Half a Century of the Biological Weapon Convention:Progress, Pitfalls, and Prospects

Manish and Vidhi Rathore

Prof Manish is the Dean of the School of International Studies, Central University of Gujarat.

Ms Vidhi Rathore is a Doctoral Fellow at the School of International Studies, Central University of Gujarat.

Summary

As the Biological Weapons Convention (BWC) marks its fiftieth anniversary since entering into force in 1975, this chapter offers a comprehensive examination of its evolution, limitations, and future trajectory. The BWC, a landmark treaty banning the development and stockpiling of biological and toxin weapons, has shaped international norms against biological warfare. However, despite its symbolic and normative importance, the convention remains structurally weak, lacking verification mechanisms, robust institutional support, and clear enforcement procedures.

Introduction

The BWC, which entered into force in 1975, stands as the foundational international legal instrument prohibiting the development, production, and acquisition of biological and toxin weapons. As the first multilateral disarmament treaty banning an entire category of weapons of mass destruction, it represented a significant normative achievement in global arms control. However, as the convention marks its fiftieth anniversary, questions arise regarding its efficacy, robustness, and adaptability in the face of emerging biological threats and rapid technological change.

Biological Weapons are those weapons with ***"disseminate disease-causing organisms or toxins to harm or kill humans, animals or plants[1] These weapons consist of two parts, one part is the Weaponized Agent i.e., disease causing organisms or toxins such as bacteria, virus, poison derived from plants or animals; the another part consists of Delivery Mechanism which delivers the weaponized agent in the form of missile, bombs, aircrafts, sprays, injection etc. The Biological Weapons are also used not only for military or strategic purposes but also for political assassination,*** *the infection of livestock or agricultural produce to cause food shortages and economic loss, the creation of environmental catastrophes, and the introduction of widespread illness, fear and mistrust among the public[2]"*

Biological warfare has long haunted the imagination of militarists and strategists alike. From the catapulting of plague-infected bodies during medieval sieges to

Japan's Unit 731 experiments in World War II, the potential for mass biological harm has always posed both a moral and security conundrum. This stance was formally recognised in treaties like the 1907 Hague Convention and later the 1925 Geneva Protocol, which banned the use of chemical and biological weapons in war. However, the Protocol did not prohibit their development or stockpiling. Attempts in the 1930s and after World War II to achieve a comprehensive ban failed. However, the United Nations (UN) continued advocating for the elimination of all weapons of mass destruction, including biological and chemical arms[3]. Despite extensive discussions in the 1950s and 1960s, no concrete agreement was reached. The issue of banning chemical and biological weapons gained renewed focus in 1968 when it was added to the agenda of the Eighteen-Nation Committee on Disarmament. A 1969 UN report and a 1970 World Health Organisation (WHO) report emphasised the severe, unpredictable, and potentially irreversible impacts of these weapons, especially on civilians. Although many nations initially supported banning both types of weapons, by the late 1960s, it became evident that only a separate ban on biological weapons was feasible[4]. This shift was influenced by the United States' 1969 decision to unilaterally renounce and destroy its biological weapons, regardless of international agreement, which encouraged broader acceptance of a step-by-step approach. Amid Cold War tensions and the growing ethical condemnation of weapons of mass destruction, momentum built for a comprehensive treaty on biological arms. The 1969 unilateral renunciation of biological weapons by the United States, under President Nixon, provided significant diplomatic momentum. By 1972, negotiations at the Conference of the Committee on Disarmament (CCD) yielded the BWC, signed by over twenty-two countries and entering into force in 1975.

Thus, this chapter aims to provide a critical and reflective analysis of the BWC's evolution over the past five decades. It assesses the treaty's historical significance, its implementation trajectory, and the development of its institutions. More importantly, it scrutinises the limitations and challenges it faces today, ranging from technological proliferation to institutional fragility and proposes pathways to strengthen its future relevance and effectiveness.

