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RESEARCH ARTICLE

The tyranny of imagination: Symbolic struggles over the bioterrorist threat and the dilemmas of preparedness

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Abstract

This article begins by observing a central paradox of counter-bioterrorism: a widening gap between the proliferation of theoretical bioterrorism scenarios and the persistent paucity of realised events. The expanding production of such scenarios generates knowledge that simultaneously fuels dual-use concerns and exacerbates proliferation dilemmas. The article examines the historical and structural conditions of preparedness practices that give rise to this dynamic. It focuses on the political and epistemic strategies of a heterogeneous coalition that advanced a highly contested threat narrative in the 1990s. Their call for immediate preparedness was coupled with a vision of biotechnological innovation in defensive research, prompting early criticism from disarmament and terrorism scholars who identified strategic dilemmas still relevant today. The article argues that the evolving field is shaped by not merely security logics but also the agendas of those promoting preparedness. While it is quite unclear whether an adversary as capable as depicted in counter-bioterrorism's conception ever will emerge, increasing demonstrations of the feasibility of bioterrorist attacks keep security actors under continuous pressure to prepare. Because preparedness derives primarily from actors' own anticipatory practices, counter-bioterrorism has become a strategic field in which actors are, in effect, compelled to play against their own imaginations.

Keywords: biological warfare; biosecurity; dual-use dilemma; preparedness; WMD terrorism

Introduction

In recent years, rapid advances in the life sciences – most notably in gene editing – have renewed debates about dual-use research and the boundaries between legitimate innovation and potential misuse.[1] Although these discussions also centre on risk governance, they revive earlier concerns about the need for greater preparedness, particularly regarding deliberate misuse and its most radical manifestation, bioterrorism. Simulation exercises and scenario planning have long served as key means of projecting such possibilities into strategic futures.

Theoretical scenarios differ in agents, delivery methods, and potential impact, ranging from small-scale attacks to catastrophic events involving the release of genetically modified pathogens on a mass scale.[2] A weapon-of-mass-destruction (WMD) potential has been attributed to biological weapons repeatedly throughout their history. Because of the capability of biological agents to

[1]National Academies of Sciences (hereafter NAS), *Biodefense in the Age of Synthetic Biology* (The National Academies Press, 2018), available at: {https://doi.org/10.17226/24890}, accessed 2 July 2025; Ana Ruxandra Badea and Oliver Feeny, 'Genome editing dilemma: Navigating dual-use potential and charting the path forward', *Bioethical Inquiry*, 22:1 (2025), pp. 101–10.

[2]Manfred Green, James LeDuc, Daniel Cohen, and David Franz, 'Confronting the threat of bioterrorism: Realities, challenges, and defensive strategies', *The Lancet Infectious Diseases*, 19:1 (2019), pp. e2–e13; Yelena Bibermann, 'The technologies and international politics of genetic warfare', *Strategic Studies Quarterly*, 15:3 (2021), pp. 6–31.

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replicate across organisms, even small quantities would lead to cumulative damage. If intervention did not occur at an early stage, it was claimed, such attacks could have the potential to cause damage relatively unrestricted by spatial and temporal constraints, resulting in hundreds of thousands of fatalities – at least in theory.[3] WMD scenarios were contested from the start within the broader military and security domain.[4] Indeed, as I will show, interpretive battles over the potential impact of biowarfare have been a historical constant – linking earlier Western armament programmes, where this potential was actively pursued, to the later discourse on bioterrorism, where it served as justification for urgent counter-measures.

While rooted in Cold War–era concerns about state-sponsored terrorism, the discourse on bioterrorism gained renewed momentum in the 1990s, particularly in the wake of revelations about Soviet and Iraqi weapons programmes. Since then, the threat of biological terrorism has become a subject of intense scrutiny. At the turn of the century, a growing number of experts in counterterrorism, biodefence, and public health discussed how to prepare for such attacks, what agents or delivery systems terrorists would use, and what infrastructure they could target. These efforts have intensified since the 2001 anthrax attacks and have become part of the security practices of transatlantic allies.[5] They are reflected in a plethora of specialist articles, exercise documentation, lessons learned, and emergency plans.[6] Research has explored pathogen availability, modification feasibility, and infrastructural vulnerabilities – from food supply chains to public transit.[7]

Nevertheless, in contrast to the large number of scenarios, there are but few realised incidents. The majority are hoaxes and undocumented powder finds. A small number of deaths and nearly eight hundred cases of illness are concentrated in two cases: the poisoning of food by a Buddhist sect in Oregon in 1984 (approximately 750 people suffering from diarrhoea) and the anthrax attacks in the USA in 2001 (five deaths, twenty-one infections).[8] Bioterrorists appear far less in historical records than in strategy papers, scientific journals, or simulation exercises. This paradox captures the strategic dilemma at the heart of bioterrorism preparedness: the very research intended to defend against attacks may also enable them, by producing knowledge and tools susceptible to misuse.[9]

Following the work of Lakoff and Collier,[10] epistemic and strategic practices associated with that dual-use dilemma adhere to a logic of preparedness: considering the catastrophic consequences

[3]United Nations (hereafter UN), *Chemical and Bacteriological Weapons and the Effects of Their Possible Use* (United Nations, 1969), available at: {https://digitallibrary.un.org/record/577283?ln=ar&v=pdf}, accessed 14 February 2024; Gregory Koblentz, 'Pathogens as weapons: The international security implications of biological warfare', *International Security*, 22:3 (2003/2004), pp. 84–122.

[4]Cf. Jean Guillemin, *Biological Weapons: From the Invention of State-Sponsored Programs to Contemporary Bioterrorism* (Columbia University Press, 2005), pp. 120ff; Jonathan Tucker, 'Introduction', in Jonathan Tucker (ed.), *Toxic Terror: Assessing Terrorist Use of Chemical and Biological Weapons* (MIT Press, 2000); Milton Leitenberg, 'The self-fulfilling prophecy of bioterrorism', *Nonproliferation Review*, 16:1 (2009), pp. 95–109.

[5]Filippa Lentzos and Nikolas Rose, 'Governing insecurity: Contingency planning, protection, resilience', *Economy and Society*, 38:2 (2009), pp. 230–54.

[6]For example, Sergio Bonin, *International Biodefense Handbook: An Inventory of National and International Biodefense Practises and Policies* (Center for Security Studies, ETH Zurich, 2009), available at: {https://www.files.ethz.ch/isn/31146/Biodefense_HB.pdf}, accessed 4 January 2024; Christian Enemark, *Biosecurity Dilemmas: Dreaded Diseases, Ethical Responses, and the Health of Nations* (Georgetown University Press, 2017).

[7]Christian Enemark, 'United States biodefense, international law, and the problem of intent', *Politics and the Life Sciences*, 24:1/2 (2005), pp. 32–42; Naveen Gunaratne, 'The Ebola virus and the threat of bioterrorism', *The Fletcher Forum of World Affairs*, 39:1 (2015), pp. 63–76.

[8]Seth Carus, *Bioterrorism and Biocrimes: The Illicit Use of Biological Agents Since 1900* (Fredonia Books, 2002 [1998]); National Consortium for the Study of Terrorism and Responses to Terrorism (START), *Global Terrorism Database*, available at: {https://www.start.umd.edu/gtd/}, accessed February 2025.

[9]Enemark, *Biosecurity Dilemmas*, pp. 26ff.

[10]Andrew Lakoff, 'The generic biothreat, or, how we became unprepared', *Cultural Anthropology*, 23:3 (2008), pp. 399–428; Andrew Lakoff and Stephen Collier, 'The problem of securing health', in Andrew Lakoff and Stephen Collier (eds), *Biosecurity Interventions: Global Health and Security in Question* (Columbia University Press, 2008, pp. 7–32).

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that could result from a specific event, probability-related calculations become secondary considerations. Crisis management applies novel epistemic practices, such as scenario planning or other simulative procedures, extrapolating hypothetical disasters to formulate appropriate preparatory measures.[11]

The article examines the sociogenesis of bioterrorism preparedness by drawing on two interrelated concepts: the *social venture of counter-bioterrorism* describes early attempts of diverse actors to convince policy and public of a bioterrorism threat. It gave rise to the *strategic action field of counter-bioterrorism*, which operates under the mentioned security rationale. I draw on more recent field theory from Fligstein and McAdam[12] and will elaborate my approach in the next section. To outline the emergence of the field as well as its epistemic and strategic routines, the article focuses on the beliefs, agendas, and political tactics of the heterogeneous network of actors that engaged in its constitution. Both their conceptualisation of the threat and the means to promote their demands are characterised by a fundamental ambiguity. Scenarios may genuinely aim to inform preparedness or be crafted to justify pre-established political, scientific, or economic agendas.[13]

Against this backdrop, the presented argument diverges from the conception of preparedness as a security rationale mentioned above. At least in the case of (counter-)bioterrorism, preparedness does not appear as merely a new security 'logic'; it also must be understood as a legitimising framework tailored to the strategic needs and interests of diverse actors proposing it in distinction to alternative positions – taken for example by proponents of arms control.

My central proposition has two levels. First, the way the social venture conceptualised and propagated the threat of bioterrorism and the means to prepare for it produced the strategic dilemma that shapes counter-bioterrorism to this day. It generated a substantial and excessive demand of strategic research directly connected to the dual-use problem. The established field reinforces this dilemma. This is because of two reasons: it operates within an environment characterised by a high degree of uncertainty regarding enemies' capacities, motives, or even existence. And it reproduces the strategic need for preparation by outlining the feasibility of biological warfare and the vulnerability of population and infrastructure. By doing so, the field (re)creates a continuing compulsion to act not despite but rather because of the absence of an attack. Since preparedness is mainly based on counter-bioterrorism's conceptions and simulations of its anticipated adversary, this creates a feedback loop I refer to the tyranny of imagination.

Theoretic framework and positioning

According to the social scientists cited, the preparedness paradigm emerged in Western security policy at the turn of the millennium due to uncertainty over new biological threats, including bioterrorism. Indeed, uncertainty is a pivotal concept in counter-(bio)terrorism and biodefense. It pertains to the actual involvement of state or substate actors in this armaments sector, the likelihood of bioterrorist attacks, and their potential consequences. All these factors are, to varying degrees, unpredictable and thus beyond the scope of risk assessment. Against this backdrop, the focus of 'security' shifts to new social technologies designed to 'govern' the future in the face of incalculable threats.[14]

Through the lens of this rationality, anticipated harm becomes the decisive trigger for institutional action. Social technologies employed are vulnerability analyses, scenario-based planning, and other simulative procedures. These serve two purposes: outlining the scope of the threat and informing preparatory action. Regarding bioterrorism, one must add biodefense practices

[11]Cf. Lakoff, 'The generic biothreat'; Limor Samimian-Darash, 'Governing future potential biothreats: Toward an anthropology of uncertainty', *Current Anthropology*, 54:1 (2013), pp. 1–22.

