PENTAGON PRESS

MANOHAR PARRIKAR
idsa
MANOHAR PARRIKAR INSTITUTE FOR DEFENCE STUDIES AND ANALYSES
मनोहर पर्रिकर रक्षा अध्ययन एवं विश्लेषण संस्थान

50 Years of the Biological Weapons Convention

Tracking the Journey

Editor

Ajey Lele

50 Years of the Biological Weapons Convention

Tracking the Journey

50 Years of the Biological Weapons Convention

Tracking the Journey

Editor

Ajey Lele

MANOHAR PARRIKAR INSTITUTE FOR DEFENCE STUDIES AND ANALYSES
मनोहर पर्रिकर रक्षा अध्ययन एवं विश्लेषण संस्थान

PENTAGON PRESS LLP

First published in 2025 by

PENTAGON PRESS LLP
206, Peacock Lane, Shahpur Jat
New Delhi-110049, India
Contact: 011-26490600

Typeset in AGaramond, 11 Point
Printed by Aegean Offset Printers, Greater Noida

ISBN 978-81-988370-1-1

www.pentagonpress.in

Contents

SECTION III
Negotiation and Verification

SECTION IV
Science, Safety and Security

SECTION V
Challenges

Preface

The Biological Weapons Convention (BWC), also known as the Biological and Toxin Weapons Convention (BTWC), was enacted on March 26, 1975. In 2025, the world marks the 50th anniversary of this landmark treaty. The BWC was the first multilateral agreement to comprehensively ban an entire category of weapons of mass destruction. It prohibits the development, production, and acquisition of biological weapons, while also recognizing the value of peaceful biological research and encouraging international cooperation in the life sciences.

Over the past five decades, the BWC has played a vital role in promoting global collaboration in biology and biotechnology. The convention welcomed Kiribati as its 189th State Party in May 2025. Over the past fifty years, the BWC has succeeded in building a global consensus against the weaponization of biology.

This volume presents a comprehensive analysis of the BWC's historical development, key accomplishments, and potential future challenges I am grateful to all the contributors who generously shared their time and expertise in preparing this volume. I extend my sincere thanks to Ambassador Sujan R. Chinoy, Director General of the Manohar Parrikar Institute for Defence Studies and Analyses (MP-IDSA), New Delhi, for his encouragement and support in undertaking this project. Special acknowledgment is due to Ms. Meghna Pradhan, Research Analyst at MP-IDSA, for her editorial assistance.

The views expressed in this volume are personal.

New Delhi
01 June 2025

Ajey Lele

List of Abbreviations

3D	Three Dimensional
9/11	September 11 World Trade Center Attacks
A-4D (Aircraft)	Attacker 4 Skyhawk, Variant "D"
ABSA	American Biological Safety Association
AG	Australia Group
AI	Artificial Intelligence
AM	Additive Manufacturing
APC	Antigen-Presenting Cells
BDT	Biological Design Tools
BIMSTEC	Bay of Bengal for Multi-Sectoral Technical and Economic Cooperation
BoNT	Botulinum neurotoxins
BSL	Biosafety Level
BSLs	The System of Biosafety Levels
BTWC	Biological and Toxin Weapons Convention
BW	Biological Weapons
BWC	Biological Weapons Convention
CBMs	Confidence-Building Measures
CBR	Chemical Biological and Radioactive materials
CBRN	Chemical, Biological, Radiological and Nuclear
CBW	Chemical and Biological Weapons
CCD	Conference of the Committee on Disarmament

CD	Conference on Disarmament
CETs	Critical Emerging Technologies
CMC	Coordinating Management Committee
Cmte	Committee
COVID-19	Coronavirus Disease 2019
CRISPR	Clustered Regularly Interspaced Short Palindromic Repeats
CRISPR-Cas9	Clustered Regularly Interspaced Short Palindromic Repeats-associated protein 9
CTBT	Comprehensive Test Ban Treaty
CW	Chemical Weapons
CWC	Chemical Weapons Convention
DISA	Disarmament and International Security Affairs
DIY	Do-It-Yourself
DNA	Deoxyribonucleic Acid
DRDE	Defence Research Development Establishment
DRDO	Defence Research and Development Organisation
DURC	Dual-Use Research of Concern
eCBM	Enhanced Confidence-Building Measures
ECtHR	European Court of Human Rights
ENDC	Eighteen National Committee on Disarmament
EU	European Union
F-100 (Aircraft)	Fighter 100 Super Sabre
F-4C (Aircraft)	Fighter 4 Phantom II, Variant "C"
FAO	Food and Agriculture Organization
FMCT	Fissile Material Cut-off Treaty
FOC	Friends Of Chair
GHSA	Global Health Security Agenda
GHSI	Global Health Security Initiative
GMO	Genetically Modified Organisms
GOF	Game of Function

GPU	Gosudarstvennoye Politicheskoye Upravleniye (State Political Directorate)
H1N1	Hemagglutinin type 1 and Neuraminidase type 1
H5N1	Hemagglutinin type 5 and Neuraminidase type 1
H7N9	Hemagglutinin type 7 and Neuraminidase type 9
HMV	High Molecular Weight
HPCSA	Health Professions Council of South Africa
HQ	Headquarter
IAEA	International Atomic Energy Agency
IBCh	Institute of Bioorganic Chemistry
IFBA	The International Federation of Biosafety Associations
iGEM Foundation	International Genetically Engineered Machine Foundation
IHR	International Health Regulations
IORA	Indian Ocean Rim Association
ISO	International Organization for Standardization
ISU	Implementation Support Unit
JFK	John Fitzgerald Kennedy
KGB	Komitet Gosudarstvennoy Bezopasnosti
LLMs	Large Language Models
LMIC	Low and Medium Income Countries
LMW	Science Advisory Board
MCBW	Mass Casualty Biological Weapon
MERS	Middle East Respiratory Syndrome
MERS-CoV	Middle East Respiratory Syndrome Coronavirus
MIRV	Multiple Independently Targetable Re-entry Vehicle
MoU	Memorandum of Understanding
Mpox	Monkeypox
mRNA	messenger Ribonucleic Acid
MSPs	Meetings of State Parties
MTCR	Missile Technology Control Regime

MXs	Meetings of Experts
NAM	Non-Aligned Movement
NATO	North Atlantic Treaty Organisation
NCPs	National Contact Points
NGOs	Non-Governmental Organizations
NIH	National Institutes of Health
NPT	Treaty on the Non-Proliferation of Nuclear Weapons (commonly known as the Non-Proliferation Treaty)
NSG	Nuclear Suppliers Group
NTI	The Nuclear Threat Initiative
OPCW	Organisation for the Prohibition of Chemical Weapons
PAC	Public Accounts Committee
PAC	Permanent Armaments Commission of the League of Nations
PCR	Polymerase Chain Reaction
PHEIC	Public Health Emergencies of International Concern
POWs	Prisoners of War
PPE	Personal Protective Equipment
PR	Permanent Representative
PrepCom	Preparatory Committee
PSP	Paralytic Shellfish Poisoning
Q fever	Query Fever
R&D	Research and Development
RevCon	Review Conferences
S&T Mechanism	Science and Technology Mechanism
SAB	Science Advisory Board
SAgns	superantigens
SARS	Severe Acute Respiratory Syndrome
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus (2 Indicates that it is the second strain identified in this group)

SBV	Sri Balaji Vidyapeeth
SEB	Staphylococcal enterotoxin B
SIPRI	The Stockholm International Peace Research Institute
Soviet Union	Union of Soviet Socialist Republics
SS-11	Surface to Surface Missile 11 "Sego" (NATO Reporting Name). Soviet Designation: Universal Rocket 100 (UR-100)
SS-13	Surface to Surface Missile 13 "Savage" (NATO Reporting Name). Soviet Designation: Solid Fuel Rocket 2 (RT-2)
SS-17	Surface to Surface Missile 17 "Spanker" (NATO Reporting Name). Soviet Designation: MIRV Equipped Universal Rocket 100 (MR-UR-100) "Sotka"
SS-18	Surface to Surface Missile 18 "Satan" (NATO Reporting Name). Soviet Designation: Rocket 36 Modernised (R36M)
Sub-cmte	Sub Committee
TCR	T-Cell receptor
TRC	Truth and Reconciliation Commission
TWG	Temporary Working Group
U.S.	United States
UAPA	Unlawful Activities (Prevention) Act
UK	The United Kingdom
UN	United Nations
UN-BRWG	United Nations BioRisk Working Group
UNEP	United Nations Environment Programme
UNGA	United Nations General Assembly
UNMOVIC	United Nations Monitoring, Verification and Inspection Commission
UNODA	United Nations Office for Disarmament Affairs
UNSC	United Nations Security Council
UNSCR	United Nations

UNSCOM	United Nations Special Commission
UNSGM	United Nations Secretary General's Mechanism
US	United States
USAID	United States Agency for International Development
USAMRIID	The U.S. Army Medical Research Institute of Infectious Diseases
USD	United States Dollar
VEE	Venezuelan Equine Encephalitis
VEREX	Verification Experts Group
VX (Nerve Agent)	Venomous Agent "X"
WG	Working Group
WHO	World Health Organization
WIV	Wuhan Institute of Virology
WMD	Weapons of Mass Destruction
WOAH	World Organisation for Animal Health

Tables and Figues

TABLES

FIGURES

About the Editor and Contributors

Dr. Ajey Lele is a Deputy Director General at the Manohar Parrikar Institute for Defence Studies and Analyses (MP-IDSA), New Delhi. His areas of research include Weapons of Mass Destruction (WMD), Space and Strategic Technologies.