The Genesis of the Biological Weapon Convention (1972–1975)

Negotiation History

The Geneva Protocol of 1925 was the first significant step toward banning biological weapons, prohibiting their use in warfare. However, many countries added reservations allowing retaliation, making it a no-first-use agreement. After the Second World War, disarmament talks on biological and chemical weapons were stalled until 1968, when the United Kingdom (UK) proposed separating the two issues and focusing on biological weapons first. This led to the negotiation of the BWC between 1969 and 1971. The United States (US) and the Union of Soviet Socialist Republics (USSR) jointly submitted identical draft treaties in 1971, leading to an agreement. The BWC was endorsed by the UN in December 1971 and opened for signature in April 1972[5].

The BWC was the product of both geopolitical pragmatism and idealism. With both the US and USSR embroiled in the Cold War, there was a shared interest in limiting the risk of escalation through uncontrollable and unpredictable biological agents. The UK, acting as a mediator, tabled a draft that would form the basis of the final treaty. Notably, the convention only prohibited

biological weapons themselves and omitted any verification provisions, an intentional omission driven by superpower concerns over sovereignty and surveillance.

Entry into Force and Early Ratifications

Article XIV of the BWC states that the Convention will enter into force after the required ratification by twenty-two governments, including the Governments designated as Depositaries of the Convention. It was ratified by 22 signatory governments, including those of the USSR, the UK, and the US, which were designated as depositaries of the convention, and entered into force on March 26, 1975[6]. By 1997, all the permanent members of the UN Security Council (UNSC) had joined, along with other states, marking its membership at 140[7]. The number of state parties has gradually increased to 188 as of 2025. Despite this expansion, five states remain non-signatories or non-ratifiers[8], including countries in regions with heightened bioterrorism concerns. The early years of the BWC were marked more by symbolic adherence than substantive compliance.

Key Provisions of the BWC

The BWC, formally known as *the Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and Their Destruction*, was negotiated in Geneva and opened for signature in April 1972, entering into force in March 1975. It expanded upon the 1925 Geneva Protocol by prohibiting not only the use but also the development, production, and stockpiling of biological weapons. States Parties to the BWC pledged never to acquire or retain *microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes*, nor any weapons or delivery systems intended to use them for hostile purposes or in armed conflict. Since 1980, eight Review Conferences have been held to ensure the Convention remains effective and adaptable to scientific, technological, and geopolitical changes. The Convention comprises fifteen articles. However, it allows dual-use research and peaceful biological activity, creating interpretive ambiguity. Article VI enables states to lodge complaints with the UNSC, and Article X encourages international cooperation on peaceful uses; yet, both remain underutilised[9].

Implementation and Achievements since 1975

Confidence-Building Measures (CBMs)

In the absence of a verification mechanism, CBMs were introduced in 1986 following the second Review Conference to reduce suspicion and enhance transparency and international cooperation in peaceful biological research. States Parties are expected to submit annual reports on high-containment laboratories, vaccine production, and outbreaks of infectious diseases to the BWC's ISU by 15 April, covering activities from the previous year[10]. However, participation is uneven as many countries either do not submit reports or provide incomplete information, which further weakens the CBMs' effectiveness and highlights the need for stronger, more consistent compliance mechanisms. Despite being a voluntary mechanism, CBMs have become a central, albeit imperfect, tool for implementation.

Review Conferences

Since 1980, Review Conferences have been convened every five years to assess the operation of the treaty. These have been

pivotal in shaping norms, but also reveal deep political divisions. At the second BWC Review Conference in 1986, the states agreed to implement a set of Confidence-Building measures, which include the exchange of information[11]. The 2001 Review Conference was especially notable. Between 1995 and 2001, the Ad Hoc Group worked to develop a protocol to enhance BWC compliance, including provisions that allow states to declare relevant facilities and permit on-site inspections, including challenge inspections. However, disagreements over key issues, such as the extent of inspections and the role of export controls, hindered progress. A compromise draft was issued in March 2001, but in July, the US rejected the draft and further negotiations, citing concerns over national security and commercial interests. At the Fifth BWC Review Conference in December 2001, the U.S. proposed ending the Ad Hoc Group's mandate in favour of annual meetings, a move opposed by other states. When the conference resumed in 2002, no agreement was reached on verification measures[12]. Between 2011 and 2022, conferences made incremental progress on biosecurity and international cooperation, but failed to establish enforceable mechanisms or new institutional structures.