[12]Neil Fligstein and Scott McAdam, *A Theory of Fields* (Oxford University Press, 2012).

[13]Susan Wright, 'Terrorists and biological weapons: Forging the linkage in the Clinton administration', *Politics and the Life Sciences*, 25:1/2 (2006), pp. 57–115 (pp. 93–4).

[14]Lakoff and Collier, 'The problem of securing health'; Lakoff, 'The generic biothreat'; Samimian-Darash, 'Governing future potential biothreats'.

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that examine how agents or devices and infrastructures might be weaponised.[15] Scholars mentioned have mapped the rationality of preparedness as a novel security calculus. While insightful, this approach risks overlooking that justifications may mask interests. It also overlooks how an approach to security is shaped by actors' convictions and habits resonating with their professional background or involvement in other domains – such as science or entrepreneurship.

Whereas Lakoff and Collier analyse preparedness primarily within the broader biosecurity domain – also encompassing emerging infections – my analysis focuses on the sociogenesis of counter-bioterrorism as a distinct and historically contingent field. Following Bigo,[16] I argue that security as social action is neither purely discursive nor purely rational but instead embedded in institutional struggles shaped by the interests and commitments of those involved.

This does not imply a separation between discourse and practice. Discourses, argumentation, and narration are integral components of (security) practice, situated within institutional positions and strategic action. Previous studies have examined how biosecurity narratives unfold in official documents, often reconstructing the rationalities expressed therein. While this has yielded important insights, it also risks inferring a coherent security logic from discursive justifications that may reflect the institutional affordances rather than the heterogeneous interests and unquestioned convictions of practice.[17]

As I will show, bioterrorism preparedness appears far more ambiguous in practice than it does as a coherent security rationale in sociological accounts. For instance, actors did not frame bioterrorism primarily as a low-probability, high-consequence threat. Rather, it was often portrayed as both highly likely and potentially devastating. This framing reflected positional dynamics within the field, as both the feasibility and the destructive potential of biological weapons remained deeply contested.

This article therefore treats discursive constructions of threat as not self-standing rationalities but rather outcomes of symbolic struggles within arenas of actors competing over the definition and management of security problems. I therefore draw on field theory,[18] focusing on actors involved in the conceptualisation of bioterrorism in the late twentieth century. This includes analysing the institutional dynamics and interests that made their security draft particularly compelling for a range of actors and policy domains. I speak of a draft in terms of an interpretive proposal in response to factual uncertainty. When brought into play, a draft can be adopted by other actors who adjust it to their own competences and needs.[19] The term *symbolic struggles* serves as a generalising concept encompassing both epistemic practices (used to interpret uncertainty and define strategies) and institutional practices (to mobilise capital and to create legitimacy). This may include networking and occupying or creating strategic positions to influence others relevant for the project.

A draft is the product of not only actors' meaning-making but also the situational features they face. This includes expectations of relevant actors who are outside of the immediate coalition but capable of providing legitimacy and resources. In modern contexts this primarily involves economic and legal capital with state actors as main providers.[20] Also, a draft is shaped by those who oppose it. Proponents either need to address criticism by argument or to bypass it by tactic. Symbolic struggles are closely aligned with Fligstein and McAdams's concept of agenda-setting: this is to frame stories to 'induce cooperation from people by appealing to their identity, belief

[15]Anna Johnson-Winegar et al., 'Department of Defense capabilities supporting bioterrorism response', in Luther Lindler et al. (eds), *Biological Weapons Defense: Infectious Diseases and Counterbioterrorism* (Humana Press, 2005), pp. 3–22; Enemark, 'United States biodefense, international law, and the problem of intent'.

[16]Didier Bigo, 'Security and immigration: Toward a critique of the governmentality of unease', *Alternatives*, 27:1 (2002), pp. 63–92.

[17]Carlo Caduff, 'On the verge of death: Visions of biological vulnerability', *Annual Review of Anthropology*, 43 (2014), pp. 105–21 (p. 108).

[18]Fligstein and McAdam, *A Theory of Fields*.

[19]Ibid., pp. 47ff., 91ff.

[20]Ibid., 19, 77ff., 94–5.

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and interests, while [concurrently] using those same stories to frame action against various opponents'[21] – or, in a more politically settled context: to bring people to align with your draft, while challenging alternative proposals.

They established what I refer to as a *social venture*: a person-centric, loosely connected network of skilled individuals centred around the security draft. Bioterrorism preparedness emerged through mutual adjustment between the threat narrative and proponents' strategic needs. In many cases, these actors were lateral entrants rather than established experts within the security domain. In fact, criticism they faced came from terrorism experts as well as weapons and disarmament specialists.

Regarding field theory, I understand a social venture as a variant of *collective strategic action*, which is an iterative process of meaning-making (epistemic practices) and social mobilisation (institutional practices). Epistemic practices construct a shared frame of reference, balancing the venture's ideas and interests. Mobilisation refers to recruiting significant actors and securing support from higher-level authorities. The process is iterative, as both recruitment and persuasion may reshape the collective frame[22] – in this case, the definition of the bioterrorism threat and its counter-measures. It must be added that not necessarily all actors involved in a venture may share the same commitment to the project. Some actors may expect a surplus in terms of other objectives.[23] Practices embraced by a draft may offer, for example, research and market opportunities or create funds that actors try to reallocate for other purposes.

Analytically, the transition from a collective practice to a relatively structured domain of activity can be defined by the acceptance of a proposal in higher-level contexts. The regularisation, legalisation, and budgeting of the practice enable routine procedures to take form. Formal organisation and professional routinisation reinforce the collective meaning of the practice. Collective action is now embedded in a structured space of action termed a *strategic action field*. Activity is centred around a core understanding of what is at stake in the field – what problem is to be addressed or what service must be maintained. At this stage of activity, consensus is reached on what the purpose of practice is and by what legitimate or reasonable means it is to be pursued.[24] Routines stabilise strategies through professional norms and habits at the individual level and through formal organisation at the meso-level.[25] There is normally dissent on problem definitions or best practices, but this dissent is organised within the consensus on what is at stake. A field may be described as a shared space of legitimate dissent.[26] Routinisation does not preclude innovation; on the contrary, it enables knowledge accumulation and refinement of practices. Yet that kind of innovation is bound to core assumptions. Normally, reflexive processes do not cover challenging the purposefulness of the field. This would entail actors questioning their practice and the identity of their profession. For that kind of existential query, an external event is necessary, which challenges core assumptions and undermines legitimacy.[27]

The article reconstructs the emergence of the counter-bioterrorism field through symbolic struggles over the bioterrorism threat in the 1990s. In doing so, it identifies the core assumptions and strategic repertoires introduced by the social venture. Before turning to the analysis, it is necessary to address the kind of warfare that gave rise to the symbolic struggles in question. I provide a brief historical outline of how bioweapons came to be categorised as WMDs, and how, to some extent, biological warfare itself is a product of symbolic struggles within Western military fields.

[21] Ibid., 50–1.
[22] Ibid., 91ff., 109–10.
[23] For the problem to distinguish between 'instrumental' and 'existential' motives, cf. ibid., 22ff.
[24] Ibid., 10ff., 57ff., 107.
[25] Ibid., 64–5, 79–80.
[26] Ibid., 96ff.
[27] Ibid., pp. 100ff., 105ff.

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Uncertainty surrounding the armaments sector and the capabilities of its weaponry fuelled far-reaching interpretative battles over the bioterrorism threat from the late twentieth century to the present day.

Early Western biowarfare as a subject and product of symbolic struggles

Conceptually, Western bioweapon programmes of the twentieth century emerged at the intersection of two key developments: the establishment of bacteriology as a scientific discipline at the turn of the twentieth century and the evolution of aerial warfare theory during the inter-war period. Bacteriology and its adjacent disciplines provided the scientific foundations for cultivating bacteria – and later viruses – on an unprecedented scale and preparing them as potential combat agents.[28] In military circles, biological weapons were discussed in analogy to chemical warfare, envisioned as tools of intelligent warfare: aerial biochemical strikes behind enemy lines were expected to undermine the opponent's productive capacity and civilian morale while leaving infrastructure intact.[29]

Yet no weaponised agent had been developed, let alone tested in the field. When Auguste Trillat, a biochemist and leading figure of the French programme, referred to a 'microbial cloud', he imagined an infectious aerosol released over urban areas. However, he had no insight into how such a concentration could be achieved and how meteorological conditions would affect the dispersal.[30] From a military point of view, there was also the question of how to control bioweapons. The use of an infectious agent could lead to blowback against allied forces. The incubation period would allow an adversary to implement hygiene measures. Successful control would mitigate the damage; the administration of prophylactic drugs could negate it entirely.[31]

In addition to technical and conceptual issues, there was widespread scepticism in political and military arenas. The extensive use of chemical agents in WWI had not yielded substantial tactical gains but instead led to the traumatisation of soldiers by each side. Aerial warfare by that means could reproduce a strategic zero-sum game on a more intensive level. Since biowarfare theoretically targeted civilian populations, it was contested on moral grounds by politicians and high-ranked militaries, who described it, for example, as 'dishonourable' or 'unchristian'. Such concerns led states to voluntarily ban biochemical warfare under the 1925 Geneva Conventions.[32]

Uncertainty and opportunity: Preparing for the enemy's attack

However, the early programmes were able to prevail in sceptical military and political arenas due to what I call strategic blindness. This refers to the persistent inability of intelligence to confirm the status of foreign bioweapon programmes. Uncertainty surrounding the strategic intentions, the institutional extent, and even the existence of an opponent's programme was the most significant environmental and operational feature confronting military fields – indeed, strategic blindness continued to structure the later defensive programmes under the paradigm of preparedness.

It led to persistent suspicions that adversaries might be pursuing offensive capacities under the guise of civil or defensive research. France launched its programme in the end of the 1920s, following Trillat's accusations of a secret German one. Similar allegations, along with fears that the French programme had fallen to the Wehrmacht in 1939, prompted the interlinked biowarfare efforts of

[28]Guillemin, *Biological Weapons*, pp. 6ff.

[29]I do not discuss Japan's (ultimately unsuccessful) biological warfare in Southeast Asia (see ibid., pp. 75–91). While it constitutes both the first and last known instance of modern biological warfare, it had little influence on the Western trajectories of biowarfare, biodefence, and later counter-bioterrorism, which are the focus of this article.

[30]Ibid., pp. 24ff.

[31]Ibid., pp. 43–4; Gert Harigel, *Chemical and Biological Weapons: Use in Warfare, Impact on Society and Environment* (Carnegie Endowment for International Peace, 2001), available at: {https://www.wagingpeace.org/chemical-and-biological-weapons-use-in-warfare-impact-on-society-and-environment/}, accessed 4 July 2025.