Dr. Jean Pascal Zanders is Founder and Researcher at the Trench, where he focuses on chemical and biological armament and disarmament, employing foresight strategies to examine the future of the Chemical and Biological Weapons Conventions and to identify preconditions for new global and regional disarmament initiatives

Dr. Anshu Joshi is Assistant Professor, Centre for Canadian, US and Latin American Studies at Jawaharlal Nehru University, New Delhi, India

Prof. Malcolm Dando is Emeritus Professor at the Department of Peace Studies at the University of Bradford.

Dr. Alexander Kelle is Senior Researcher at the Institute for Peace Research and Security Policy (IFSH) Berlin Office, University of Hamburg.

Dr. Michael Crowley is affiliated with the Department of Peace Studies and International Development (PSID) at the University of Bradford.

Mr. Abhishek Verma is Research Analyst at the Manohar Parrikar Institute for Defence Studies and Analyses (MP-IDSA), New Delhi.

Amb. DB Venkatesh Verma is Member of the UN Secretary-General's Advisory Board on Disarmament Matters; formerly Permanent Representative to the Conference on Disarmament and Ambassador to the Russian Federation and Spain.

Dr. James Revill is Head of the WMD and Space Security Programmes at the United Nations Institute for Disarmament Research (UNIDIR).

Dr. Mrinmayee Bhushan is Founder and Director at Mindfarm Novatech Private Limited and a Distinguished Fellow at Strategic Research and Growth Foundation, India.

Dr. Ketan Thorat is Fellow 'E'/Scientist D and Regulatory Compliance Officer at iBRIC—Institute for Stem Cell Science and Regenerative Medicine (inStem), Bengaluru. His areas of interest are Regulatory Sciences and Biosafety & Biosecurity.

Dr. Suryesh Kumar Namdeo is Visiting Scholar at the DST Centre for Policy Research at the Indian Institute of Science (IISc), Bengaluru.

Dr. Kai Ilchmann is Honorary Senior Research Fellow at the Harvard Sussex Program.

Dr. Tatyana Novossiolova is Senior Analyst in the Arms Control and Non-Proliferation and Geoeconomics Programmes at the Centre for the Study of Democracy.

Mr. Animesh Roul is Executive Director at the Society for the Study of Peace and Conflict (SSPC), where he works on counterterrorism, radical Islam, terror financing, and armed conflict and violence in South Asia.

Prof. Manish is Professor in the Centre for International Politics at the School of International Studies (SIS) at the Central University of Gujarat (CUG), where he works on Foreign Policy, Arms Control/Disarmament, Terrorism, South Asia, and International Politics.

Ms. Vidhi Rathore is Research Scholar at the Central University of Gujarat.

SECTION I

CONTEXT

1

Biological Warfare and Biological Weapons: The Risk

Dr. Ajey Lele

1.1. Introduction

The science of biology studies life and examines living things, including the processes involved in their evolution. This vast field encompasses fundamental processes like reproduction, cell division, and genetic inheritance, which the scientific community has studied and analyzed for centuries. Biology is subdivided into branches such as botany (the study of plants) and zoology (the study of animals). Over centuries, biology has become an extremely dynamic and interdisciplinary field, integrating principles from chemistry, medicine, and physics to create focused areas for research like biochemistry, biomedicine, and biophysics.

For some time now, biology is studied at different levels and specific domains have been identified based on the scientific logic. Like molecular biology examines the chemical and energy transformations within organisms; cell biology focuses on cells, the basic units of life; organismic biology studies whole organisms; and population biology investigates groups of organisms and their interactions within their environment. These levels can be further specialized into fields like morphology, taxonomy, biophysics, biochemistry,

genetics, epigenetics, and ecology. Specific organisms are also studied in dedicated fields like ornithology (birds), ichthyology (fishes), and microbiology (microorganisms).[1]

Biology's applications are extensive, supporting modern medicine and healthcare through the development of treatments and diagnostics, transforming agriculture and food production by breeding and nutritional enhancement, and driving innovation in biotechnology to create pharmaceuticals, biofuels, and modified crops. Furthermore, biology is crucial for understanding ecosystems and biodiversity in environmental science, enabling conservation and sustainability efforts, while also serving as a basis for scientific research in various fields. The rapid development of vaccines during the COVID-19 pandemic, one of humanity's greatest challenges in the last century, showcased the significant evolution of research and development in biological sciences. However, this knowledge also has a dual nature, as biology has been utilized for military purposes since ancient times.

The concept of using biological agents in warfare has been around for centuries, evolving from ancient practices to modern concerns about genetically engineered pathogens. Throughout history, various methods have been employed to deliberately spread disease among enemies, highlighting a long and troubling history of biological warfare.

Biological warfare involves intentionally spreading diseases among people, animals, or plants. Biological weapons work by releasing harmful bacteria or viruses into an environment that is not ready to defend against them. These agents can be very effective at killing plants, farm animals, pets, and people. While many types of modified bacteria and viruses resistant to medicines could be used, common examples include bacteria, rickettsiae, viruses, toxins, and fungi.

The military use of living organisms to inflict casualties is a long-standing aspect of warfare, predating written history. From ancient practices like poisoning water sources and catapulting infected corpses to returning diseased prisoners, biological warfare is not a modern phenomenon; bioweapons are nearly as old as humankind. Throughout history, numerous powers have strategically employed them in various conflicts.

1.2. From Medieval Era

The ancient Greek god Apollo, primarily known for beauty, light, and the arts (and later associated with the sun), also held the power to inflict and cure disease. In Homer's *Iliad*, plagues were depicted as arrows shot by Apollo, potentially representing one of the earliest known concepts of a bioweapon.[2]

Although the understanding of germ theory was limited in the 14th and 15th centuries, the medieval belief that the stench of decay could transmit disease likely motivated the use of corpses as a form of biological weapon. The following historical accounts from that era illustrate this practice:

- **1340:** During the siege of Thun L'Eveque in Hainault (present-day Northern France), attackers catapulted dead horses and other animals into the castle. The defenders reported an unbearable "stink and air" that forced them to negotiate a truce, suggesting the intended effect was to sicken or demoralize them.
- **1346:** During the Tartar siege of Caffa (Crimean Peninsula),[3] the attacking forces suffered a plague outbreak. Before retreating, they catapulted the infected bodies of their dead over the city walls. This act is believed to have contributed to the spread of the 'Black Death' to Italy via fleeing residents.
- **1422:** At Karlstein in Bohemia, besieging forces hurled the decaying bodies of fallen soldiers over the castle walls. They also accumulated animal manure, presumably with the intention of spreading disease. Despite these efforts, the defenders held out, and the five-month siege was ultimately unsuccessful.