Regional and Global Cooperation

The BWC has spurred some cooperation with international bodies. The United Nations Office for Disarmament Affairs (UNODA)[13] has engaged with the BWC on overlapping biosecurity agendas. Regional workshops and capacity-building efforts have improved disease surveillance and bio-safety norms in parts of Africa, Latin America, and Southeast Asia. However, these initiatives often operate in silos. The integration of public health, law enforcement, and arms control remains limited, weakening the global response to both deliberate and natural biological threats.

Limitations of the BWC

Absence of Verification Protocol

The most widely cited flaw of the BWC is its lack of a verification and compliance regime; i.e., there is no mechanism for dealing with violations of the rules established by the BWC or the Geneva Protocol. The absence of an enforcement mechanism poses a significant threat to the international community[14]. Unlike the Chemical Weapons Convention (CWC), which empowers the Organisation for the Prohibition of Chemical Weapons (OPCW) to conduct inspections on states that abide by the convention, the BWC lacks similar institutional tools for inspection, detection, or deterrence of treaty violations. Allegations concerning the Soviet Union's Biopreparat programme say it is unclear whether biological weapons were destroyed or transferred to benign purposes, and more recently, speculative accusations involving China and North Korea have gone unresolved due to this enforcement gap. Initially, the state parties did not pay sufficient attention to the lack of verification measures about the BWC[15]. During the third BWC Review Conference in 1991, attempts were made to establish an ad hoc committee of verification experts, known as VEREX, to examine and determine possible verification techniques using scientific and technological methods. A decade later, state parties convened a Special Conference of States Parties to establish another ad hoc body, tasked with developing a legally binding protocol, part of which focused on verification. Despite several years of negotiations among states in the late 1990s and early 2000s, the protocol failed due to technological challenges and was rejected in 2001, primarily because of US opposition[16].

This shortfall has fostered a climate of mistrust and ambiguity regarding compliance. Proposals for intrusive inspections or a standing verification body have been repeatedly blocked due to concerns over state sovereignty, proprietary information and surveillance risks. Similarly, the weak institutional support from the BWC's ISU, established in 2006, remains grossly underfunded. With a small staff and limited mandate, the ISU is unable to conduct inspections, verify compliance, or respond to violations. It relies on voluntary funding and lacks the legal authority or political clout enjoyed by sister institutions, such as the IAEA or OPCW. Without a dedicated, empowered body to implement the convention, much of the BWC's normative force remains aspirational rather than operational.

Dual-Use Dilemma

Biological research inherently serves dual purposes. Leena Raxtar (2021) in her article defines "*Dual-Use Research of Concern (DURC) research into certain high-consequence pathogens and toxins which could potentially be used as deadly weapons, meaning the possession of the agent is the possession of a potential biological weapon"*. In the early 2010s, the US advocated for the inclusion of Dual-Use Research of Concern (DURC) during BWC Review Conferences[17]. It has been debated for a long time as to what extent the BWC prohibits bio-weapons-related research. Looking at Article 1 of the BWC, unlike production or stockpiling, research is not explicitly mentioned anywhere[18]. These Technologies developed for public health—such as gain-of-function studies or synthetic virus construction—can be repurposed for malicious ends. In 2011, controversy over viral gain-of-function research in the Netherlands and the United States raised concerns about the potential for peaceful research to aid third parties in developing biological weapons. While the issue has been discussed in the BWC, it remains ungoverned[19]. The BWC does not adequately distinguish between peaceful and hostile intent, nor does it regulate emerging technologies in synthetic biology, gene-editing or microbial engineering. This ambiguity hampers effective oversight and makes the BWC vulnerable to exploitation by states or non-state actors under the guise of legitimate research.