[32]Guillemin, *Biological Weapons*, pp. 4ff., 8ff.

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the UK, Canada, and the United States.[33] The UK's initiative initially pursued a defensive purpose but shifted once early offensive successes emerged.

In 1942, British field trials of a cluster bomb containing *Bacillus anthracis* revealed an alarming offensive potential, as the pathogen was hundreds of times more lethal than chemical agents.[34] Faced with this destructive promise, civil defence strategies appeared insufficient. Existing biodefence measures focused on stockpiling resources for military personnel and government leadership but not the general population.

Consequently, the transatlantic action field shifted towards establishing a strategic retaliation capability – a move validated through what Guillemin refers to as 'looking glass justification':[35] own capabilities were used to project opponents' latent arsenal. To restore a presumed balance, US industrial capacity was used to manufacture UK-designed anthrax weapons. Yet when the war ended, it became clear that Germany had never run a biological weapons programme. By that time, the UK had already placed an order for half a million cluster bombs from the United States.[36]

Following WWII, biological weapons were classified alongside chemical and nuclear weapons as WMDs. While the term itself emerged in its earliest usage as a moral category condemning the human consequences of modern warfare, it also acquired a political meaning in post-war debates within the United Nations General Assembly. Focusing on the destructive capacity of modern weaponry – demonstrated most dramatically at Hiroshima – it became associated with policies of precaution and arms control. In this regard, the term referred to not only existing weapon systems but also future technological developments considered capable of producing comparable levels of destruction. Consequently, chemical and biological weapons came to be viewed as emerging forms of 'scientific warfare'.[37] To justify and implement regulatory measures, the strategic significance of present and future chemical-biological (CB) systems was largely taken for granted.[38]

However, many experts have cast doubt on this categorisation, especially in terms of its capability.[39] As biological weapons were never deployed in practice, the strategic and technical concerns mentioned above remained unresolved. The military action fields, now re-embedded within their respective national contexts, continued to develop military goods that were both illicit in their use and controversial in strategic terms. This put the nascent military branch in a somewhat precarious position regarding both legitimacy and reasonability of their practice.

On the eve of the Cold War, the rationale for pursuing biological weapons shifted from their factual destructive power to their anticipated strategic value – thus the destructive potential of future weapons and their presumed retaliation or deterrence capacity. Yet it was precisely in this respect that they began to fall behind nuclear arms. Given the uncontested destructive power of the latter, the wisdom of investing in an uncertain biological potential was increasingly questioned. As Guillemin as well as Horowitz and Narang note, nuclear programmes led to the medium-term decline of Western bioweapons ambitions, except for the United States.[40] Within the US military, the programme was able to maintain its position because of the awareness of a Soviet programme –

[33]Ibid., pp. 24ff., 40ff., 57ff.; Brian Balmer and John Ellis van Courtland-Moon, 'The British, United States and Canadian biological warfare programs', in Filippa Lentzos (ed.), *Biological Threats in the 21st Century* (Imperial College Press, 2016), pp. 43–67.

[34]Guillemin, *Biological Weapons*, pp. 55, 65.

[35]Ibid., p. 56.

[36]Ibid., pp. 66ff.

[37]Seth Carus, *Defining 'Weapons of Mass Destruction'* (National Defense University Press, 2012), pp. 6ff.

[38]This applied equally to both supporters of strategic development and its critics. For the latter, cf. Theodore Rosebury, *Peace or Pestilence: Biological Warfare and How to Avoid It* (Hassel Street Press, 2021 [1949]).

[39]Harigel, *Chemical and Biological Weapons*.

[40]Guillemin, *Biological Weapons*; Michael Horowitz and Neil Narang, 'Poor man's atomic bomb? Exploring the relationship between "weapons of mass destruction"', *Journal of Conflict Resolution*, 58:3 (2014), pp. 509–35 (pp. 528–9); cf. the UK Program: Balmer and Courtland-Moon, 'The British, United States and Canadian biological warfare programs'.

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although the extent of that programme remained a matter of speculation. In the shadow of the nuclear competition, the two superpowers thus entered a blind biological arms race.[41]

Symbolic struggles and the legitimation of biowarfare capabilities

The classification of biological weapons as WMDs therefore emerged from not operational success but rather symbolic struggles over their projected destructive potential. The field's legitimacy hinged on producing a notional weapon that had already been categorised as a WMD. The cheaper production of the agent seemed to offer a surplus over nuclear arms. Legitimacy was provided by rather idealistic calculations. Hypothetical scenarios had always suggested a frightening potential. This is the result of scaling the actual high levels of virulence or toxicity of individual warfare agents with the quantities used. Such scenarios tended to ignore technical obstacles to release and the counter-measures taken by the opposing side.[42]

Partly in response to sustained criticism, the US army conducted extensive field tests using various simulants between 1963 and 1965. When linked to biological parameters, the resulting physical data seemed to confirm the status of bioweapons as a cost-effective variant of WMDs. For instance, it was estimated that using anthrax to cause one fatality per square mile would be one hundred times cheaper than chemical or nuclear alternatives.[43] According to this grim arithmetic, dispersing 50 kilograms of the agent over a populated area could result in up to 200,000 deaths.[44]

Even though no operational bioweapons were ever deployed, the field's evolution was marked by intense symbolic struggles over legitimacy and over the presumed strategic relevance of future systems. These spectacular projections prefigured later contests over the bioterrorism threat, where the same controversial scenarios were repurposed to justify new counter-measures against anticipated attacks.[45]

However, technical hurdles became apparent when the development of an operational (non-lethal) brucellosis-based system for the US air force failed. Critics seized the opportunity to voice their discontent with the entire endeavour. A report by the Office of Systems Analysis concluded that, given the uncertainties in predicting and controlling biological warfare, the United States should focus exclusively on its nuclear capability.[46]

The controversy prompted the Nixon administration to reassess US policy, ultimately leading the president to issue an executive order terminating the programme in 1969. This abrupt decision reflected a paradox that had accompanied bioweapons since their inception: the effectiveness of existing systems was always contested, yet the imagined potential of future ones remained boundless and unproven. It was this open-ended potential, ironically, that caused the legitimation strategy to backfire. From a realpolitik perspective, the prospect of a low-cost WMD – or a 'poor man's bomb' – raised fears of an arms race involving minor powers. In this context, the pursuit of bioweapons came to be seen as a strategic zero-sum game, especially if successful.[47] These tensions fed into subsequent multilateral efforts, culminating in the Biological and Toxin Weapons Convention (BTWC), which entered into force in 1975 and was ratified by all permanent members of the UN Security Council. The BTWC was the first international treaty to ban the research of

[41] Guillemin, *Biological Weapons*, pp. 92ff.

[42] Harigel, *Chemical and Biological Weapons*; Guillemin, *Biological Weapons*, pp. 95ff.

[43] UN, *Chemical and Bacteriological Weapons and the Effects of Their Possible Use*, pp. 44ff.; Koblentz, 'Pathogens as weapons'.

[44] World Health Organisation (hereafter WHO), Executive Board, *Health Aspects of Chemical and Biological Weapons* (World Health Organisation, 1970), pp. 95ff., available at: {https://meselsonarchive.hsites.harvard.edu/sites/g/files/omnuum7261/files/2025-05/1970%20WHO%20Health%20Aspects%20of%20CBW.pdf}, accessed 2 July 2025.

[45] I will come back to this point later, as it highlights a recurring pattern of legitimacy struggles through a longer historical perspective.

[46] Guillemin, *Biological Weapons*, pp. 120ff.

[47] Jonathan Tucker, 'A farewell to germs: The U.S. renunciation of biological and toxin warfare, 1969–70', *International Security*, 27:1 (2002), pp. 107–48.

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an entire category of weapons. Since its adoption, only research for peaceful or defensive purposes has been permitted.[48] While the convention marked a historical milestone in the prohibition of biological weapons, its limitations soon became apparent.

The emergence of counter-bioterrorism as a strategic action field

Factual programmes, fictional weapons

There had long been suspicions in Western security circles that the Soviet Union was violating the treaty. However, strategic blindness made remote assessment difficult, and the BTWC lacked a formal verification mechanism. Particularly problematic was the fact that the treaty permitted the cultivation and study of pathogens for peaceful purposes. This could enable state actors to reproduce and covertly store biological weapons. The offensive capabilities that a state might develop would therefore be defined by not existing stocks but rather the knowledge of developing and delivering agents. Crucially, such expertise could be acquired through defensive or even medical research.[49]

When the programme known as Biopreparat was revealed in the wake of *glasnost*, the surprise was not that the Soviet Union had violated the treaty but rather the scale of the violation. The USSR had not only continued its offensive programme after signing the BTWC; it had expanded it. What gradually emerged was a vast network of institutions conducting research on highly contagious agents – including *Y. pestis* and the variola virus – under the guise of medical, veterinary, or defensive work. Recombinant DNA techniques were used to increase pathogen virulence and resistance. In addition, some thirteen delivery systems were reportedly developed for classical agents, including cluster bombs and medium-range missiles. While these missiles could not reach US territory, they could target European NATO allies.[50]

Meanwhile, suspicions were mounting that Iraq had also initiated a bioweapons programme. The United States was convinced and began vaccinating its troops prior to Operation Desert Storm. UN inspections later confirmed these allegations. Indeed, Iraq launched its programme in 1983. Bioweapons were intended to supplement Iraq's chemical arsenal and enhance deterrence. In practice, the effort failed. At the start of the US intervention, Iraq possessed only 180 'poorly designed biological weapons', whose effectiveness was doubted even by its own military.[51] The programme ended with the second Gulf War and the imposition of UN sanctions, although Iraq managed to conceal some of its activities until 1995.

By the early 1990s, these programmes had become established facts, yet their concrete technical capacities remained opaque. Operation Desert Storm had been justified as a preventive war against WMD proliferation, and post-war narratives claimed that an adversary armed with such weapons had been defeated.[52] Still, security actors lacked clarity regarding Iraq's real capabilities. The opacity was even greater in the case of Biopreparat, most notably concerning the genetic techniques employed, as the most authoritative reconstruction demonstrates.[53]

[48]United Nations Office of Disarmament Affairs (hereafter Unoda), *Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological and Toxin Weapons and on Their Destruction* (Unoda, 1972), available at: {https://treaties.unoda.org/t/bwc}, accessed 2 July 2025.

[49]Enemark, *Biosecurity Dilemmas*, pp. 5ff.

[50]Horowitz and Narang, 'Poor man's atomic bomb'; Jens Kuhn and Milton Leitenberg, 'The Soviet biological warfare program', in Filippa Lentzos (ed.), *Biological Threats in the 21st Century* (Imperial College Press, 2016), pp. 79–102.