During the 1767 French and Indian War in North America, the English reportedly used blankets contaminated with the smallpox virus to spread the disease among Native Americans. Smallpox spreads most easily in the early rash stage through droplets from coughing or sneezing. Later, it can also spread by touching contaminated items like clothing, bedding, or blankets. Even after a person is no longer around, the virus can survive in scabs, saliva, urine, or fluids from skin sores, and stay on objects. Outbreaks have been linked to dirty linens from smallpox patients, showing that blankets could carry and spread the virus.[4]

During World War I, Germany attempted to gain an advantage by targeting

enemy livestock with anthrax. In 1915, they launched a small and rudimentary biological warfare program. As part of this effort, German agents deliberately infected animal shipments bound for Allied forces from five neutral countries: Romania, Spain, Norway, the United States, and Argentina. The goal was to disrupt food supplies and transportation systems, both of which heavily depended on animals. Targeted livestock included sheep, cattle, horses, mules, and even reindeer in Norway. The animals were infected either by injecting anthrax directly into their bloodstream or by feeding them sugar laced with the bacteria.[5] However, the program had only limited success. In a war that claimed millions of human lives, the loss of a few thousand animals had little overall impact.

By the 1920s, in hindsight, the lesson seemed obvious: biological weapons were not a major threat. Ironically, this perception—that biological warfare was ineffective—helped pave the way for its future development. Most nations considered bioweapons relatively useless, especially when compared to chemical weapons, which had caused massive casualties. As a result, there was little international concern or regulation regarding biological warfare. During 1930-40 period the U.S. Army medical officer Leon Fox[6] had expressed an opinion that the utility of bacterial warfare would depend on the practicability of employing this form of a warfare and there are limitations in regards to the suitability of biologic agents as an effective weapon in warfighting.

As mentioned earlier in the 14th century, the Tatars used a more gruesome tactic during their siege of Kaffa, a Black Sea port and key gateway to the Silk Road. When some of the city's inhabitants fled by sea in ships unknowingly infested with rats carrying fleas infected with Yersinia pestis, the bacterium responsible for the plague. These ships docked at various Italian ports, sparking outbreaks that would soon engulf much of Europe. Over the next three years, the bubonic plague—later known as the Black Death—swept northward, killing nearly one-third of Western Europe's population.

It was not until the 19th century that scientists uncovered the microbial causes of infectious diseases. One of the first diseases to be explained by this new "germ theory" was anthrax, a deadly infection commonly found in sheep and cattle. The theory's pioneers—Robert Koch, Louis Pasteur, and Joseph Lister—played key roles in understanding and combating the disease. Koch was the first to isolate and describe the anthrax bacterium, Bacillus anthracis.

Pasteur later developed the first successful vaccine for animals, while Lister's antiseptic practices helped reduce the spread of infection. Together, their work laid the foundation for modern microbiology and turned the tide against diseases like anthrax.[7] The research on biological weapons could be said to have begun after these discoveries. Despite the signing of the Geneva Protocol in 1925 banning offensive use of biological weapons, several European countries developed bioweapons during the 1930s and 1940s.[8] To date the only fully documented modern use of biological weapons by a state has been in Japan's attacks against China during World War II.

During World War II, Japan[9] used biological weapons to attack Chinese civilians, causing thousands of deaths. The Japanese Imperial Army had started developing biological weapons in the 1930s, led by Lieutenant General Ishii Shiro, a military physician. Ishii's team infected Chinese cities with plague-carrying fleas and later used aerial spraying, bombings, and sabotage to spread disease. Ishii, after returning from Europe in 1932, believed that biological weapons were the future of warfare. Ironically, the 1925 Geneva Protocol that banned biological weapons made him more interested in them, as the ban suggested these weapons were particularly dangerous.

Dr. Ishii Shiro's plan required considerable funding, something only the Emperor of Japan at the time could approve. Fortunately for Ishii, Emperor Hirohito was a biologist and he funded the program suggested by him. When Japan invaded Manchuria in 1932, they established the puppet state of "Manchukuo." In 1935, Ishii convinced his superiors of the potential of biological warfare (BW). He began conducting experiments with dangerous pathogens in Harbin, Manchuria. By 1937, his experiments were successful enough for the Japanese War Ministry to approve the construction of a large BW research facility in Pingfan, about 65 kilometers south of Harbin. Around the same time, Japan started fighting in China. While they won many battles, they were much outnumbered by the Chinese forces. Possibly, hence they turned to biological warfare to annihilate Chinese people in areas Japan wanted to control.

The Pingfan Institute was completed in 1939. Ishii, now a general, led the facility, which was officially known as "Water Purification Unit 731" to cover up its true purpose. Unit 731 studied many dangerous pathogens, including anthrax, plague, gas gangrene, and tularemia, to see if they could be

used as biological weapons. Other diseases like typhus, cholera, smallpox, and tuberculosis were also tested, but they were harder to use as weapons. In addition, the Japanese experimented with poisons, such as blowfish toxin. Chinese prisoners were used to test the effectiveness of these pathogens. Some prisoners were tied to poles outdoors and sprayed with bacteria from planes. The results were horrifying. The prisoners were carefully watched as they became ill and died, with their conditions documented in drawings. Some were used in bomb tests, where bombs containing bacteria were detonated near them to observe how the bacteria caused gas gangrene.

By 1940, Unit 731 had developed an anthrax bomb and produced 4,000 of them. They also planned to use bubonic plague as a weapon. To do this, they bred rats infected with plague and collected fleas from them. The fleas were then put in baskets and attached to aircraft to spread the plague. In October 1940, a Japanese plane flew over the city of Ningpo, which was still controlled by the Nationalist Chinese, and released plague-infested fleas. Around 500 people died, and the city was thrown into panic. The researchers at Unit 731 continued their experiments and became even more ruthless. They began using Chinese prisoners not only as test subjects but also as incubators to breed pathogens. Prisoners were injected with dangerous diseases, and once they reached the point of death, they were chloroformed, and their blood was drained from their bodies.

The Japanese researchers working on biological weapons also studied chemical herbicides and pathogens to destroy crops (agricultural weapons). Their focus was on plant pathogens like "fungal smuts" and "nematode worms" intended to attack Soviet and North American wheat fields. Smuts were potentially highly effective bioagents. When the wheat plants are intentionally infested with loose smut, they bring in disasters results. In loose smut, the wheat head, which should be filled with grains, is as a substitute replaced by a blackened mass of spores. These spores are easily dispersed by wind and can infect other wheat plants downwind, leading to widespread disease within a field. The Japanese had developed a production facility that could generate about 90 kilograms of smuts annually.

The Japanese example motivated Western nations to indulge into bioweapons development program. In the immediate postwar period at least three countries—Britain, the Soviet Union, and the United States—continued

large, ambitious programs of bioweapons development, building on their wartime work.[10]

The German army was the first to deploy weapons of mass destruction—both chemical and biological—during the First World War. While their chemical attacks, such as the use of chlorine and mustard gas, had significant battlefield impact, their biological warfare efforts were far more limited in scope and largely ineffective. Covert operations involving pathogens like anthrax and glanders aimed to infect livestock or contaminate animal feed in enemy nations, targeting the agricultural and transportation capabilities of countries such as Russia, France, and the United States. These early biological attacks failed to achieve major strategic results but marked the beginning of modern biological warfare. In the postwar period, amid ongoing international tensions and fueled by alarming—often inaccurate—intelligence reports, several European powers initiated their own biological weapons programs well before the outbreak of the Second World War.[11]

British leadership was trying with expand the idea of bioweapons since 1934. The prime mover was a Whitehall bureaucrat named Sir Maurice Hankey. However, the bioweapon program started taking shape post 1942 when Winston Churchill started taking active interest. In the summer of 1942, the British conducted their first large-scale BW experiment on Gruinard Island, off the coast of Scotland. By this time, they had mastered the skill of producing Anthrax bombs and then subsequently conducted the tests by using Vickers Wellington bomber.

In 1981, a radical activist group calling itself the "Dark Harvest Commandos" placed a package along the London–Exeter railway line near Porton Down, home to the UK's Chemical Defence Establishment. The package contained soil taken from Gruinard Island—an isolated site used by the British government in 1941 to test anthrax spore bombs during World War II. The group claimed their action was symbolic, 'returning the seeds of death to their source.' Laboratory analysis of the soil revealed only low concentrations of Bacillus anthracis spores—about 10 organisms per gram—posing minimal risk due to decades of natural decay. A second package was later sent to the Conservative Party Conference, but this time, no spores were detected. Following the government's initiative to decontaminate Gruinard Island in 1986, the group's activities ceased.[12]

By 1941, the Americans also had started considering the option of bioweapons. Taking the help of British work on anthrax, by 1943 the Americans[13] designed a bomb suitable for mass production. This munition weighed 1.8 kilograms (4 pounds). 106 of these 'bomblets' were to be packed into a 225-kilogram (500 pound) cluster-bomb canister and dropped over enemy population centers. The Americans also had investigated anti-crop bioagents,[14] including 'potato blights' and 'wheat rusts'; 'sclerotium rot,' which can attack soybeans, sugar beets, sweet potatoes, and cotton; and 'blast diseases' to attack rice.