Definition of Biological Weapons

Another significant and structural limitation of the BWC is the way it defines a biological weapon. Article l (1) of the BWC defines biological weapons as "microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes". The definition of biological agents and toxins has not been disputed by the parties since the Convention was signed; nevertheless, the absence of a definition for "weapons, equipment, or means of delivery" caused difficulty. Switzerland retained the authority to determine for itself what constitutes weapons, equipment, or delivery systems intended to deploy toxins or biological agents when it ratified the BWC[20]. While constructive ambiguity can be helpful during treaty negotiations, it often leads to disputes over interpretation and weakens compliance measures. A central complexity arises from the dual-use nature of biotechnology, which can be applied for both peaceful and harmful purposes. The BWC's emphasis on 'intent' reflected in the phrase 'no justification' for possessing biological agents makes it a broad and future-proof instrument[21]. However, this general-purpose criterion is inherently difficult to verify, as proving intent without accompanying action[22] is a significant legal and practical

challenge. Detecting biological agents alone offers only partial insight and does not fully reveal whether they are intended for prohibited uses. The BWC does not entirely ban the development, production, stockpiling, or retention of biological agents and toxins. This only applies to types and quantities that are not justified for prophylactic, protective, or other peaceful purposes. Specific biological agents and toxins may be retained, produced, or acquired through different means and then tested in laboratories or the field[23]. Thus, while the treaty's flexible language helps it adapt to emerging technologies, it complicates enforcement and compliance by making the determination of hostile intent particularly elusive.

Contemporary Challenges to the BWC

Technological Advancements

Rapid advances in science and technology are creating new risks for the BWC and global efforts to prevent the misuse of biology. Some emerging technologies could lead to more advanced biological weapons by enhancing their spread, durability, or effectiveness, thereby overcoming previous limitations. Others may even redefine biological warfare entirely[24]. The AI-amplified bio-threat can be categorised into three types: hypothetical, emerging, and immediate. Because of the need for future developments in nanotechnology, hypothetical risks like nanobots and human control viruses, for instance, have low probabilities at this time; the criminal distribution of Genetically Modified Organisms (GMOs) is a new risk with a moderate likelihood that is emphasised by advanced genetic engineering; and the alteration of microorganisms to attack crops and vital systems is an immediate and high probability threat[25]. Similarly, engineered microbes that break down materials could pave the way for future biological weapons that target materials. The technological progress is also making the delivery and targeting of biological agents easier. Meanwhile, expanding databases of human genetic information could theoretically be used to develop "ethnically targeted" weapons, though this area remains underexplored in BWC discussions. Life sciences research is becoming more decentralised and accessible. Genome editing tools, such as CRISPR-Cas9, now enable the digital design and remote synthesis of DNA, challenging traditional export control systems[26]. Furthermore, user-friendly tools and platforms like "cloud labs" and single-use bioreactors lower the technical barriers, making advanced biological work possible even outside conventional labs. The democratisation of biology, as seen in initiatives like the iGEM competition and DIY bio groups, brings both innovation and risk. The COVID-19 pandemic revealed profound systemic weaknesses in global bio-preparedness. Although the BWC does not directly govern naturally occurring disease outbreaks, it is closely connected to broader biosafety and biosecurity concerns. Calls have grown to integrate public health, disease surveillance, and bio-defence into a unified bio-security regime. However, efforts to use the pandemic as a catalyst for BWC reform have been politically contested. Some states view bio-surveillance proposals as intrusive, while others seek to expand Article X cooperation mechanisms for vaccine access and pandemic response[27]. While many of these groups are developing their bio-safety standards, the growing number of actors working with dual-use technologies increases the challenge of monitoring and enforcing compliance with the BWC[28]. Although building a sophisticated biological weapon remains complex and resource-intensive, the expanding accessibility of biological tools and knowledge is changing the threat landscape. Without adaptation and

due to the lack of a standing scientific advisory body, the BWC may struggle to keep pace with these developments and ensure global biosecurity.