[51]Tim Trevan, 'The Iraqi biological warfare program', in Filippa Lentzos (ed.), *Biological Threats in the 21st Century* (Imperial College Press, 2016), pp. 113–29 (p. 121).

[52]Wright, 'Terrorists and biological weapons', p. 64.

[53]Milton Leitenberg, Raymond Zilinskas, and Jens Kuhn, *The Soviet Biological Weapons Program: A History* (Harvard University Press, 2012), pp. 343ff.

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Conflicting security drafts and symbolic struggles in the US discourse

Persistent rumours and later revelations about the programmes formed the starting point for a new bioweapons discourse. It emerged from the question of the capabilities of the weapons developed and unfolded around their security implications. This section contrasts two central drafts that diverged over the actual capability of biological weapons. It therefore traces how competing security drafts mobilised different interpretations of biological threats and proposed contrasting institutional responses.

The hegemonic position was first taken by arms control experts. Sceptical about the WMD capability of bioweapons, they nevertheless recognised an immediate proliferation threat to international and US security. It was prominently advocated by Milton Leitenberg and Barbara Rosenberg, who proposed strengthening the BTWC by introducing effective verification mechanisms to overcome strategic blindness. A transparency policy should be applied across all biological armament sectors, covering even grey-zone research. Even defensive research, they argued, produced dual-use materials and knowledge, thus raising the risk of proliferation and international distrust.[54]

This approach conflicted with a second position advocating an expansion of biodefence. Both its conceptual foundations and policy trajectory were associated with Joshua Lederberg. A pioneer of recombinant DNA technology, he was awarded the Nobel Prize in Medicine in 1957.[55] Although not a weapons expert, Lederberg was considered an expert on two rising security issues: genetic engineering and emerging infections. Throughout the 1980s and 1990s, he served on various committees, including those of the US Department of Defense (DoD) and the Office of Technological Assessment (OTA). In 1993, he became a member of President Clinton's cabinet as an advisor on biological threats. Lederberg's position reflects his role as a cultural broker between health and security agendas. He argued for a hybrid approach that emphasises naturally occurring and man-made epidemics as the health and security challenges of the coming century. His achievement lies in the synthesis of two hitherto distinct strands of research.[56]

Drafting bioterrorism preparedness

The first strand stems from the growing movement of epidemiologists and microbiologists concerned with the health threats posed by emerging infections – a category encompassing novel pathogens such as HIV/AIDS or zoonotic influenza. Given Western societies' dependence on mobility and interconnected infrastructures, they appeared as inherently vulnerable to contagion. Thus, several emerging infections were increasingly recognised as (inter)national security threats.[57]

'Vulnerability' here serves as a multifunctional term. Increased mobility heightens the likelihood of introducing pathogens to susceptible populations and amplifies pandemic impact. It also refers to the cascading effects of disease across social systems. Beyond public health, potential damage included economic crises or social destabilisation. To describe these dynamics, epidemiologists increasingly employed simulations as not only analytical tools but also instruments to raise political awareness. Lederberg assumed that the deliberate release of highly contagious agents would mimic natural epidemics, aggravated by the same vulnerabilities. Modified agents, like novel pathogens, would also evade pharmaceutical counter-measures.[58]

[54]Barbara Rosenberg and Gordon Burk, 'Verification of compliance with the biological weapons convention', in Susan Wright (ed.), *Preventing a Biological Arm Race* (MIT Press, 1990), pp. 301–329; Milton Leitenberg, 'Biological weapons arm control', Project on Rethinking Arms Control: PRAC Paper No. 16, available at: {https://api.drum.lib.umd.edu/server/api/core/bitstreams/b917253b-4c7c-4f35-99b0-a4464a7263de/content} accessed 4 July 2025; Wright, 'Terrorists and biological weapons', p. 66.

[55]Ibid., pp. 65ff.

[56]Ibid., pp. 66–8.

[57]Nicolas King, 'Security, disease, commerce: Ideologies of postcolonial global health', *Social Studies of Science*, 32:5–6 (2002), pp. 763–89; Lakoff, 'The generic biothreat'.

[58]Lakoff, 'The generic biothreat'; Lakoff and Collier, 'The problem of securing health'.

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The second strand Lederberg drew on involved biodefence specialists and some terrorism experts. They warned of a 'poor man's bomb' that Biopreparat might have developed. While this was largely speculative, Lederberg argued that adversaries would eventually exploit biotechnology to create such weapons. In his view, the WMD potential of these still-futuristic systems would be comparable to nuclear arms.[59]

In this discourse, terrorist groups replaced the hostile state as the most probable users of biowarfare. Bioterrorism was not a new concept. A handful of experts, including Lederberg, had warned of future biological terrorism since the 1980s. In many cases, the narrative lacked analytical validity, let alone empirical foundation. It was intertwined with the Reagan-era concept of state-sponsored terrorism, a framework rooted in rather speculative and occasionally conspiratorial models.[60] It posited worldwide networks linking communist countries, third world 'rogue states', and terrorist groups facilitating WMD proliferation. Biochemical weapons were central because they were treated as low-cost variants that terrorist groups could easily produce.[61] Within this framework, they would eventually get hold of such weapons and, more or less by definition, use them.[62] Driven by radical ideologies, such terrorists could be neither deterred nor drawn into arms control. The discourse therefore drew terrifying images of inevitable asymmetric biowarfare launched against US cities, costing thousands to millions of lives.[63]

Lederberg lent such catastrophic scenarios scientific credibility. In estimating bioweapons' presumed damage, he invoked comparisons to the Spanish flu, which killed 30–50 million people.[64] Like-minded biodefence specialists reused Cold War–era calculations or adapted their methods for contemporary scenarios. An OTA report from 1993 co-edited by Lederberg posited that dispersing 100 kg of anthrax in an urban area could kill up to three million people – even if a classic agent were used.[65] Lederberg contrasts this imminent threat with a positive vision based on the technological progress offered by innovations in genetic engineering. Because natural and man-made epidemics unfold in a time-delayed cascade, he argued, their effects could be contained through appropriate preparedness – marking a crucial difference between biological warfare and nuclear annihilation.[66]

Practical implications of preparedness and points of conflict with arms control

Preparatory measures ranged from disease surveillance to the stockpiling of advanced pharmaceuticals.[67] More relevant for the present argument, however, are the epistemic practices that underpinned these measures. Preparedness requires strategic action to be guided by assumptions about the technological and organisational capacities of potential adversaries. As known from previous bioweapons programmes, the operational environment of strategic action is characterised by uncertainty. Under the condition of strategic blindness, red-teaming methods and scenario-based exercises become indispensable for anticipating enemy behaviour. Research at the intersection of medicine and biodefence is required to identify likely agents, targets, and vulnerabilities. This knowledge, in turn, informs detection strategies, surveillance infrastructures, and the development of medical counter-measures.[68]

[59] Wright, 'Terrorists and biological weapons', p. 80.

[60] Ibid., pp. 63ff.

[61] Jeffrey Simon, 'Terrorists and the potential use of biological weapons: A discussion of possibilities', *RAND Corporation*, R-3771-AFMIC (1989), available at: {https://www.rand.org/pubs/reports/R3771.html}, accessed 5 July 2025.

[62] Cf. Tucker, 'Introduction', for a critical assessment.

[63] Cf. Joseph Douglas and Neil Livingstone, *America the Vulnerable: The Threat of Chemical/Biological Warfare* (Lexington Books, 1987); Simon, 'Terrorists and the potential use of biological weapons'.

[64] Jessica Stern, 'Dreaded risks and the control of biological weapons', *International Security*, 27:3 (2003), pp. 89–123 (p. 100).

[65] Office of Technology Assessment (hereafter OTA), *Proliferation of Weapons of Mass Destruction: Assessing the Risks*, OTA-ISC-559, Report (1993), p. 51, available at: {https://ota.fas.org/reports/9341.pdf}, accessed January 2024.

[66] Wright, 'Terrorists and biological weapons', p. 80.

[67] OTA, *Technology Against Terrorism: Structuring Security*, OTA-ISC-511, Report (1992), available at: {https://ota.fas.org/reports/9235.pdf}, accessed January 2024.

[68] Cf. Enemark, 'United States biodefense, international law, and the problem of intent'.

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Calls to expand state funding for biomedical research in anticipation of emerging infections were advanced by biotechnology firms and medical experts. Lederberg, who was involved in this initiative, transferred these demands into the domain of biodefence. Genetic research, he argued, would provide critical knowledge for countering both emerging and engineered pathogens. In this way, health and security objectives could be aligned within an integrated research agenda situated at the intersection of military defence, domestic security, and epidemic preparedness.[69]

Strategic networking was also required to prepare for envisaged asymmetric biological attacks. Biodefence capabilities now needed to extend into the civilian sphere to protect broader populations – an aim previously regarded as unrealistic within military-centric frameworks. To achieve this, public health agencies and biotechnology firms would need to be incorporated into the security research community.[70] However, both the expansion of biodefence and the introduction of cutting-edge genetic techniques became key points of contention with proponents of arms control. This is because both would inevitably increase distrust by expanding classified activities while simultaneously heightening the risk of proliferation through dual-use research.[71]

Lederberg was not alone in seeking a strategic link between health and security. But what made Lederberg's proposal particularly compelling is that it drew on two initiatives and systematised their agendas. Furthermore, as a brilliant and well-connected scientist, his pronouncements had significant impact. As we will see, he also had a personal network of prominent individuals from diverse professional backgrounds, forming the initial social venture. Ultimately, his strategic positioning in the government cabinet became crucial, allowing him and allies to influence policy perceptions beyond professional disputes.

The social venture of biodefence and counter-bioterrorism

Until the mid-1990s, biodefence played only a marginal role in security policy. The military value of biological weapons was considered discredited, and terrorism ranked as a secondary concern. The 1991 Nunn-Lugar Cooperative Threat Reduction initiative focused on WMD non-proliferation. Measures such as the re-employment of former bioweapons researchers, decommissioning of Biopreparat infrastructures, or their conversion to civilian use reflected a disarmament rationale.[72]

Against this background, the venture advanced a preparedness paradigm through strategic networking as well as symbolic and political manoeuvres that gradually translated the agenda into institutional commitments and routinised practices.

Early networking and agenda-setting practices

Concurrently, Lederberg became the focal point of a network of biotech entrepreneurs, infectiologists, and biodefence and terrorism experts who shared the threat narrative – or at least endorsed the practices associated with it. Together with Bill Patrick, a former bioweapons scientist, Lederberg amplified bioterrorism concerns. In 1995, Patrick addressed a government security meeting of 400 participants, framing bioterrorism as a credible threat considering the sarin gas attack by Aum Shinrikyo and the rising profile of al Qaeda. He warned that Iraq could have released botulinum toxin into the World Trade Center's ventilation system, citing the 1993 bombing. Lederberg echoed these fears, equating (bio)terrorists and viruses as existential threats to humanity that only science could counter.[73]

[69]Wright, 'Terrorists and biological weapons', pp. 68ff., 74–5.

