential GCBRs.

## • The Role and Limits of Transparency Measures in Disincentivizing Biological Weapons

**Clarisse Bertherat**

*Researcher, Weapons of Mass Destruction,  
United Nations Institute for Disarmament Research*

**Louison Mazeaud**

*Associate Researcher, Weapons of Mass Destruction,  
United Nations Institute for Disarmament Research*

**Jaroslav Krasny**

*Researcher, Weapons of Mass Destruction,  
United Nations Institute for Disarmament Research*

**James Reville**

*Head of Programme, Space Security and Weapons  
of Mass Destruction, United Nations Institute  
for Disarmament Research*

### SUMMARY

This essay focuses on the role of transparency in the disincentivization of biological weapons. The central argument is that transparency is unlikely as a stand-alone tool to disincentivize biological weapons programs. However, in combination with other measures, greater transparency in biological research activities can reduce biological arms-racing tendencies and build confidence in the 1972 Biological Weapons Convention. The essay begins with an overview of different forms and directions of transparency. The essay draws from historical drivers of past biological weapons programs to look at what role transparency measures could theoretically play in disincentivizing biological weapons and bolstering biological disarmament. The essay then turns to assess how transparency has operated in the biological weapons regime, taking into consideration the role and limitations of Confidence-Building Measures among other measures, including peer reviews. Finally, the essay explores alternative approaches to generating transparency in the biological weapons regime, including open-source data and methods as a means of forcing greater transparency in biological research and development activities. It concludes by looking at what else is needed for transparency to disincentivize biological weapons.

## Attribution as a Deterrence for Biological Weapons

**Gregory Lewis**

*Former Acting Director of Biosecurity Research Group,  
Future of Humanity Institute, University of Oxford*

### SUMMARY

Some future biological outbreaks may not originate from nature but rather from human mistake or malice. Attribution is the task of discovering which humans or institutions are responsible for accidental or deliberate outbreaks. Although attribution in contexts of accidental misuse is valuable, I focus here on attribution of deliberate misuse—through the development or use of biological weapons—because it is a more pressing and more complex problem. Call this “biological weapons attribution.”

Effective bioweapons attribution serves a number of purposes: Identifying the perpetrator of an attack may give insight into their motivation and capability and so inform early responses (e.g., whether subsequent attacks are likely, and if so their likely targets); bioweapons attribution is necessary (but not sufficient) to bring perpetrators to justice and render them incapable of causing further harm; and a fuller understanding of what happened may bring some comfort to victims of these crimes against humanity.

This essay primarily discusses a valuable role for bioweapons attribution: as a means of deterrence. Similar to how an increased likelihood of getting caught may discourage those contemplating a crime, revealing who used weapons deemed “repugnant to the conscience of mankind” may discourage those contemplating a bioweapons attack in the first place. Effective bioweapons attribution could therefore prevent bioweapons use and dissuade bioweapons pursuit and so could help keep the world free from biological warfare.

This is much easier said than done. I talk about the complications of bioweapons attribution as an effective bioweapons deterrent.

## After Bioweapons—What? Accountability for Development and Use of Biological Weapons

**Amanda Moodie Muldowney**

*Director of the Program for Emerging Leaders and Policy Fellow at the Center for the Study of Weapons of Mass Destruction, National Defense University*

### SUMMARY

Accountability for biological weapons development or use is critically important, as it can both dissuade the user from continuing its activities and deter other states that might be inclined to follow a similar path. However, penalizing violators of the biological weapons norm carries some unique challenges: It is difficult to determine an appropriately proportional response, and the victim of this violation may be reluctant to admit what has happened. The menu of options for dealing with non-compliance includes public denunciation, sanctions, military action, or action from the United Nations Security Council. In addition, recent experiences in the chemical weapons realm may offer alternative approaches for accountability, such as prosecution using universal jurisdiction principles or international criminal tribunals. Although these options are not mutually exclusive and can be used in combination, they are also likely to be lengthy processes, so the international community must recognize that accountability cannot happen overnight.

## Section 2: Disincentivization Challenges That Require Further Addressing

- Two Competing Bioweapons Non-Proliferation Policies: Deterrence by Denial and Dissuasion

**Sonia Ben Ouagrham-Gormley**

*Associate Professor, Schar School of Policy and Government, George Mason University*

### SUMMARY

Over the past few years, analysts have promoted the idea that a policy of deterrence by denial could help deter bioweapons use because building strong defenses against bioweapons will convince potential users of their futility. In this essay, I argue that a biodeterrence by denial policy can instead have a proliferating effect because (1) the conditions for building strong defenses against bioweapons are not present today and (2) claiming readiness for a bioattack when defenses are weak can invite states and terrorist groups to develop those weapons. This essay offers an alternative policy of bioweapons dissuasion, which aims to exploit the current challenges of bioweapons development to convince would-be proliferators that the cost–benefit ratio is not in favor of bioweapons development. The essay also evaluates the extent to which new technologies such as artificial intelligence can or cannot support bioweapons development.

## The Biological Weapons Taboo: A “New” Focus for Arms Control

**Michelle Bentley**

*Professor of International Relations and  
Director of the Centre for International Security  
at Royal Holloway, University of London*

### SUMMARY

International policymakers and analysts state that norms are a necessary and vital means of biological arms control. Yet this statement is an ideal that is not reflected in reality. The anti-bioweapons regime is built primarily around measures that seek to change the strategic environment by ensuring biological aggression cannot be enacted or convincing actors that biowarfare is not in their strategic interests, a state of affairs termed here as “strategic restraint.” These strategic measures do not preclude the idea that arms control should also stigmatize biowarfare as a form of “normative restraint.” Yet norms have not been made a priority in bioweapons control and are reduced to a secondary by-product of strategic restraint.