Not much dependable information about the Soviet's investments in the biological weapons development program during World War II is available. Ken Alibek[15] (original name is Kanatjan Alibekov), a senior official of the Soviet 'Biopreparat' BW organization in the late 1980s and early 1990s, emigrated to the United States in 1992. He has been instrumental to provide various details about the Soviet investments in the biological weapons. As per him, the Soviets interest in this field go back to 1928; three years after the USSR signed the Geneva Protocols. The initial focus was to weaponize typhus; the prime testing ground was at Solovetsky Island, in the Arctic, north of Leningrad in the White Sea. This research was overseen by the GPU, which later became the KGB. When Hitler's forces invaded the Soviet Union in the summer of 1941, the bio weapons related facilities were relocated in the west to the east, in the Ural Mountains. The town of Kirov became the main facility after the move. The Soviets also found a new testing ground, at Rebirth Island in the Aral Sea.

During the summer of 1942, as German forces advanced deep into Soviet territory toward the Caucasus and Stalingrad, an unprecedented outbreak of tularemia struck both Soviet and German troops. The scale and sudden emergence of the disease in frontline soldiers raised suspicions among some experts. Ken Alibek, a former senior official in the Soviet biological weapons program Biopreparat, became convinced that the outbreak was not a natural event but rather the result of a biological weapons (BW) attack gone awry, possibly initiated by the Soviets themselves. Veterans within the Biopreparat organization reportedly shared anecdotal accounts that supported his suspicions, suggesting the Soviet Union may have been experimenting with weaponized pathogens even during the war.

During 1943, few German soldiers on leave in the Crimean Peninsula experienced an outbreak of Q fever. It is possible to intentionally spread this infectious disease as aerosolized material. As per Alibek, this could have been the result of a deliberate BW test or attack, possibly targeting troop concentrations. Interestingly, despite these outbreaks, Germany showed little interest in the operational use of biological weapons during World War II. One significant reason for this reluctance was geographic: Germany, located in the heart of Europe, shared borders with many of its likely military targets. The unpredictable nature of biological agents—especially their potential to spread uncontrollably across national boundaries—made them a strategic liability. Pathogens, after all, do not respect front lines or borders, and any biological attack could easily rebound on the aggressor's own population. This geographical vulnerability likely played a key role in the German military's decision to avoid pursuing bio weapons capabilities aggressively, despite advancements in chemical warfare.

However, England, separated from potential enemies by the English Channel, was in a better position to conduct research on biological weapons and the Americans were in an even safer position, with their enemies' being oceans away. Similarly, as an island nation, Japan had a degree of separation from China that made biological weapons attractive to the Japanese. In a way Japanese scientists did much of a pioneering work in the areas of development of biological weapons and delivery platforms, however with very little success.

In 1948, the US built a massive, sealed spherical test chamber at Fort Detrick, Maryland, known as the 'Eight Ball' or 'One-Million-Liter Test Sphere'. This facility was used to study the aerosol dispersal of pathogens, particularly in the context of biological warfare research. Animals were tethered inside the sphere while aerosolized agents were released to study their spread. The sphere was decommissioned after President Nixon ended the US offensive biological warfare program in 1969.[16] Initial American BW production in the postwar period focused on the plant pathogens investigated during the war: smuts, blights, blasts, rusts, and rots. Simultaneously, the American BW developers were not ignoring human pathogens. They were working on the agents like anthrax, Q fever, VEE, and toxins like botulism. On 25 November 1969, President Nixon formally announced that the US would abandon offensive biological weapons program. The Eight Ball was shut down and

hundreds of researchers taken off the program. In hindsight, Mr. Nixon's decision, though largely forgotten, was one of the most significant and positive actions of his administration.

However, more than the Americans, it was the Soviets whose biological weapons program was more researched, developed and well reputable. Unlike Chemical weapons, which had greater military acceptability them (the first world war also sometimes gets referred as the war of the chemists) biological weapons was one area where intensive research in the Soviet Union was happening. The Soviets gained knowledge on biological weapons from the captured Japanese people. The Soviets used Japanese plans to build a new and sophisticated bio weapon plant in Sverdlosk in 1946. In the mid-1950s, responsibility for biological weapons research and development was transferred from the KGB to the Red Army, and the program expanded dramatically. Research facilities were built in specific cities to help conceal their purpose. Even the Ministry of Agriculture was brought into the task, setting up a branch to develop bioagents to attack crops and livestock.

At its peak, the Soviet Union's biological weapons program was the largest and most sophisticated in the world, employing an estimated 60,000 personnel across more than 100 facilities in eight cities. With an annual budget approaching US$1 billion, the program stockpiled thousands of bio bombs filled with deadly agents such as anthrax, plague, and smallpox. Perhaps the most alarming aspect of this program was the advanced scientific work being done to enhance the virulence and resistance of known pathogens. Soviet scientists, using genetic engineering, had developed strains of anthrax that were resistant to vaccines, as well as more potent and deadly variants of smallpox—potentially capable of evading existing immunity. The Soviets were also involved in manufacture of Anti-Agricultural Biological Weapons. They had a large biological weapons program, including weapons aimed at harming crops and livestock. The program, called 'Ecology,' worked on diseases like foot-and-mouth, rinderpest, African swine fever, and psittacosis. They also made progress in genetic engineering, creating new types of bacteria and viruses with some resistant to antibiotics like modified versions of plague and anthrax for use in warfare.[17]

Despite signing the Biological and Toxin Weapons Convention (BTWC) in 1972, the Soviet Union was known to continue with its offensive bioweapons

program in secret. Soviet leadership justified the violation by asserting, without clear evidence, that the United States was also covertly breaching the treaty. This clandestine effort persisted throughout the Cold War.

According to Ken Alibek, the Soviets conducted extensive testing throughout the 1980s and early 1990s, placing great importance on the biowarfare program. Several key political and scientific departments were directly involved in various activities associated with this program.

Many of these tests were carried out on a remote island in the Aral Sea. Agents such as anthrax, tularemia, Q fever, brucellosis, glanders, and plague were tested, often on monkeys. In these experiments, small missiles were used to disperse a cloud of biological agents about 25 meters above the ground. Around 100 monkeys were tied to posts arranged in rows on the test field. Scientists in protective suits monitored the effects through binoculars and took detailed notes. Surviving animals were then monitored for several days until they died, to study the progression of the disease.

Following the collapse of the Soviet Union, President Boris Yeltsin took steps to dismantle the remnants of the bioweapons program. He ordered the destruction of all existing biological weapons and shut down key research and production facilities. In 1992, Russia signed a trilateral agreement with the United States and the United Kingdom aimed at converting or dismantling its offensive BW infrastructure. One tangible result of this cooperation was the dismantling of the Stepnogorsk facility in Kazakhstan, funded by the US under nonproliferation initiatives. Many former Soviet scientists began to speak openly with Western investigators, expressing a complex mixture of guilt for their role in developing weapons of mass destruction, and pride in their scientific achievements.

Beyond the superpowers, countries like Iraq, Syria, China, and a few others are believed to have continued or initiated biological weapons programs after 1972, in violation of the BTWC. While it is difficult to confirm these activities with certainty, circumstantial evidence suggests the possibility. As a result, the global threat of biological warfare had remained a serious concern, despite international agreements intended to prevent it, mainly during the period of Cold War.

Even before the collapse of the Soviet Union, Iraq had acquired and developed biological weapons—often with the help of commercial suppliers

from the U.S., Europe, and Japan. Notably, in the 1980s, Iraq legally purchased anthrax from the American Type Culture Collection, a non-profit organization in Maryland, with approval from the Reagan administration. By the 1990s, Iraq had produced at least 8,000 liters of anthrax.

In 1999, a US congressional report had claimed that Iraq also possessed smallpox. Despite several United Nations inspections and Iraq's occasional admissions to stockpiling bioweapons (some of which were later destroyed), the UN inspectors have long suspected that much of Iraq's program remained hidden. According to a defector interviewed by The New York Times, "money was no object in Iraq's quest for weapons of mass destruction," suggesting that Iraq had both the resources and intent to continue developing biological weapons.[18] It is important to mention that the US agencies had not found any bio weapons after they had invaded Iraq post 9/11.