[70]Ibid., pp. 68–9.

[71]Jonathan King and Harlee Strauss, 'The fallacy of defensive biological weapons programmes', in Erhard Geissler (ed.), *Biological and Toxin Weapons Today* (Oxford University Press, 1986), pp. 120–32; Charles Piller and Keith Yamamoto, 'The U.S. biological defense research program in the 1980s: A critique', in Susan Wright (ed.), *Preventing a Biological Arm Race* (MIT Press, 1990), pp. 133–68.

[72]Wright, 'Terrorists and biological weapons', pp. 76ff.

[73]Ibid., pp. 77ff.

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In this heated climate, the boundary between fact and fiction blurred. *The Cobra Event*,[74] a techno-thriller novel by science journalist Richard Preston, gained extraordinary political traction. It depicted bioterrorist attacks using a recombinant virus, Cobra, combining smallpox's virulence with the neurodegenerative effects of a moth virus. The airborne disease attacked the brain, leading to auto-cannibalistic behaviour and certain death. In 1997, biotech entrepreneur Craig Venter recommended the book to President Clinton, who reportedly reacted with alarm. The preface – based on unnamed sources, including biodefence expert Bill Patrick – claimed full scientific accuracy.[75] Clinton consulted his science advisor, Nobel laureate Joshua Lederberg, who reassured him of the plot's plausibility.[76] Concurrently, Preston published several articles describing Biopreparat's weapon stockpiles with precision as impressive as it was questionable. At Lederberg's urging and Clinton's invitation, Preston presented these claims before Congress, claiming the Soviet Union possessed 400 intercontinental missiles armed with genetically modified smallpox, plague, and Ebola viruses – now reportedly 'missing'.[77]

Two notable figures were Craig Venter and William Haseltine. Venter, a leading genome researcher, founded Celera Genomics, the private company that challenged the Human Genome Project with its commercial sequencing effort. Haseltine had founded Human Genome Sciences. Both stood to gain from heightened public investment in genetic and biomedical research. At Lederberg's instigation, both testified before the US Cabinet on the emerging threat of genetic warfare. In 1998, Haseltine was commissioned to design a tabletop exercise to generate a sense of urgency among decision makers. His scenario depicted the clandestine release of a recombinant virus. Like Preston's Cobra, it combined the properties of variola with other horrific agents. Initially it caused smallpox-like symptoms, prompting participating senators to develop a vaccine. Unfortunately, the virus was 'programmed' to suddenly cause haemorrhagic fever, rendering the vaccine ineffective. The disease wreaking havoc on the population left the senators disturbed. The message was as bleak as it was clear: without prior knowledge about weaponisation and adequate preparation, all measures would come too late.[78]

These targeted interventions were coupled with a broader media offensive in 1997. Lederberg initiated a special issue of the *Journal of the American Medical Association* (hereafter JAMA),[79] featuring contributions from various experts convinced of the bioterrorism threat. Lederberg himself predicted the imminent release of modified germs on a massive scale. Terrorism researcher Jeffrey Simon was more specific in terms of numbers, literally heralding a bioterrorism event that would cost hundreds of thousands of lives.[80] Such projections were surpassed by Secretary of Defence William Cohen, who on ABC pointed to five grams of sugar, claiming that the same amount of anthrax could kill half the population of Washington – a rather fanciful estimate.[81]

Within the security domain, arms and terrorism experts criticised the exaggerated spectacle of bioweapons' destructive power and the presumed ease of producing futuristic agents outside of state-run programmes.[82] While these voices were prominent in security discourse, they lacked

[74]Richard Preston, *The Cobra Event* (Ballantine Books, 1997).

[75]Phillipp Sarasin, *Anthrax: Bioterror als Phantasma* [Anthrax: Bioterrorism as Fact and Fantasy] (Suhrkamp, 2004), pp. 73ff.

[76]Cf. Jean Guillemin, *American Anthrax: Fear, Crime, and the Investigation of the Nation's Deadliest Bioterror Attack* (Times Books, 2011), p. 13. Recent scholarship has analysed comparable dynamics in which security fiction contributes to the construction of future threat imaginaries and the legitimation of security agendas. See Andersen Engberg-Pedersen, 'The national security novel: "Useful fiction," persuasive emotions, and the securitization of literature', *Critical Inquiry*, 51:2 (2025), pp. 225–46, on the role of security novels in contemporary security discourse, functioning as both tools for anticipating future threats and instruments of persuasion and agenda-setting.

[77]Sarasin, *Anthrax*, pp. 81ff.

[78]Wright, 'Terrorists and biological weapons', pp. 88–9.

[79]Joshua Lederberg and Annette Flanagin, 'Infectious disease and biological weapons: Prophylaxis and mitigation', *JAMA*, 276:5 (1997), pp. 419–20.

[80]Jeffrey Simon, 'Biological terrorism: Preparing to meet the threat', *JAMA*, 278:5 (1997), pp. 428–30.

[81]Milton Leitenberg, 'Biological weapons in the twentieth century: A review and analysis', *Critical Review of Microbiology*, 27:4 (2001), pp. 267–320 (p. 305).

[82]Wright, 'Terrorists and biological weapons', p. 86.

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political influences and comparable media reach. Cohen's TV appearance was followed by an ABC documentary focusing exclusively on alarming voices.[83]

During this initial stage, the boundaries between fictional, empirical, and analytical categories were deliberately blurred. Haseltine's scenario operates in a similar register as Preston's *The Cobra Event*: both mobilise fictional elements while claiming proximity to plausible scientific developments. In this way, the scope of the threat is extended through strategic narration. While rumours about existing weapons programmes were amplified, proponents simultaneously outlined scenarios in which technologically sophisticated adversaries could develop a new generation of biological weapons – largely independent of the actual proliferation risks associated with those programmes. Notably, Preston maintains a partial distinction between fiction and analysis, whereas Haseltine's scenario explicitly collapses this boundary, presenting speculative biotechnological futures as actionable security concerns. This narrative strategy emerged at a time when a new wave of biotechnology firms promoted visions of innovation in pursuit of venture capital investment.[84]

In this regard, the rationale for bioterrorism preparedness appears less as the outcome of a coherent security logic than as the product of a strategic narrative advanced by actors who adapted the threat to their positional interests. Although the narrative was contested from the start, symbolic struggles did not unfold within the broader discursive arena. Instead, the social venture largely bypassed criticism of arms control specialists by directing its interventions towards key points of political influence – the presidential cabinet, the senate, and major media outlets. Contingency also shaped the emergence of bioterrorism preparedness. In the face of sustained criticism, the venture's efforts might have failed had Clinton not been extraordinary receptive to the threat narrative. Multiple sources describe the president as 'deeply scared' and plagued by vivid 'nightmares' of bioterrorism in US cities.[85]

Symbolic consecration and early institutionalisation

This convergence of scientific consultation and emotional resonance culminated in a high-level security meeting on 10 April 1998. Except for Barbara Rosenberg, the participants were hand-selected by Lederberg and Venter. Rosenberg's plea for enhanced prevention efforts was overwhelmed by a unified insistence on the need for rapid expansion of biodefence to counter an evolving threat. It should also be noted that several of the proponents held advisory positions or financial stakes in biotechnology firms that would later benefit from federal funding.[86]

In course of the meeting, Clinton approved a $171 million biodefence budget. This decision institutionalised the venture's draft, constituting an act of official consecration of the threat narrative – one whose symbolic effect far exceeded the initially modest financial scale. From that point on, bioterrorism became a recognised object of policy concern. Consequently, scientists, companies, and public health and security professionals increasingly framed their work in relation to biodefence to secure access to R&D programmes and federal grants. For instance, public health actors, still suffering from Reagan-era cuts, echoed claims of vulnerability to drain additional funding from the DoD,[87] while biodefence emphasised the medical co-benefits their research would offer even in the absence of attacks.[88]

At this stage, the emerging field was not driven by a necessarily shared strategic assessment of an immediate threat. Rather, it was also shaped by different institutional logics and economic

[83]Ibid., p. 83.

[84]Cf. Gary Pisano, *Science Business: The Promise, the Reality, and the Future of Biotech* (Harvard Business Review Press, 2006), pp. 111ff.

[85]Guillemin, *American Anthrax*, p. 13; Sarasin, *Anthrax*, p. 88.

[86]Wright, 'Terrorists and biological weapons', pp. 90–1.

[87]E.g., Institute of Medicine (hereafter IOM) and National Research Council (hereafter NRC), *Chemical and Biological Terrorism: Research and Development to Improve Civilian Medical Response* (National Academies Press, 1999).

[88]Wright, 'Terrorists and biological weapons', pp. 85–6, 93–4.

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rationales. The paradigmatic draft offered opportunities for diverse sectors. There were health specialists who believed in a serious bioterrorism risk. Epidemiologist Donald Henderson calculated that an additional stockpile of approximately 20 million vaccines would be necessary to prevent a disruptive smallpox epidemic in the wake of an attack.[89]

First steps of routinisation: The ambiguous role of scenario exercises

Yet the dynamics unfolding are not reducible to opportunistic rationales. The institutionalisation of preparedness came with routines, which in turn recursively shaped and reinforced a distinct epistemic and strategic culture. A key part was played by civilian and governmental centres dedicated to simulating bioterrorism exercises. Established by the late 1990s, they served not only to assess and identify infrastructural vulnerabilities but also to 'sensitise' decision makers and practitioners across public domains and administrative levels.[90]

Therefore, large-scale exercises revolved around the fixed narrative: the release of highly sophisticated agents on American soil. They prefigured not only the failure of arms control strategies but also a terrorism with highly operative capabilities in strategic and technological terms.[91] TOPOFF (May 2000), a large-scale simulation with 10,000 participants, staged the simultaneous release of chemical agents in New London and plague bacteria in New Jersey. DARK WINTER (June 2001) simulated a national epidemic caused by aerosolised smallpox. Both exercises followed a near-identical script: delayed or insufficient responses lead to surging morbidity, overwhelming medical systems, followed by civil unrest, resource exhaustion, and eventual systemic collapse.[92]

Increasingly routinised simulations reinforced the venture's core assumptions as strategic paradigms of the evolving field. Its distinct culture rested on a blurring of boundaries between analytical assessment and fictional narratives. While such scenarios were presented as tools for exposing institutional weaknesses and deriving appropriate counter-measures, they simultaneously framed the threat as highly certain –in terms of both its likelihood and its catastrophic effects. Moreover, the exercises propagated pre-scripted solutions on which the dramaturgy depended: to stay ahead of an ostensibly inevitable attack, one must initiate intersectoral emergency planning but also commit to large-scale investments in biodefence research and medical counter-measures. DARK WINTER was conceptualised by a biodefence centre founded in 1998 by Henderson. The scenario resembled Henderson's theoretical one. Unsurprisingly, similar conclusions were drawn regarding the need for additional stockpiles.[93]

By depicting future asymmetric biowarfare as a matter of dramatic plausibility, scenarios effectively bypassed these controversies, much as expert opposition had previously been circumvented through political mobilisation. To some extent, they simply echoed central claims and prefixed solutions within their dramaturgy.[94] Thus, many lessons were learned long before conclusions were drawn. Major exercises and speculative scenarios generated predictable media attention, thereby inscribing a still largely fictional terrorism into the collective memory of US society – and presumably its adversaries as well.