Geopolitical Fragmentation

Geopolitical rivalries increasingly shape arms control diplomacy. Over the past two decades, the global political climate has grown increasingly hostile to multilateral disarmament efforts, particularly in the realm of biological weapons. The resurgence of great power competition, especially among the U.S., China, and Russia, has intensified, marked most recently by Russia's 2022 invasion of Ukraine, which further strained diplomatic cooperation under the BWC. Meanwhile, accusations regarding the origins of COVID-19 and allegations of clandestine bio-weapons programmes have fuelled disinformation and further eroded trust among nations. Amid these rivalries, states have rapidly expanded their biotechnology capabilities, including a proliferation of high-containment laboratories; yet, transparency has not kept pace[29]. This opacity fuels mistrust and accusations of biological weapons development, which cannot be independently verified in the absence of effective BWC compliance mechanisms. Historical examples, including the Iraq WMD controversy and the repeated use of chemical weapons in Syria, underscore the dangers of misinformation, eroded trust, and inadequate verification. Recent Russian claims about U.S.-funded labs in Ukraine reflect how geopolitical tensions can weaponise BWC discourse, highlighting the urgent need for credible, transparent, and enforceable compliance tools. The result is a fragmented diplomatic environment where states are more likely to pursue national bio-security strategies than commit to global disarmament norms[30].

Bioterrorism and Non-State Actors

Bioterrorism is another significant threat to global security. Bioterrorism attacks are rare and often criminal, with political implications. The rise of non-state actors poses a fundamental challenge to the BWC, which is inherently state-centric in its design. Terrorist groups, rogue researchers and even lone individuals may gain access to dangerous biological materials due to the democratisation of biotechnology. Terrorists are more likely to use biological weapons because they are less expensive and more destructive than conventional weapons. They are also easier to conceal and transport; a small amount can have a long-term impact on a larger population, making them more appealing[31]. In 1984, the Rajneeshee Cult was accused in Oregon of attempting to spread Salmonella enterica in an attempt to influence local elections. Despite infecting 751 people, authorities could not trace the disease to the cult even when a similar strain was found in their clinic[32]. Another such event, the 2001 anthrax letters in the US, underscored the feasibility and lethality of small-scale biological attacks. Similarly, in 1999, Al-Qaeda hired a biologist to develop biological weapons in Kandahar and 2016, Belgian Police alleged biological weapon-based activities, but US Homeland Security refuted claims[33]. Despite international collaborations such as the BWC and the Convention on Biological Diversity (CBD), these agreements do not address biosecurity for non-accountable parties, including non-state actors. They do not fall under the category of parties who will be held accountable or scrutinised for their actions. Although the 2004 UN Security Council Resolution 1540 obliges states to prevent non-state actors from acquiring WMDs, coordination with the BWC regime has been minimal[34].

Future Pathways for BWC

Revising the Verification and Compliance Mechanisms

Revisiting the 2001 draft protocol remains a pressing necessity. A hybrid verification model combining voluntary transparency measures, third-party audits, and AI-driven monitoring of open-source data could provide a feasible compromise. With advances in science since the 1990s, there is a clear need to reassess verification tools for the BWC. A proposed "VEREX 2.0" process could involve all States Parties and draw on expertise from science, industry, and civil society to evaluate both traditional and emerging methods, such as bioforensics and open-source intelligence, for monitoring compliance. This initiative would support fact-based cooperation on challenges such as the use of covert biological weapons and suspicious outbreaks, helping to strengthen the BWC regardless of differing national views on verification[35]. There is a need for creating a new Joint Assessment Mechanism to handle biological incidents more effectively. A more ambitious proposal to strengthen the BWC is the creation of an International Agency for Biological Safety (IABS), similar to the IAEA. Proposed by Kazakhstan in 2020, this body would oversee export controls, monitor biotech for peaceful use, maintain a registry of sensitive discoveries, and coordinate global responses to biological threats. However, establishing such an agency would require consensus among major powers—an unlikely feat in today's divided geopolitical climate. As a practical alternative, like-minded countries could pursue a dual-track approach: support the universal BWC efforts while forming smaller, high-ambition coalitions to push forward stronger biosecurity measures, similar to the model of the Financial Action Task Force[36].