As per a report released in 2025 by the US State Department,[19] North Korea continues to operate a covert biological weapons program in defiance of international treaties. The report states that North Korea possesses the technical capability to produce and possibly deploy biological agents, including genetically engineered bacteria, viruses, and toxins. Despite being a signatory to the Biological Weapons Convention since 1987, North Korea has not submitted a compliance report in over three decades and is believed to have maintained such capabilities since at least the 1960s. The US assesses that Pyongyang can use unconventional delivery systems like sprayers or poison pen injection devices to covertly deploy these weapons. It needs to be noted that the half-brother of the North Korean President Kim Jong-un was killed by a chemical attack in Malaysia[20] on the orders of the North Korean government (as per the US agencies). Kim Jong-nam died after a bizarre encounter at Kuala Lumpur airport in 2017, when two women smeared his face with VX nerve agent.

The 2025 report underscores North Korea's long-standing pattern of secrecy and non-compliance, highlighting a significant breach of Articles I and II of the Biological Weapons Convention. This report reinforces ongoing concerns about the country's broader weapons programs, including its parallel pursuit of nuclear capabilities. Additionally, the report raises alarms over a 2024 strategic partnership treaty between Russia and North Korea, which includes cooperation in fields such as space, biology, AI, IT, and nuclear energy.

1.3. Biological Weapons

Today, no official Cold War-era biological weapons are known to exist. This could be a perception and not necessarily a reality, however there is concreate evidence in regards to the availability of any bio weapons. Possibly, it is unlikely that biological weapons will be used in a conventional war between two nation-states anytime soon, except possibly in a conflict involving a rogue state. However, there are concerns that terrorists could use unconventional methods to spread biological threats, such as sending anthrax through the mail. There is also the fear that a crude bomb could be used to spread harmful germs. If terrorists gain access to Cold War-era technology, they might develop improvised versions of old weapons. That is why it is important to understand the history of known biological weapons and delivery systems.

Before the Cold War, biological weapons generally fell into two types: agent specific weapons and general-purpose weapons. Agent-specific weapons were designed to deliver a particular germ to a target, while general-purpose weapons used the same kind of munitions and delivery systems regardless of the germ involved.

Biological (and agricultural) weapons are known to be disease-causing agents like bacteria, viruses, or toxins, intentionally used to harm people, animals, or crops. These weapons can be hard to detect, slow-acting, and difficult to control. Following paragraphs present some useful information in this regard. It may be noted that this information is available on internet and taken complied by using various sources.

- ***Key Concepts:***
    a) *Pathogens*: Disease-causing organisms such as bacteria, viruses, and fungi.
    b) *Toxins*: Poisonous substances from living organisms that can be weaponized.
    c) *Biowarfare*: Military use of biological agents to disable or kill.
    d) *Bioterrorism*: Non-state actors using bio-agents to cause fear, harm, or disruption.

- ***Examples of Biological Weapons:***
  a) *Anthrax*: A dangerous bacterial infection, often affecting the lungs or skin.
  b) *Botulinum toxin*: A powerful nerve toxin causing paralysis.
  c) *Smallpox*: A once-deadly virus, now eradicated but still a potential threat.
  d) *Plague*: A bacterial disease spread by fleas or rodents.
  e) *Tularemia*: A bacterial infection causing fever and skin ulcers
  f) *Viral hemorrhagic fevers*: Deadly viruses like Ebola and Marburg that cause internal bleeding and high mortality.

- ***Anthrax Weapons (Agent Specific Weapons)***

Biological munitions must be able to turn a bulk liquid or solid agent into fine particles, droplets, or vapor for effective dispersion. The specific properties of each germ place limits on how its weapon can be designed. For example, to understand why anthrax spores are used in biological weapons, it's important to know their technical advantages and limitations in terms of production and delivery.

Till 1972 the US had following anthrax weapons in their stockpile:

a) *Type & Designation of Weapon*: Special Munitions E 2
   Agent: Bacillus anthracis (This anthrax bacterium can be cultivated in ordinary nutrient medium under aerobic or anaerobic conditions)
   Mechanism: Bursting
   Remarks: 7.62-mm rifle shell with dry agent fill
b) *Type & Designation of Weapon*: Disseminator, dry agent, E 41 R 2
   Agent: Bacillus anthracis
   Mechanism: Dispersion
   Remarks: Small rectangular can using carbon dioxide propellant
c) *Type & Designation of Weapon*: Spray tank, dry agent, E 41
   Agent: Bacillus anthracis
   Mechanism: Dispersion
   Remarks: 75 to 140 kg payload for F100, F-4C, A-4D aircraft.

The American defence industry had developed following general category weapons. These weapons were also capable of using anthrax as an agent for the warhead:

a) *Type & Designation of Weapon:* Warhead, guided missile M210
Agent: BW Agent
Mechanism: M143 bomblets
Remarks: Entered inventory in mid 60s with 139km range.

b) *Type & Designation of Weapon:* Spray tank, liquid agent, A/B 45-1
Agent: BW agent
Mechanism: Spray
Remarks: Payload for F-4C aircraft.

c) *Type & Designation of Weapon:* Spray tank, liquid agent, A/B Y-1
Agent: BW Agent
Mechanism: Spray
Remarks: An expendable munition about 85cm in diameter and 400cm long, for high-speed tactical aircraft.

d) *Type & Designation of Weapon:* Spray tank, dry agent, A/B 45 Y-2, A/B 45 y-4, A/B 45 4-4
Agent: BW Agent
Mechanism: Dispenser
Remarks: Developed mainly for rice-blast spores and PG toxin agent. Payload designed for F 100, F105 and F4C aircraft.

e) *Type & Designation of Weapon:* Bomb cluster, 750-1b, E 108 R2, E61 R4; Bomblet, spherical M143
Agent: BW Agent
Mechanism: Bursting
Remarks: These weapons were under development during 1960s. The M143 bomblet was developed for Sergeant warhead.[21]

- ***Smallpox Weapons***

According to Jonathan Tucker of the Monterey Institute of International Studies,[22] Soviet smallpox-based biological weapons were designed for use

against the US cities in a scenario of total nuclear war. Here the idea was to use such weapons for killing any survivors after a nuclear exchange. Tucker had mentioned that, over a 20-year period, at least four types of Soviet ICBMs—the SS-11, SS-13, SS-17, and SS-18 were fitted with special biological warheads. Many of these missiles were kept in launch-ready silos near the Arctic Circle, where the cold climate helped preserve the smallpox agent for long durations. Later, Soviet engineers developed refrigerated warheads for the more advanced SS-18 missiles, allowing the biological payload to survive the intense heat of atmospheric re-entry. As per some reports after 1986, Soviets had also placed the Chinese cities on the target list.

Some officials had claimed to have seen Gorbachev's signature on a Soviet Politburo document authorizing the production of smallpox for the war against the United States as late as in February 1986. Tucker mentions that the Soviet Union may have been responsible for distributing samples of the smallpox virus to other countries including Iraq and North Korea, following the World Health Organization's eradication of the disease in the late 1970s.[23]

Looking back at the long history of biological warfare, several key points become clear. First, biowarfare has been a part of many nations' military strategies throughout the twentieth century. Second, despite widespread moral condemnation from ethicists and politicians and the existence of treaties these objections have not stopped the development or occasional use of biological weapons. Third, bioweapons programs often do not end even when officially abandoned. Say, Japan's wartime program was later studied and expanded by both the US and the USSR in the 1940s.

In the post-9/11 era, the global focus has shifted from traditional biowarfare to the threat of bioterrorism. While the exact nature of this threat is hard to predict, understanding the historical trajectory of bioweapons can help us evaluate future risks more rationally. It is important to maintain perspective: while awareness and preparedness are necessary and can help prevent overreactions like those seen during the US anthrax letter scare. At the same time, COVID-19 crisis has demonstrated that what a global disease spread could do to the human health and global economy. Given the millions who still die each year from preventable infectious diseases, we must ask how many resources should be devoted to preparing for a hypothetical, human-made biological disaster.[24] All in all, it is important to balance our response.