Although the financial resources involved remained modest, routinised narratives and scenario practices established the symbolic and organisational foundations of a preparedness paradigm that would expand rapidly in the wake of the shocks of 9/11 and the anthrax letters.

[89]Lawrence Altmann, 'Smallpox vaccine urged to fight terrorist attacks', *New York Times* (11 March 1998), available at: {https://www.nytimes.com/1998/03/11/us/smallpox-vaccine-urged-to-fight-terrorist-attacks.html}, accessed 24 February 2024.

[90]Wright, 'Terrorists and biological weapons', p. 96.

[91]Guillemin, *American Anthrax*, p. 10; Lakoff, 'The generic biothreat'.

[92]Monica Schoch-Spana, 'Bioterrorism: US public health and a secular apocalypse', *Anthropology Today*, 20:5 (2004), pp. 8–13.

[93]Dale Rose, 'How did the smallpox vaccination program come about?', in Andrew Lakoff and Stephen Collier (eds), *Biosecurity Interventions: Global Health and Security in Question* (Columbia University Press, 2008), pp. 89–120.

[94]Schoch-Spana, 'Bioterrorism'.

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The rise of (counter-)bioterrorism

Factual vs. fictional bioterrorism

The figure of bioterrorism as portrayed in public and policy discourses has little in common with its historical counterpart. In terms of the technological sophistication of agents and delivery methods, imagined and actual bioterrorism are almost diametrically opposed. The most detailed study of this period identified only five confirmed cases of attempted bioterrorist activity, ranging from attempted acquisition of biological agents to their actual deployment, throughout the entire twentieth century.[95] In one case (Larry Harris, 1993, 1995), no pathogen was acquired. In two others, the amount of pathogen obtained was negligible (RISE, 1992; Minnesota Patriot Council, 1991). Most offenders exhibited psychological issues, and their operational capabilities to execute even small-scale attacks were questionable.[96]

Only the Rajneesh Buddhist sect managed to effectively disseminate a biological agent (*S. typhi*). In 1984, a subgroup of the sect manually contaminated several salad bars in The Dalles, Oregon, aiming to influence local elections by incapacitating voters. Although the attempt failed in its political aim, approximately 750 people experienced diarrhoeal illness.[97]

It is fair to say that historical cases play a negligible role in the dominant discourse for the sake of legitimacy. One exception is Aum Shinrikyo. During the investigation into the Tokyo subway sarin attacks in 1995, Japanese authorities discovered that the cult had tried to develop biological weapons. Authorities seized large quantities of laboratory equipment and tons of culture media intended for botulinum toxin production. Aum Shinrikyo released anthrax spores on at least ten occasions between 1990 and 1995. While biodefence advocates took this as validation of their worst-case projections, arms control and terrorism experts remained sceptical. None of the anthrax releases resulted in infection. Despite having substantial production capacities, the group failed to develop an effective botulinum-based combat agent. Despite spending roughly $30 million, Aum Shinrikyo failed to produce a single viable biological weapon. For that reason, it ultimately turned to chemical warfare.[98]

Aum Shinrikyo nonetheless served as a symbolically useful case to articulate demands for preparedness. Attention was shifted from the group's actual failures to its intentions and to the unrealised potential. In the case of the sarin gas attacks, advocates of the biochemical terrorism thesis argued that with slightly better preparation, the outcome could have been exponentially deadlier. The same logic was applied to botulinum toxin.[99]

Within the emerging security field, such reinterpretations transformed empirical failure into symbolic evidence of latent catastrophic potential, illustrating how threat perceptions were shaped through ongoing symbolic struggles rather than operational realities. The considerable organisational and technical obstacles Aum Shinrikyo faced were therefore largely disregarded in favour of speculative projections – as shown in the previous section, an interpretation advanced in a context of increasingly entangled institutional interests in affirming the credibility of the threat.

(Re)drafting bioterrorism in the context of new terrorism

Another fundamentalist group, al Qaeda, came into focus. While there was no concrete evidence of a bioterrorist programme, isolated statements by Osama bin Laden hinted at WMD ambitions.

[95] Carus, *Bioterrorism and Biocrimes*, p. 7, Table 1.

[96] Ibid., pp. 42–76; case studies by different scholars can be found in Jonathan Tucker (ed.), *Toxic Terror: Assessing Terrorist Use of Chemical and Biological Weapons* (MIT Press, 2000).

[97] Seth Carus, 'The Rajneeshees (1984)', in Jonathan Tucker (ed.), *Toxic Terror: Assessing Terrorist Use of Chemical and Biological Weapons* (MIT Press, 2000), pp. 115–38.

[98] Bruce Hoffman, 'Terrorism by weapons of mass destruction: A reassessment of the threat', *Security and Peace*, 17:2 (2000), pp. 125–30.

[99] Critically: Wright, 'Terrorists and biological weapons', pp. 73ff; Tucker, 'Introduction'.

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In interviews, he declared that he would consider deploying such weapons against Western civilians. But these statements may have been rhetorical, designed to exploit the cultural resonance of WMDs.[100]

The prominence of al Qaeda in these debates must be understood within a broader shift in terrorism studies during the 1990s. Increasingly lethal attacks against civilian targets led scholars to speak of a 'new terrorism', characterised by a willingness to inflict mass casualties. This discourse resembles in part the older Reagan-era discussions of a large-scale terrorism threat, but in a more analytical manner and with respect to empirical evidence, since several attacks resulted in exorbitant fatality rates.[101]

More speculative was the revival of the discourse on weapons of mass destruction (WMD) terrorism from the Reagan era. Once again, WMDs and CBRN[102] weapons were strongly associated, despite the destructive power of biochemical weapons remaining highly contested. Scholars coined terms such as 'dirty bomb' and 'nuclear terrorism', painting pictures of whole cities annihilated in an instant and contaminated by radiation.[103]

As outlined in the previous section, proponents of the emerging field of counter-bioterrorism advanced similar scenarios. However, as RN terrorism was considered a high-consequence threat, the argument that biological weapons (BW) was easily produced was emphasised. This argument was pushed to the point where prediction became indistinguishable from prophecy, when various bioterrorism and defence specialists proclaimed from 1995 on that a biological attack was not be a question of if, but when.[104]

Other experts warned that fixation on WMD terrorism could obscure adversaries' strategic options: massive casualties could also be inflicted with conventional weapons and unconventional tactics.[105] In that respect, as Brian Jenkins remarked, worst-case scenarios regarding WMD threats in general could create false strategic imperatives by imaginative fixation on speculative yet horrific events, while neglecting the full scope of more likely attacks carried out by combining conventional (traditional and trusted) weapons with innovative strategic manoeuvres.[106]

The attacks of 11 September seemed to validate this critique, since they were executed by exactly that combination. In the aftermath to the attacks, Congress criticised the 'failure of imagination' of the security fields as a source of the disaster.[107] But with respect to WMDs and bioterrorism, this statement is not true. As outlined, from 1998 on to several months before 9/11, scenario exercises were executed, preparing US security for a range of attacks, from an aerial smallpox release to simultaneous asymmetric biochemical warfare in different cities. Given that, imagination was not absent; rather, anticipatory practices channelled strategic attention towards WMD scenarios, as Jenkins predicted.

The anthrax letters and the paradoxical expansion of counter-bioterrorism

Yet only weeks later, the deadliest biological attack in US history took place. Between 18 September and 9 October 2001, two waves of anthrax-laced letters were sent to senators and major media outlets. The second series contained powdered anthrax of exceptional quality, capable of causing

[100]Tucker, 'Introduction'.

[101]Tucker, 'Introduction'; cf. Brad Roberts (ed.), *Hype or Reality? The 'New Terrorism' and Mass Casualty Attacks* (The Chemical and Biological Arms Institute, 2000), for the discussion; more recently: Alexander Spencer, 'New versus old terrorism', in Richard Jackson (ed.), *Routledge Handbook of Critical Terrorism Studies* (Routledge, 2018), pp. 124–33.

[102]CBRN stands for chemical, biological, radiological, and nuclear weapons.

[103]Bradley Thayer, Richard Falkenrath, and Robert Newman, *America's Achilles' Heel: Nuclear, Biological, and Chemical Terrorism and Covert Attack* (MIT Press, 1998); critical: Brian Jenkins, 'The WMD terrorist threat: Is there a consensus view?', in Brad Roberts (ed.), *Hype or Reality?*, pp. 241–5; Brian Jenkins, *Will Terrorists Go Nuclear?* (Prometheus Books, 2008).

[104]Cf. Wright, 'Terrorists and biological weapons', pp. 57–8.

[105]Ibid., pp. 97–8; Jenkins, 'The WMD terrorist threat'.

[106]Jenkins, 'The WMD terrorist threat'.

[107]Commission on Terrorist Attacks upon the United States, *The 9/11 Commission Report: Final Report of the National Commission on Terrorist Attacks Upon the United States* (2004), pp. 339ff., available at: {https://www.govinfo.gov/app/details/GPO-911REPORT}, accessed 7 March 2026.