Institutional Strengthening

The ISU must be expanded and granted greater operational capacity. This includes the authority to coordinate investigations, organise compliance reviews, and liaise with other international agencies. A dedicated BWC secretariat, modelled on the OPCW, could serve as a central hub for treaty implementation. Funding should be diversified and secured through assessed contributions rather than ad hoc donations. While evolving practices may influence the interpretation of a treaty, they do not formally amend it. Given the scientific advances since the BWC's adoption in 1972 and lessons from the COVID-19 pandemic, it is recommended that the international community officially codify the current understanding of Article I. This could be achieved through a new provision addressing dual-use research of concern, which would require states to implement robust biosafety and biosecurity regulations. The Ninth Review Conference, which also needed to renew the mandate of the ISU, presents an opportunity to include such a provision in its outcome document, thereby aligning the BWC's enforcement framework with modern challenges and state practice[37].

Integrating Science and Policy

A permanent science and technology review mechanism should be instituted, with a multidisciplinary advisory panel that meets annually. This body would evaluate emerging biotechnologies, assess dual-use risks, and advise states parties on potential amendments to the BWC. Linking scientists, policymakers, and ethicists would improve regulatory foresight and reduce the science-policy gap. To ensure compliance with the BWC, it is crucial to govern and establish oversight of dual-use research. Targeted

uptake of new technologies could help verify compliance, especially in future agreements between BWC States Parties. With the growing efficiency of AI, it holds significant potential for detecting signs of genetic engineering by identifying subtle patterns of manipulation. However, ensuring the accuracy of such systems is crucial to avoid false attributions with serious consequences. Governments, academia, and society must engage in ethical discussions and develop robust regulations to guide the responsible use of AI in managing biological threats. International collaboration is also crucial in building safe, effective, and ethically sound AI systems that can support global biosecurity efforts[38].

Enhancing Multilateral Engagement

Greater emphasis must be placed on including the Global South in biosecurity dialogues. Many developing countries perceive the BWC as a Western-driven agenda that neglects Article X commitments on peaceful cooperation. Addressing vaccine inequity, infrastructure deficits, and knowledge transfer will help build trust and legitimacy among the member parties.

Way Forward

Over the past fifty years, the BWC has played a crucial symbolic role in stigmatising the use of biological weapons. It has facilitated dialogue, established norms, and promoted cooperation on the peaceful use of biological resources. However, the BWC's structural limitations—particularly its lack of verification, enforcement, and institutional support—have hindered its effectiveness in a world of rising biological risks. As synthetic biology advances and global instability deepens, the stakes for biological disarmament are higher than ever. The BWC must evolve from a static legal framework into a dynamic governance system capable of addressing both state and non-state threats. This requires bold political will, innovative verification mechanisms, and an inclusive approach to science and diplomacy. The next fifty years of the BWC will determine whether the world can prevent the misuse of biology or be caught off guard by it.

Endnotes:

1 'What Are Biological Weapons? – UNODA'. Accessed 10 May 2025. https://disarmament.unoda.org/biological-weapons/about/what-are-biological-weapons/.

2 Ibid.

3 Goldblat, Jozef . 'The Biological Weapons Convention: An Overview'. *International Review of the Red Cross*, 29 June 1997. http://international-review.icrc.org/articles/biological-weapons-convention-overview.

4 Ibid.

5 'History of the Biological Weapons Convention – UNODA'. Accessed 10 May 2025. https://disarmament.unoda.org/biological-weapons/about/history/.

6 Ibid.

7 Goldblat, Jozef . 'The Biological Weapons Convention: An Overview'.

8 'Membership and Regional Groups – UNODA'. Accessed 10 May 2025. https://disarmament.unoda.org/biological-weapons/about/membership-and-regional-groups/.

9 'Biological Weapons – UNODA'. Accessed 10 May 2025. https://disarmament.unoda.org/biological-weapons/.

10 'Confidence Building Measures – UNODA'. Accessed 10 May 2025. https://disarmament.unoda.org/biological-weapons/confidence-building-measures/

11 'The Biological Weapons Convention (BWC) At A Glance | Arms Control Association'. Accessed 10 May 2025. https://www.armscontrol.org/factsheets/biological-weapons-convention-bwc-glance-0.