#This chapter is an updated version of Ajey Lele, *Bio-Weapons: The Genie in the Bottle*, Chapter 1, Lancer Publishers, New Delhi, 2004, pp.1-19

NOTES

1 Susan H. Joshi, Edna R. Green, *Biology*, Encyclopedia Britannica. 24 November 2024. https://www.britannica.com/science/biology Accessed on 24 February 2025.

2 A very detailed information about use of biology in ancient warfare is available at, Adrienne Mayor, *Greek Fire, Poison Arrows and Scorpion Bombs: Biological and Chemical Warfare in Ancient World*, Overlook Duckworth, New York. 2009

3 Mark Wheelis, *Biological Warfare at the 1346 Siege of Caffa.* Emerging Infectious Diseases. Centers for Disease Control and Prevention. Volume 8, Number 9. September 2002. Pg. 971-975. ISSN: 1080-6059. DOI. 10.3201/eid0809.010536.

4 Alicea Hibbard, *Investigating the Smallpox Blanket Controversy.* American Society for Microbiology. 15 November 2023. https://asm.org/articles/2023/november/investigating-the-smallpox-blanket-controversy Accessed on 12 March 2025.

5 Ioannis Nikolakakis et al, *Instances of Biowarfare in World War I (1914-1918).* Cureus, Volume 16 Issue 4. 29 April 2024. DOI. 10.7759/cureus.59329

6 Leon A. Fox, *Bacterial Warfare.* The Scientific Monthly. American Association for the Advancement of Science. Volume 55 Issue 1. 1 July 1942. Pg. 5-18

7 Steven M. Block, *The Growing Threat of Biological Weapons.* American Scientist. January 2001. https://www.americanscientist.org/article/the-growing-threat-of-biological-weapons Accessed on 19 March 2025.

8 Roger Roffey et al, *Biological Weapons and Bioterrorism Preparedness: importance of public-health awareness and international cooperation.* Clinical Microbiology and Infection. European Society of Clinical Microbiology and Infectious Diseases. Volume 8 Issue 8. August 2002. Pg. 522-528.

9 For Japan's BW Program: Robert Gomer et al, *Japan's Biological Weapons: 1930-1945.* The Bulletin of the Atomic Scientists. October 1981. https://www.jstor.org/stable/community.34553947 and Jeanne Guillemin, *Crossing the Normative Barrier: Japan's Biological Warfare in China in World War II.* Biological Threats in the 21st Century. Imperial College Press. 6 September 2016. Pg. 17-40 and *Establishment in Manchuria.* History of Biological Weapons and the Young Ishii Shiro, Pacific Atrocities Education. https://www.pacificatrocities.org/establishment-in-manchuria.html Accessed on 12 April 2025, and, *History of Biowarfare,* Public Broadcasting Service (PBS). https://www.pbs.org/wgbh/nova/bioterror/hist_nf.html Accessed on 12 April 2025.

10 *Biological Warfare,* Science Direct. https://www.sciencedirect.com/topics/medicine-and-dentistry/biological-warfare Accessed on 3 April 2025.

11 Friedrich Frischknecht, *The History of Biological Warfare: Human experimentation, modern nightmares and lone madmen in the twentieth century.* EMBO reports. EMBO Press. Volume 4 Supplementary 1. 2003. DOI: 10.1038/sj.embor.embor849

12 *Gruinard Island*, Science Direct. https://www.sciencedirect.com/topics/medicine-and-dentistry/gruinard-island Accessed on March 25 2025.

13 Michael Johnson, *Balloon Warfare: What is the CCP up to? Part II.* Jewish Policy Center. 24 February 2023. https://www.jewishpolicycenter.org/2023/02/24/balloon-warfare-what-is-the-ccp-up-to-part-2/ . Accessed on April 25, 2025.

14 Some Details about the use of Agricultural Herbicides by the US for Military Purposes are at, Kenneth R. Olson and Larry Cihacek, *How United States Agricultural Herbicides Became Military and Environmental Chemical Weapons: Historical and Residual Effects.* Open Journal of Soil Science. Scientific Research Publishing (SCRIP). Volume 12 Issue 2. February 2022. DOI: 10.4236/ojss.2022.122002

15 Ken Alibek and Stephen Handelman, *Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Program in the World- Told from the Inside by the Man who Ran It.* Dell Publishing New York. May 2000. Also available at the National Library of Medicine, from the following link: https://www.nlm.nih.gov/nichsr/esmallpox/biohazard_alibek.pdf Accessed on April 26 2025.

16 Greg Goebel, *A History of Biological Warfare (1).* Vectors. 1 October 2023. https://vc.airvectors.net/twgas_3.html Accessed on 22 December 2024.

17 Jonathan B. Tucker, *Biological Weapons in the Former Soviet Union: An Interview with Dr. Kenneth Alibek.* Centre for Nonproliferation Studies. November 6, 1998. https://www.nonproliferation.org/wp-content/uploads/npr/alibek63.pdf Accessed on 14 February 2025, and, Roger Roffey, Anders Tegnell and Fredrik Elgh, *Biological Warfare in a Historical Perspective.* Clinical Microbiology and Infection. European Society of Critical Microbiology and Infectious Diseases. Volume 8 Issue 8. August 2002. Pg 450-454. ISSN 1198-743x DOI: 10.1046/j.1469-0691.2002.00501.x.

18 Judith Miller: *A Nation Challenged: Secret Sites; Iraqi Tells of Renovations at Sites for Chemical and Nuclear Arms.* The New York Times. 20 December 2001. https://www.nytimes.com/2001/12/20/world/nation-challenged-secret-sites-iraqi-tells-renovations-sites-for-chemical.html , and, Alexandra M. Lord, *A Brief History of Biowarfare.* Office of the Public Health Service Historian. National Library of Medicine. January 2002. https://web.archive.org/web/20090507001003/https://lhncbc.nlm.nih.gov/apdb/phsHistory/resources/pdf/biowar_pics.pdf Accessed on 24 Jan 2003.

19 Taejun Kang, *North Korea Continues to Pursue Covert Biological Weapons Program:US.* Radio Free Asia. 21 April 2025. https://www.rfa.org/english/korea/2025/04/21/north-korea-biological-weapon/ Accessed on April 25 2025.

20 *North Korea used VX Nerve Agent to Kill Leader's Brother, Says US.* British Broadcasting Corporation. 7 March 2018. https://www.bbc.com/news/world-asia-43312052 Accessed on April 1 2025.

21 For the entire discussion on Anthrax weapons, refer: Ajey Lele, *Biological Weapons and the US.* Strategic Digest. Manohar Parrikar Institute for Defence Studies and Analyses. November 2001. Pg. 1488-1494, and, *Volume II: CB Weapons Today.* The Problem of Chemical and Biological Warfare. Stockholm International Peace Research Institute (SIPRI). 1973. ISBN 91-85114-16-2.

22 Jonathan Tucker, *The Once and Future Threat of Smallpox*, Atlantic Monthly Press New York. 1 September 2001. ISBN 0871138301

23 Rebecca Katz: *Public Health Preparedness: The Best Defense againsnt Biological Weapons.*

The Washington Quarterly. Centre for Strategic and International Studies (CSIS) and Massachusets Institute of Technology (MIT). Volume 25 Issue 3. 2002. Pg. 69-82. https://ciaotest.cc.columbia.edu/olj/twq/sum2002/twq_sum2002g.pdf Accessed on 24 March 2025.

24 Friedrich Frischknecht, *The History of Biological Warfare: Human experimentation, modern nightmares and lone madmen in the twentieth century.* EMBO reports. EMBO Press. Volume 4 Supplementary 1. 2003. DOI: 10.1038/sj.embor.embor849

2

Biological Warfare and Biological Weapons: The Response

Dr. Ajey Lele

2.1. Introduction

After analysing the threat posed by biological weapons, it is now important to examine the countermeasures that have been implemented globally over the past 50 years. The development and potential use of biological agents as weapons has prompted a range of responses from the international community. These countermeasures span diplomatic agreements, public health preparedness, scientific research, dos and don'ts for scientific community, aspects of biosafety and biosecurity and military defence. In this connection, one of the most important structures developed globally is the 1972 Biological Weapons Convention (BWC) or Biological and Toxic Weapons Convention (BTWC). This treaty which entered into force during 1975 prohibits the development and stockpiling of biological weapons.