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inhalational infection. In total, twenty-two people were infected and five died. The letters invoked the destruction of the United States and Israel, concluding with the phrase 'Allah is great'. Given timing and content, media and politics quickly blamed al Qaeda for release and Iraq for proliferation, falsely assuming the regime had continued its bioweapon production. Although the FBI cautioned against premature conclusions, it faced intense political and media pressure.[108]

From this point on a large-scale response emerged, driven less by empirical evidence than by spectral visions of (biological) WMD terrorism. In effect, actors operated under a self-reinforcing logic of preparedness: dystopian projections generated funding streams, which in turn sustained the very imaginary that had justified them. The Bush administration increased the biodefence budget to an annual average of $5.5–6 billion, with financial commitments extending at least until 2013.[109]

The anthrax letters thus acted as a critical catalyst through which the symbolic infrastructure of bioterrorism preparedness, established during the late 1990s, translated into large-scale institutional and financial commitments. A biodefence procurement market emerged, with more than $5 billion in guaranteed contracts awarded to private firms for vaccines and therapeutics under Project Bioshield.[110]

In response to US activity, allied states adopted similar preparedness strategies. At the supranational level (EU, NATO) and within individual countries (e.g., Germany, France), worst-case scenarios were simulated and analogous emergency infrastructures developed, though on a smaller scale.[111] Internationally, a renaissance of biodefence unfolded, evidenced by the construction of new high-security laboratories and the proliferation of cross-sectoral R&D initiatives. Countries such as Russia and China also ramped up their efforts – probably reacting more to novel US engagement in an ambiguous armament sector than to a bioterrorist threat.[112]

This large-scale mobilisation occurred on account of a terrorism event considered the worst enemy of the 'free world' – one foreshadowed by Aum Shinrikyo and materialised in the anthrax attacks. Yet this almost perfect adversary had one flaw: it did not exist. The anthrax strain used in the letters led FBI investigators to not the Middle East but rather the biodefence laboratory at Fort Detrick, Maryland. The alleged perpetrator, who avoided prosecution by suicide, did not fit the profile of an innovative mujahideen: he was a Caucasian biodefence researcher who suffered from paranoid depression. According to investigators, his motive may have been to 'warn' the US of an anthrax attack – he did warn officials in the late 1990s, advocating increased biodefence founding. The letters could be seen as a false flag attempt to force the nation to 'prepare'.[113] Al Qaeda had indeed been attempting to obtain a pathogenic strain of anthrax since 1998, albeit rather half-heartedly and ultimately without success. However, it was only in the wake of counterterrorism efforts that the organisation developed an interest in the very type of weapon that terrified its sworn enemy.[114]

Counter-bioterrorism as social action field and the dilemmas of preparedness

From 2002 on, a multibillion-dollar strategic action field emerged in the United States, triggering similar efforts internationally. The resulting renaissance of biodefence is largely dis-embedded from its former military context. The US field linked biodefence with domestic security and disaster protection. Networks evolved between security agencies and public health, agricultural, and

[108]Guillemin, *American Anthrax*, pp. 106ff.

[109]Enemark, *Biosecurity Dilemmas*, pp. 26–7.

[110]Filippa Lentzos, 'The American biodefense industry: From emergency to nonemergence', *Politics and the Life Sciences*, 26:1 (2007), pp. 15–23.

[111]Filippa Lentzos and Nicolas Rose, 'Governing insecurity: Contingency planning, protection', *Economy and Society*, 38:2 (2008), pp. 230–54.

[112]Bonin, *International Biodefense Handbook*; Enemark, *Biosecurity Dilemmas*, pp. 28ff.

[113]Guillemin, *American Anthrax*, pp. 13ff., 215ff.

[114]Cf. Leitenberg, 'The self-fulfilling prophecy of bioterrorism'.

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environmental services.[115] R&D and strategic planning were carried out by state and private actors, as well as across their intersections.

Yet in the absence of a factual attack, the mentioned epistemic practices remained the sole vanishing point under which the diverse forms of preparedness could unfurl. Vulnerability analysis, simulation exercises, and scenario planning have become routine actions for the rising field.[116]

Routinising bioterrorism preparedness and the accumulation of knowledge

Continuous threat assessment was necessary to inform counter-measure development. Imaginative practices like simulative exercises were matched with research on potential combat agents and delivery systems. Since every agent comes with a spectrum of possible releases, an iterative learning curve evolved: expanding knowledge on agents and devices informed scenario planning, while scenario building highlighted new vulnerabilities and biodefence research expanded the imagined range of combat agents and systems of release.

By the turn of the century, US biodefence had already replicated the resistant anthrax strain from Biopreparat. Another project produced a cultivation system for the same pathogen based on commercially available components.[117] Non-traditional warfare agents, such as emerging pathogens, are routinely analysed for potential weaponisation.[118] Some projects used genetic engineering to weaponise otherwise harmless viruses. For example, a biodefence team attempted to modify mousepox to develop the pathogenic properties of variola.[119]

Technical and strategic research extrapolated potential delivery systems and structures. Faced with strategic blindness, it outlined the opportunity structure of the manoeuvres of an unknown adversary. Several systems of dispersion were conceptualised. For instance, it became clear that gardening air blowers would be suitable for dissemination of a range of agents,[120] and experiments were conducted to determine the parameters for the concentration of agents like plague or anthrax needed to contaminate a specific number of cubic metres under varying environmental conditions.[121] Further vulnerabilities are presented by private drinking water systems,[122] public transport,[123] and food supply chains.[124] Even the milk distribution system was analysed as an appropriate vehicle for the release of the botulinum toxin.[125]

Considering the evolution of the practice since the turn of the century, the scenarios envisaged have become both more concrete and broader in scope compared to the former worst-case scenarios. The accumulation and combination of the different dimensions of knowledge routinely led to a multiplication of scenarios and their empirical consolidation.

[115]Cf. Bonin, *Biodefense Handbook*, for several national programmes.

[116]Lakoff, 'The generic biothreat'.

[117]Enemark, 'United States biodefense, international law, and the problem of intent'.

[118]E.g., for epizootics: Mark Polyak, 'The threat of agroterrorism: Economics of bioterrorism', *Georgetown Journal of International Affairs*, 5:2 (2004), pp. 31–8; for water-borne diseases: Zygmunt Dembek, 'Modeling for bioterrorism incidents', in Luther Lindler et al. (eds), *Biological Weapons Defense: Infectious Diseases and Counterbioterrorism* (Humana Press, 2005), pp. 23–41; for Ebola: Naveen Gunaratne, 'The Ebola virus and the threat of bioterrorism', *The Fletcher Forum of World Affairs*, 39:1 (2015), pp. 63–76.

[119]Enemark, 'United States biodefense, international law, and the problem of intent'.

[120]Nola Kennedy and William Hinds, 'Release of simulated anthrax particles from disposable respirators', *Journal of Occupational and Environmental Hygiene*, 1:1 (2004), pp. 7–10; Enemark, *Biosecurity Dilemmas*, pp. 18ff.

[121]Luise Pitt and Ross LeClaire, 'Pathogenesis by aerosol', in Luther Lindler et al. (eds), *Biological Weapons Defense: Infectious Diseases and Counterbioterrorism* (Humana Press, 2005), pp. 65–78.

[122]Dembek, 'Modeling for bioterrorism incidents'.

[123]Gunaratne, 'The Ebola virus and the threat of bioterrorism'.

[124]Cf. Orlando Cenciarelli, Paul Riley, and Agoritsa Baka, 'Biosecurity threat posed by botulinum toxin', *Toxins*, 11:12 (2019), pp. 1–9, available at: {https://doi.org/10.3390/toxins11120681}, accessed 5 July 2026.

[125]Lawrence Wein and Yifang Liu, 'Analyzing a bioterror attack on the food supply: The case of botulinum toxin in milk', *Proceedings of the National Academy of Science*, 102:28 (2005), pp. 9984–9.

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Within the field, positions emerged that focused on more realistic scenarios in distinction to the apocalyptic ones dominating the emergence of counter-bioterrorism. Drawing on a growing body of empirical evidence, small- and medium-scale scenarios appeared as a reflexive correction to speculative worst-case calculations.[126] But in this way, biodefence research explored a growing body of possible systems and agents, while small-scale scenarios inevitably expanded the tactical scope of bioterrorist attacks. Every technological innovation inspired further anticipatory and preparatory action.

For example, developments in drones gave rise to the scenario of equipping them with pesticide sprayers, already identified as effective dispersion systems for numerous agents.[127] In recent years, biotechnology and AI developments have reintroduced large-scale threat scenarios into the discourse. For instance, a red-team approach explored the intersection of both, asking to what extent their combination would allow the cost-effective synthesis and weaponisation of pathogens,[128] while strategic and scientific papers increasingly speculate about next-generation bioweapons enabled by biotechnological innovation.[129] Similar concerns are being incorporated into AI governance. Leading AI companies are increasingly commissioning external security experts to conduct red-teaming projects to identify the potential misuse of LLMs and their associated harmful capabilities and social vulnerabilities.[130] This includes field experts, for example, biodefence specialists, who assess the extent to which AI systems can be exploited for biological misuse.[131]

Within these debates, calls for preparedness are frequently justified, for instance to 'out-innovate […] strategic competitors'.[132] By doing so, the field in cooperation with industry not only reintroduces WMD projections into planning but also (re)generates pressure to act – proactively exploring the feasibility of the very cutting-edge weaponry it initially sought to prepare for.

The dilemmas of preparedness

These developments invite a step back to reflect on the field's overall trajectory and its emerging tensions. Initially faced with what was framed as a nearly existential threat, the field developed a compulsion to act – or, depending on perspective, an opportunity to pursue – every conceivable measure, including mutually contravening ones.

Following scenarios such as DARK WINTER, biodefence expanded into civic security. Public and private actors built extensive stockpiles of medical counter-measures against known agents. Simultaneously, fictional scenarios such as Preston's novel or Haseltine's exercise legitimated dual-use research into modified or recombinant agents – developments that could ultimately undermine the protection established by medical stockpiles.

Indeed, if one takes science-fiction scenarios seriously, stockpiling specific drugs appears structurally insufficient. A sophisticated bioterrorist as depicted in the discourse could simply deploy a

[126]Cf. the sobering study of Dana Shea and Frank Gottron, *Small-Scale Terrorist Attacks Using Chemical and Biological Agents: An Assessment Framework and Preliminary Comparisons* (Congressional Research Service Report, 2004), available at: {https://digital.library.unt.edu/ark:/67531/metacrs6102/}, accessed 7 July 2026.

[127]Kallenborn Zachary and Philipp Bleek, 'Swarming destruction: Drone swarms and chemical, biological, radiological, and nuclear weapons', *Nonproliferation Review*, 25:5 (2018), pp. 523–43.

[128]Christopher Mouton, Caleb Lukas, and Ella Guest, 'The operational risks of AI in large-scale biological attacks', RAND Corporation Research Report RR-A2977-1 (2023), available at: {https://www.rand.org/pubs/research_reports/RRA2977-1.html}, accessed 6 July 2026.

[129]E.g., Bibermann, 'The technologies and international politics of genetic warfare'; Green et al., 'Confronting the threat of bioterrorism'.

[130]Lama Ahmad, Sandhini Agarwal, Michael Lampe, and Pamela Mishkin, OpenAI's Approach to External Red Teaming for AI Models and Systems, arXiv:2503.16431 [cs.CY], 24th January 2025, pp. 1–15.

[131]Anthropic, *Progress from Our Frontier Red Team*, Report (2025), available at: {https://www.anthropic.com/news/strategic-warning-for-ai-risk-progress-and-insights-from-our-frontier-red-team}, accessed 16 June 2025.