This essay engages with a specific norm—the biological weapons taboo—to both highlight and challenge the way the regime ignores norms. The essay outlines the taboo to demonstrate why actors are normatively averse to bioweapons and why new arms control measures that directly reflect and seek to strengthen this aversion can radically improve biowarfare prevention. The essay argues that policymakers must (1) fully understand the taboo as the basis of a new arms control framework and (2) introduce measures that recognize, formalize, and codify the taboo as an international value and standard of behavior. The essay shows what this approach would mean in practice and the types of policy needed not only to enact the taboo (as the basis of more effective arms control) but also to place the taboo at the very center of the regime within its own right.

## Prospects for Assessing State Intent to Proliferate Biological Weapons

**Nathan A. Paxton**

*Senior Director, Global Biological Policy  
and Programs, Nuclear Threat Initiative*

### SUMMARY

Action to disincentivize states from acquiring bioweapons assumes a prior belief of knowing and being able to alter intent for such arms. This essay identifies several questions and lines of analysis that require examination as a more coherent body of explanations and policy to prevent bioweapons acquisition and use is developed. It examines the complexities of understanding and influencing state motivations to develop biological weapons, highlighting the lack of comprehensive studies on their proliferation compared to nuclear proliferation, and argues that technical or observational data alone is insufficient to grasp state intent. The essay challenges a potential bioweapons epistemic community to think hard about how bioweapons might fit into a state's strategic goals, as well as whether bioweapons provide unique capabilities. Drawing from previous work on nuclear weapons, this essay argues that focusing on how a state might pursue a nuclear weapon would improve understanding of bioweapons proliferation. The means and process of bioweapons procurement could offer subtle clues regarding a state's ultimate strategic goal. The essay encourages future work to think through how a state's bioweapons pursuit flows more explicitly from its strategic goals and environment. Finally, the essay summarizes policy and research questions that could guide bioweapons analysts to create a more coherent foundation for an epistemic community and for greater security against this class of arms.

## Biotechnology and the “Dead Zone” for Managing Dual-Use Dilemmas

**Tristan A. Volpe**

*Assistant Professor in the Defense Analysis Department  
at the Naval Postgraduate School (NPS) and Non-Resident  
Fellow in the Nuclear Policy Program at the Carnegie  
Endowment for International Peace*

### SUMMARY

What role does the overlap between civilian and military activities in the life sciences play in thwarting arms control over biological weapons? States have used international institutions to control many dual-use capabilities, from nuclear reactors to aircraft and rockets. But efforts to manage the military uses of biotechnology in this manner—including with the Biological Weapons Convention (BWC)—have consistently fallen short. Recent research from Jane Vaynman and me reveals why this is the case. We specify how variation in the two dimensions of dual-use nature of technology can enable or block arms control agreements. This essay first summarizes the results from our research, focusing on how the dual-use dilemma has varied across all weapons technologies available to states over the past 150 years. The second part focuses on why it is so difficult to curtail biological weapons with international institutions. Biotechnology falls in a “dead zone” for arms control, where daunting detection and security risks kill the prospects for verifiable cooperation. The conclusion draws lessons for disincentivizing the development of bioweapons from alternative arms control efforts over other technologies in the dead zone, notably taking smaller slices and establishing behavioral norms.



## “Emergent Abilities,” AI, and Biosecurity: Conceptual Ambiguity, Stability, and Policy

**Alex John London**

*K&L Gates Professor of Ethics and Computational Technologies and Director of the Center for Ethics and Policy, Carnegie Mellon University*

### SUMMARY

Recent claims that artificial intelligence (AI) systems demonstrate “emergent abilities” have fueled excitement but also fear grounded in the prospect that such systems may enable a wider range of parties to make unprecedented advances in areas that include the development of chemical or biological weapons. Ambiguity surrounding the term “emergent abilities” has added avoidable uncertainty to a topic that has the potential to destabilize the strategic landscape, including the perception of key parties about the viability of non-proliferation efforts. To avert these problems in the future, scientists, developers, policymakers, and other parties should take credible steps to strengthen the health of the scientific ecosystem around AI.

# Section 3: Potential Tools and Narratives for Dissuasion and Deterrence

## ● Simple Tool for Disincentivizing the Worst Pandemic Bioweapons

### **Emma J. Curran**

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Institute for Health, Health Care Policy  
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### **Nir Eyal**

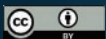
*Inaugural Henry Rutgers Professor of Bioethics  
and Director of the Center for Population-Level  
Bioethics, Institute for Health, Health Care  
Policy and Aging Research, Rutgers University*

## SUMMARY

This essay proposes a simple way to incentivize states not to develop pathogens with enhanced pandemic potential (PEPPs) as bioweapons: to tip all state actors that all of them stand to lose from developing such highly lethal, highly transmissible bioweapons. Being highly transmissible, a PEPP used as a weapon could easily spread, infecting a state's own citizens and leaders. Therefore, no state concerned for its own citizens or leaders can afford to use a PEPP weapon, even having developed or acquired it. We then show that when this is commonly known between states, having PEPPs provides no useful deterrent to a state, and there is no point getting into an arms race. Developing and stockpiling PEPP weapons gives states no gain, only risk. We end by assessing three objections to our thesis.



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