12 Ibid.

[13] 'European Union Support to the Biological Weapons Convention – UNODA'. Accessed 10 May 2025. https://disarmament.unoda.org/biological-weapons/eu-support-to-the-bwc/.

[14] Dhall, Karan. 'The Challenges Related to the Biological Weapons Convention'. RSRR, 27 April 2021. https://www.rsrr.in/post/the-challenges-related-to-the-biological-weapons-convention

[15] Huigang, Liang, Li Menghui, Zhu Xiaoli, Huang Cui, and Yuan Zhiming. 'Development of and Prospects for the Biological Weapons Convention'. *Journal of Biosafety and Biosecurity* 4, no. 1 (June 2022): 50–53. https://doi.org/10.1016/j.jobb.2021.11.003.

[16] Krasny, Jaroslav . 'The Biological Weapons Convention: Challenges and Opportunities'. *Geneva Centre for Security Policy*, no. Policy Brief No. 15 (June 2024): 14. https://www.gcsp.ch/publications/biological-weapons-convention-challenges-and-opportunities

[17] Raxter, Lena. "A Dangerous Loophole: The Biological Weapons Convention's New Interpretation That Better Addresses Potentially Deadly Biological Research." International Journal of Legal Information 49, no. 2 (2021): 102–129. https://doi-org.cuglibrary.remotexs.in/10.1017/jli.2021.13.

[18] Revill, James, John Borrie, and Richard Lennane. 'Back To The Future For Verification In The Biological Disarmament Regime?' UNIDIR, June 2022.1-30 https://doi.org/10.37559/WMD/22/BWC/02

[19] Ibid., 21.

[20] Goldblat, Jozef . 'The Biological Weapons Convention: An Overview'.

[21] Revill, James, John Borrie, and Richard Lennane. 'Back To The Future For Verification In The Biological Disarmament Regime?' Pg. 24.

[22] Krasny, Jaroslav . 'The Biological Weapons Convention: Challenges and Opportunities'. Pg. 5

[23] Ibid.

[24] Revill, James, John Borrie, and Richard Lennane. 'Back To The Future For Verification In The Biological Disarmament Regime?' Pg. 7

[25] De Lima, Renan Chaves, Lucas Sinclair, Ricardo Megger, Magno Alessandro Guedes Maciel, Pedro Fernando Da Costa Vasconcelos, and Juarez Antônio Simões Quaresma. 'Artificial Intelligence Challenges in the Face of Biological Threats: Emerging Catastrophic Risks for Public Health'. *Frontiers in Artificial Intelligence* 7 (10 May 2024): 1382356. https://doi.org/10.3389/frai.2024.1382356.

[26] Revill, James, John Borrie, and Richard Lennane. 'Back To The Future For Verification In The Biological Disarmament Regime?

[27] Ibid. Pg. 20

[28] Ibid.

[29] Ibid. Pg. 16-18

[30] Ibid.

[31] Sikandar, Ayesha. 'Biological Warfare: A Global Security Threat'. Modern Diplomacy, 5 May 2021. https://moderndiplomacy.eu/2021/05/05/biological-warfare-a-global-security-threat/

[32] Ajaykumar, Shravishtha. 'Pathogen Peril: Non-State Access to Bioweapons'. OBSERVER RESEARCH FOUNDATION, 2 July 2024. https://www.orfonline.org/expert-speak/pathogen-peril-non-state-access-to-bioweapons.

[33] Ibid.

[34] Ibid.

[35] Revill, James, John Borrie, and Richard Lennane. 'Back To The Future For Verification In The Biological Disarmament Regime?

[36] Patrick, Stewart, and Josie Barton. "Strengthening the Biological Weapons Convention." *Mitigating Risks from Gene Editing and Synthetic Biology: Global Governance Priorities*. Carnegie Endowment for International Peace, 2024. http://www.jstor.org/stable/resrep64202.6.

[37] Raxter, Lena. "A Dangerous Loophole: The Biological Weapons Convention's New Interpretation That Better Addresses Potentially Deadly Biological Research."

[38] De Lima, Renan Chaves et al. 'Artificial Intelligence Challenges in the Face of Biological Threats'.