[132]National Security Commission on Emerging Biotechnology (NSCEB), *Charting the Future of Biotechnology: An Action Plan for American Security and Prosperity*, Report (2025), pp. 98ff., available at: {https://www.biotech.senate.gov/wp-content/uploads/2025/04/NSCEB-Full-Report-%E2%80%93-Digital-%E2%80%934.28.pdf}, accessed 6 July 2026.

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modified variant, since even recombinant agents are assumed to be easily attainable. In that way, research becomes obsessive and potentially endless. This is because security actors would need to explore every possible agent, including synthetic variants, recombinants, and emerging pathogens, to identify a growing target state for medical counter-measures.[133]

More importantly, the expansion of knowledge produced not only strategic trade-offs but also dilemmas outlined by the proponents of arms control since the end of the 1980s: the manifest risks of the proliferation of material, strategic, and technological dual-use.

Given the number of activities, concerns arose now from within the field about the growing availability of sensitive information. Vulnerability analysis was increasingly seen as a double-edged sword, since articles referring to hidden vulnerabilities can also be read as templates for attacks.[134] Actors increasingly recognised that public promotion of preparedness might mobilise the wrong audience.

Yet criticism was blunt in its demands and double-edged in its implications. It was blunt because the control of sensitive knowledge seemed increasingly unfeasible given the field's scale and heterogeneity. The number of people working in biodefence-related laboratories cannot even be estimated for the United States, and the risk of vertical (in-field) proliferation had already been demonstrated by the anthrax attacks.[135]

In turn, classification of research turned out to be double-edged as well. As arms control proponents predicted, the extension of biodefence culminating in opaque projects led to a security dilemma: from the mid-2000s onward, the United States and China exchanged mutual accusations of concealing offensive research behind defensive rhetoric. Even if the respective programmes are defensive in nature, they extrapolate offensive capacities, prompting risks of proliferation or misuse in the long run.[136]

Taken together, these developments point to a deeper structural tension underlying counter-bioterrorism preparedness. The core of the problem is that increasing empirical knowledge does not lead to insights offering any kind of strategic closure. Instead, it continually broadens the range of conceivable threats. This is because each new insight tends to generate additional possibilities for anticipation, rather than narrowing the spectrum of conceivable threats. As early as the mid-2000s, a biodefence researcher remarked (without a trace of humour) that the number of possible scenarios may only be 'limited by one's imagination'.[137]

The tyranny of imagination

The preceding sections traced the emergence and institutionalisation of counter-bioterrorism as a strategic action field, as well as the strategic trade-offs it produced. Taken together, these developments reveal a more profound structural dilemma.

Following the symbolic consecration in the 1990s and the socio-economic implementation at the turn of the millennium, the field still lacked a connection to the actual security environment.

Two things need to be considered:

Firstly, there were no major attacks – apart from the anthrax letters coming from within the field. While actors do usually not question the existential purpose of their endeavour,[138] the core assumptions of the rising field – as expressed by the early draft – could be neither verified nor falsified by an external event.

Secondly, a growing number of organisations, experts, and scholars find themselves in need of both anticipating an unknown threat and simultaneously legitimating their practice in the absence of a concrete materialisation. In this way, actors find themselves in constant need of proving the

[133] Enemark, 'United States biodefense, international law, and the problem of intent'.
[134] Enemark, *Biosecurity Dilemmas*, pp. 79ff.
[135] Ibid., pp. 26ff.
[136] Ibid., pp. 3ff.; King and Strauss, 'The fallacy of defensive biological weapons programmes'.
[137] Johnson-Winegar et al., 'Department of Defense capabilities supporting bioterrorism response', pp. 3–22.
[138] Fligstein and McAdam, *A Theory of Fields*, pp. 100ff.

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purpose of their practice by anticipating the feasibility of bioterrorism, while research on the feasibility of bioterrorism also remained the sole reference for preparedness. This means legitimation and anticipation becomes an indistinguishable task – echoing the strategic ambiguity of the early venture as a structural feature of the field of practice.

In this sense, the 'looking-glass logic' of early bioweapons programmes reappeared in altered form: confronted with an increasing number of possible scenarios and persisting strategic blindness, the field reproduces the same self-escalating dynamics of the twentieth-century programmes in an inverse manner. Although pursued under a defensive agenda, it inevitably generates dual-use knowledge under the impression of its own projections. Yet, confronted with its own achievements, it constantly reformulates (or legitimises) a constant need for further anticipatory and preparatory practice.

The formula of action is as simple as consequential: one must anticipate and explore the possible actions of an enemy to identify vulnerabilities and, once such potential is revealed, prepare for it. But in this respect, a mirror-image self dictates an urgency to act, precisely in the absence of any occurrence. Since the projected capabilities of an invisible enemy are the sole vanishing point for both strategic practice and legitimation, (counter-)bioterrorism continues – like biowarfare in bygone eras – to be an ongoing product of symbolic struggles.

Under the well-known fact of strategic blindness, symbolic struggles regarding both the feasibility of biowarfare and the purpose of preparedness created a strategic game where actors find themselves in need of projecting scenarios and adapting to their very own projections – thus preparing for their own visions founded on the mentioned growing body of knowledge.

The dilemmas mentioned above are the result of anticipatory and preparatory practice under a draft in which the boundaries between threat and possibility or feasibility became indistinct from the start. But the more profound dilemma underlies and results from the field's practical routines: in the end, it does not matter whether early scenarios were exaggerated. The dilemma is that it gave rise to a field that produces an ever-growing body of both evidence and possibilities regarding the feasibility of the very same kind of warfare it initially tried to counter.

It is the practice itself that, after the dissolution of Biopreparat, has reintroduced the feasibility of biowarfare in the twenty-first century; it has also established the bioterrorist as the emblematic antagonist portrayed at the beginning of this article: a figurative adversary whose existence remains uncertain, yet whose presumed operational capacities and associated forms of weaponry are increasingly specified through preparedness itself.

This does not mean that actors intentionally 'invent' such terrorism for the sake of their practice. On the contrary, this ambiguity stems from the structure of their practice. By outlining both the feasibility of weaponisation and the operational scope for attacks, strategic practice has created a threat that is uncertain in nature but may be expected in the future.

Between possibility and facticity lies not only future action but also, nowadays, a tangible world, consisting of weak points, strategic targets, and scientific insights marked as open for misuse; not because terrorists have studied biowarfare, but because we have prepared for it, society is now characterised by a vulnerability that is both generic and protean in nature. Consequently, actors operating in the field must now consider the existing knowledge to make valid judgement of necessary preparatory action. But this logic of action, while grounded on broader empirical evidence, remains subject to a tyranny of imagination.

Conclusion

In the end, I would like to reflect on what has been said in relation to theoretical background. The article commenced with the observation of the strategic dilemma inherent to the field of counter-bioterrorism preparedness. The dilemma stems from the fact that the technological, strategic, and tactical potential of bioterrorism is amplified through the very practices meant to contain it. Thus, the field creates the conditions for the realisation of the threat it is intended to counteract.

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With a field-theoretical lens, I have distanced myself from accounts that explain the emergence of bioterrorism preparedness through broader shifts in Western security culture. Relying on epistemic practices and technologies, preparedness emerged as a new mode of security in response to (or rather in anticipation of) unpredictable but large-scale threats.

By contrast, this article focused on the actors, networking practices, and institutional dynamics. It argued that the renaissance of US biodefence under the aegis of counterterrorism preparedness was not merely the outcome of strategic anticipation and security rationales. Rather, it was deeply embedded in symbolic struggles over the nature of the threat posed by dual-use research and proliferation anxieties in the 1980s and 1990s.

Bioterrorism preparedness reflects a distinct historical narrative grounded in the perspective of the heterogeneous actors involved in the social venture. It also reflects the divergence of the agendas of these actors and institutional strategies over governmental budgets. By reconstructing the non-discursive strategies alongside the epistemic practices employed, the article shifted the focus to the more tactical dimension of the social venture of biodefence, as well as to the institutional environment in which it could succeed.

It became clear that fictional accounts and analytical arguments were intentionally blurred to advance the narrative of immediate preparedness, grounded in a renaissance of biodefence – now located at the interface of civil security, public health, and biotechnological R&D. The diffusion of security-oriented assessment and advertising is evident in the way scenarios portrayed a threat contested in the security domain. Rather than governing uncertainty, preparedness scenarios rendered bioterrorism highly certain – in terms of both likelihood of occurrence and severity of impact. They also depicted the dramaturgy of a threat that conveniently required the very tools and technologies actors sought to advance all along. This does not imply fabrication but instead reveals how strategic vision was initially shaped by position-based interests and expertise before it was reinforced by epistemic and practical routines.

By complementing existing work on preparedness with a field-theoretical perspective, this article has shown how security rationales are socially mobilised and sustained through symbolic struggles, position-based interest, and established routines.

The dilemma immanent to the field results from two interrelated factors. Firstly, strategic blindness – the uncertainty of the operative environment of preparatory action. Secondly, the systematic neglect of critical perspectives, which highlighted the trade-offs inherent to that approach. Driven by the impression of an existential threat, strategic action increasingly decoupled from empirical and analytical assessments of enemy capabilities and actual behaviour – as well as from reflection on the dual-use knowledge the field produced to counter an enemy yet to emerge.

This gave rise to an overly complex strategic situation: increasing critical insights continuously reformulate the need for further research and preparation, because the imagined adversary always seems able to exploit the very same knowledge the field generates to prepare. By rendering the feasibilities of bioterrorism, the field paradoxically and retroactively validated the imperatives of a logic based on the very premises it had originally constructed. In doing so, it constantly (re)produces a strategic game in which security actors are forced to play against themselves – in other words, to conceptualise and prepare for their own attacks.

At closing, let me give a brief outlook beyond the specific case of bioterrorism. The analysis also revealed a long-term historic pattern of symbolic struggles regarding the feasibility of biowarfare in general. The legitimation practices that shaped contemporary counter-bioterrorism closely resemble those employed in the offensive programmes. In both cases, actors sought to anticipate the capabilities of an imagined adversary and justified research agendas by reference to that anticipated potential. While the strategic ethos shifted from retaliation to (defensive) preparedness, the symbolic mechanisms through which biological threat potential was constructed remained strikingly similar. Nowadays biodefense appears as an almost symmetrical, albeit inversely transformed, continuation of the same practices that historically structured biological armament programmes.

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Beyond this diachronic case, further research may explore whether such dynamics of auto-escalation exist (synchronically) in other security fields. This may apply particularly to fields of activity subject to similar structural conditions: strategic blindness regarding the (presumed) enemy's operational capabilities and intentions, and the potential of the type of weaponry in question, as well as a structural ambiguity inherent to security practice, arising from the conflation of legitimisation and anticipation.

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