BWC was the first multilateral disarmament agreement to ban an entire category of weapons of mass destruction, prohibiting the development, production, and acquisition of biological and toxin weapons. Over the past five decades, the Convention has shaped international efforts to promote peace, security, and the responsible use of biological science. At times there is a tendency to recognise the treaty mechanism are passive attempts. However, it

is important to realise that such mechanisms encompass the proactive implementation and monitoring of agreements accepted by many states at the international level. Such bodies are dynamic in nature and do make recommendations, undertake inspections (if treaty has such provisions) and investigate certain challenges posed by some actions, which are against the treaty provisions. Also, at time some extraneous issues do impact the treaty implementations.

Over the years, in response to biological threats, whether arising naturally or through deliberate actions, a range of measures has been implemented globally. These include the strengthening of surveillance systems to detect and respond to outbreaks that may indicate a biological threat. Significant progress has been made in vaccine research, testing, and production, with some rapid diagnostic tools now industrialized. Continuous research in this field is being driven by advances in technology both in the field of biology and other sciences. Many states have developed biodefense infrastructure and are increasingly engaged in data and technology sharing. Laboratory bio-safety and biosecurity protocols have also been established to prevent accidental or intentional misuse of biological agents. Understanding and analysing these efforts provides valuable insight into how the world has adapted to one of the most complex and invisible security threats of our time.

The year 2025 marks a significant milestone in the history of arms control. The Biological and Toxin Weapons Convention (BTWC), a landmark treaty that has played a pivotal role in the global effort to eliminate the threat of biological warfare celebrates five decades of its existence. The BWC/BTWC was the first multilateral disarmament agreement to ban biological weapons. It prohibits the development, production, and acquisition of biological and toxin weapons. Over the past five decades, this convention has moulded international efforts to promote peace, security, and the responsible use of biological sciences.

Today, BWC remains a basis of global efforts to eliminate the menace of biological weapons and warfare. As we mark 50 years since the treaty's inception, it is evident that the landscape of biological sciences and associated technologies has evolved dramatically. Fifty years ago, the concept of bioterrorism had not yet fully emerged, and the economic influence of the pharmaceutical and vaccine industries was relatively limited. Now, as the BWC reaches its half-

century milestone, the convention is required to address a host of new and complex challenges. It is also important to acknowledge that the convention has already taken steps to confront some of today's pressing threats. However, the urgency and scale of emerging risks require renewed global attention and collaborative action. The following are some of the key challenges that demand immediate attention.

2.2. Verification

The basic limitation of BWC is a lack of verification mechanism. Other Weapons of Mass Destruction (WMD) treaty mechanism like the NPT (Nuclear Non-Proliferation Treaty) and the CWC (Chemical Weapons Convention) do not suffer from this limitation. For the purposes of verification: NPT relies on safeguards agreements, while CWC depend on on declarations and inspections, including the process of 'challenge inspections.' The BWC mainly relies on national compliance and voluntary transparency measures. However, there is no provision of independent verification mechanism to guarantee that states are truly adhering to the treaty's prohibitions. Over the years, confidence-building measures (CBMs) have been established to enhance cooperation and communication among states and there a reasonable response to this measure from various states. However, the entire process is voluntary and are no provisions to enforce compliance. The BWC lacks a robust enforcement mechanism. Hence, it is difficult to address violations or non-compliance. Also, there are limitations in regards to clearly identifying what is a peaceful research and hostile research. Broadly speaking, the absence of legally binding verification mechanisms significantly limits the credibility and effectiveness of the BWC/BTWC in addressing biological threats.

2.3. Developments in Biosciences and Dual-Use Research

One of the most pressing challenges the BTWC faces today is the rapid advancement of biotechnology and the dual-use nature of many of its innovations. Since 1975, several major developments have taken place in the field of biotechnology, and there is a valid concern that some of these progressions could potentially be covertly misused to develop new forms of biological weapons. Below is a list of notable innovations in the biosciences that have emerged since the 1970s. It is important to emphasize that these examples represent a selection from a much broader array of technological

breakthroughs[1] over the past five to six decades. No specific methodology has been used in curating this list, and it is not being suggested that all these technologies inherently possess the capacity to create new categories of biological weapons.

a) *Recombinant DNA Technology (1970s–1980s)*

   Enabled the insertion of foreign genes into organisms, leading to the production of human insulin and other therapeutic proteins.

b) *Polymerase Chain Reaction (PCR) – 1983*

   PCR allows for the amplification of specific DNA sequences, revolutionizing genetic research and diagnostics.

c) *Human Genome Project (1990–2003)*

   Mapped the entire human genome, providing insights into genetic diseases and paving the way for personalized medicine.

d) *Gene Therapy (1990s–present)*

   Involves altering genes within an individual's cells to treat or prevent disease. The first successful gene therapy was conducted in 1990. This therapy stands approved for clinical use.

e) *Genetically Modified Organisms (GMOs) in Agriculture (1990s–present)*

   Introduced crops with enhanced traits such as pest resistance and improved nutritional content, significantly impacting food production.

f) *Stem Cell Research (1990s–present)*

   Led to advancements in regenerative medicine and the potential for treating various diseases through tissue regeneration.

g) *CRISPR-Cas9 Gene Editing (2012)*

   A precise and efficient method for editing genes, with applications in medicine, agriculture, and biotechnology.

h) *mRNA Vaccine Technology (2020)*

   Utilized in the rapid development of COVID-19 vaccines, showcasing the potential of mRNA technology in infectious disease prevention.

i) *Synthetic Biology (2000s–present)*

   Involves redesigning organisms to produce useful substances, leading to innovations in biofuels, pharmaceuticals, and materials.

j) *Biotechnology in Environmental Management (2000s–present)*
Application of biotech solutions for waste treatment, pollution control, and sustainable agriculture practices.

Humans have benefited significantly from the research, development and innovations which have happened during last fifty years or so. It has been found that the research in the field of biosciences and biotechnology offers immense potential for progressions in medicine and agriculture. However, some of these technologies carry a significant risk of misuse from the point of view of weapon (biological) development. Breakthroughs in genetic engineering, synthetic biology, and CRISPR-based gene editing now allow for unparalleled precision in manipulating biological systems. These capabilities distort the line between genuine scientific research and potential weaponization, making oversight challenging.

The BTWC was drafted in an era when biological sciences were far less advanced than it is today. In the 21st century, it is possible to engineer pathogens with increased virulence and resistance to treatments. It is also possible (theoretically) to selectively target some specific communities. The rapid progress in synthetic biology further complicates verification and enforcement mechanisms. This evolving technological environment underscores the urgent need to strengthen the BTWC and modernize its provisions to effectively address contemporary threats.

2.4. Artificial Intelligence (AI) and Biology

Biological weapons development has historically required extensive expertise, infrastructure, and resources. Yet, recent advances in artificial intelligence (AI) are worrisome. When AI would be used in the field of biotechnology, then there is a possibility that the process of making biological weapons could get simplified further. Particularly, use of AI in genetic engineering, CRISPR, and synthetic biology could lower the barriers for altering these technologies for heinous use. These technologies have great utility in medicine and research, but also have dual-use potential and hence could be misused to design novel biological weapons with enhanced virulence, stealth, or target specificity. AI-driven tools, including large language models (LLMs), can assist in planning attacks, designing toxic molecules, acquiring sensitive data, or spreading disinformation during outbreaks.

Today, AI and digital biological design tools pose new risks to arms control, particularly because they deal in intangible information like code, algorithms, and genetic sequences. These tools are difficult to regulate using traditional export controls that rely on the transfer of physical goods. Cloud labs, where experiments can be remotely designed and executed, introduce additional complexity. National legislation and regulatory frameworks will need to evolve to account for these developments, including addressing cyber-biosecurity risks such as unauthorized access to databases, lab sabotage, and manipulation of genetic data. At the same time, AI also offers potential benefits for biological arms control and could assist improving surveillance, modelling outbreak responses, and identifying vaccine contenders. The 2022 agreement to establish a science and technology review mechanism within the Convention is a promising step toward keeping pace with rapid technological change.[2] It is important to note that BWC was designed in a pre-digital era when these threats were unimaginable.

Other emerging technologies whether used alongside AI tools or independently, could also support the development of biological weapons. One such technology is Additive Manufacturing (AM), or 3D Printing. By enabling the on-demand creation of tools and materials, AM reduces the logistical footprint and may help conceal the acquisition of specialized equipment or expertise, thereby facilitating clandestine biological weapons programs.

A related technological innovation is Bioprinting, which adapts 3D Printing techniques[3] to deposit biological materials, such as cells, in layers to create structures that mimic human tissues or organs. While this technology holds tremendous promise for medical applications like tissue engineering, drug development, and organ replacement, it also presents dual-use risks. Such as, bio-printed tissues used in pharmacological testing could potentially be repurposed for research related to biological weapons development. As Bioprinting technology continues to mature, it is essential to monitor its use and consider the implications for biosecurity and arms control.

2.5. Non-State Actors and Bioterrorism

In the 21st century, the rise of non-state actors including terrorist organizations and lone individuals has significantly heightened concerns about the potential

use of biological weapons for acts of terrorism. Lone wolf terrorism, where individuals act independently without direct support from organized groups, presents a particularly difficult challenge to detect and prevent. Today, the widespread accessibility of biotechnology tools, open-source scientific knowledge, and the potential for covert acquisition of biological agents have made the threat of bioterrorism more credible than ever before.

Compounding this issue is the absence of a comprehensive, coordinated global response to the evolving threat of bioterrorism. The BWC was established at a time when the primary concern was state-sponsored biological warfare. At that time, the concept of bioterrorism was virtually non-existent. As a result, the treaty's mechanisms and enforcement structures remain largely state-focused, leaving critical gaps in its ability to address the risks posed by non-state actors.

2.6. Fifty Years of BWC

On 26 March 2025, the UN Secretary General gave his message on the 50th Anniversary of the Biological Weapons Convention. As per him, over the past five decades, the Convention has played a vital role in uniting the international community against the use of disease as a weapon, reinforcing the principle that science and technology must serve peaceful and beneficial purposes. He cautioned that the world must remain vigilant to address any challenges in future. Rapid advances in biology and biotechnology offer tremendous opportunities but also present new risks. The BWC provides a critical framework to ensure these developments are not misused and that progress in the life sciences remains firmly rooted in peaceful intentions. He urged all States Parties to actively participate in the Working Group on the Strengthening of the Convention and for the Group to intensify its efforts to fulfil its mandate during this anniversary year.[4]

The BWC has 188 States Parties as of April 2025, with Comoros the most recent to become a party. Four states have signed but not ratified the treaty and they are Egypt, Haiti, Somalia, and Syria. Five additional states have neither signed nor acceded to the treaty and they include Chad, Djibouti, Eritrea, Israel and Kiribati.

This edited volume commemorates the 50th anniversary of the BTWC by reflecting on the process of evolution of the convention, some of its

achievements and the challenges in front of it. There are contributions from experts across diverse disciplines. The bored purpose of this book is to visit the process of treaty negation and understand the process made by this treaty during its half a century existence. It could be said that the treaty has succeeded in stigmatizing the use of biological weapons and establishing norms for cooperation and transparency. Yet, several significant challenges remain, mainly in connection with verification and finding ways to deal with advances in biotechnology and possibility of bioterrorism.

As this book reflects on the past 50 years, it also serves as a call to action for continued global cooperation in the face of emerging threats. The international community must work together to strengthen the BTWC by closing existing gaps, and ensure that biological and toxin weapons remain firmly outside the realm of state and non-state actors.

This volume can be seen both as a tribute to the progress made under the Biological Weapons Convention (BWC) regime over the past five decades and as a reminder that significant work still lies ahead. While it addresses several key issues of contemporary relevance, it is important to recognize that this publication is not intended to serve as a comprehensive account of all aspects related to the BWC. It is important to mention that although there is a common thread running through the book, the presentation also embraces a degree of randomness. Since this volume originates from India, some chapters focus on India-specific aspects. The idea is to present a perspective from the Global South, while also reflecting the viewpoint of a scientifically advanced democratic state. It is expected that this volume could contribute towards the ongoing dialogue on BWC and encourage further analysis, discussion, and action to strengthen the Convention in the years to come.

This volume is divided into five sections, each focusing on a distinct theme. Contributors were not bound by a predefined word limit, allowing them the freedom to fully develop their ideas. As a result, some chapters explore their topics in considerable depth, depending on the complexity of the issues addressed.

NOTES

1 Handwiki, *Timeline of Biotechnology.* Encyclopedia. https://encyclopedia.pub/entry/37943 Accessed on 24 March 2025

2 James Revill, Clarissa Rios and Louison Mazeaud, *What will be the impact of AI on the bioweapons treaty?* .Bulletin of the Atomic Scientists. 16 November 2024. https://thebulletin.org/2024/11/what-will-be-the-impact-of-ai-on-the-bioweapons-treaty/ Accessed on 30 November 2024.

3 Kolja Brockmann, *Advances in 3D Printing Technology: Increasing biological weapon proliferation risks?* . Stockholm International Peace Research Institute (SIPRI). 29 July 2019. https://www.sipri.org/commentary/blog/2019/advances-3d-printing-technology-increasing-biological-weapon-proliferation-risks Accessed on 27 December 2024.

4 Antonio Guterres, *Secretary-General's Message on the 50th Anniversary of the Biological Weapons Convention.* Office of the Secretary General of the United Nations. 26 March 2025. https://www.un.org/sg/en/content/sg/statement/2025-03-26/secretary-generals-message-the-50th-anniversary-of-the-biological-weapons-convention Accessed on 29 March 2025.

SECTION II

TREATY ORIGIN AND EVOLUTION

3

The 1925 Geneva Protocol

Dr. Jean Pascal Zanders

3.1. Introduction

17 June 2025 marks the centenary of the signing in Geneva of the *Protocol for the Prohibition of the Use of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare*.[1] The agreement is still in force, and as of 1 April 2025, 146 states are party to it. The document is short, barely one page. Yet, it has had a tremendous impact on the control of chemical and biological weapons (CBW). Being part of the laws of war, it did not constrain the acquisition and stockpiling of CBW in itself. However, delegitimising chemical and bacterial warfare methods laid the foundations for the comprehensive elimination of both weapon categories decades after its entry into force on 8 February 1928. At the height of the Iran-Iraq War (1980-88), the Geneva Protocol offered the legal foundation for establishing the UN Secretary-General's Mechanism to investigate allegations of CBW use in 1987. Its language also helped to define CBW use as a war crime in the 1998 Rome Statute, which established the International Criminal Court. Most countries, legal scholars and academics now view the Geneva Protocol as having entered customary international law, thus binding states irrespective of whether they have ratified or acceded to it.

After briefly introducing the Geneva Protocol, this chapter describes the establishment, structural organisation and early work of the League of Nations.

It then focusses on the arms reduction activities and how chemical and bacteriological entered the technical discussions. As the League's work was progressing, the United States convened the Washington Naval Conference, which produced a Convention that proscribed chemical warfare. While it galvanised work in the League, the document never entered into force and was never presented to states beyond the participating Great Powers for signature. However, as the next section describes, the Washington Convention gave greater legitimacy to efforts in the League to characterise future chemical and bacteriological threats. With the completion of a report in 1924, the work ended. The next part describes in depth the debates on chemical and bacteriological warfare in the Arms Traffic Conference and how they led to crafting the Geneva Protocol. The concluding section reflects on the League's work between 1920 and 1925 and how proponents and opponents of a global rule against CBW contributed to framing the norm embedded in the Geneva Protocol. It ends with an overview of the agreement's legacy over the past century.

3.2. The Prohibition on CBW Use

The Geneva Protocol frames the prohibition on CBW use in two paragraphs. The first preambular paragraph reiterates the existing condemnation of chemical warfare in earlier treaties and defines what was then understood to be a chemical weapon:

> *Whereas the use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices, has been justly condemned by the general opinion of the civilized world ...*

The first operative paragraph invites states not yet party to an earlier international agreement banning chemical weapon (CW) use to join the prohibition and extends this prohibition to the use of bacteriological methods of warfare:

> *That the High Contracting Parties, so far as they are not already Parties to Treaties prohibiting such use, accept this prohibition, agree to extend this prohibition to the use of bacteriological methods of warfare and agree to be bound as between themselves according to the terms of this declaration.*

The latter paragraph also specifies that 'the High Contracting Parties ... agree to be bound as between themselves according to the terms of this declaration'. This formulation has two significant implications. First, the Geneva Protocol is a contract, meaning the agreement no longer applies if one party breaks it (by using CBW). Second, the clause, 'agree to be bound as between themselves' means that the parties have pledged to each other rather than individually to the Protocol. Given that the Protocol does not restrain the development, production and stockpiling of CBW, the implications of both elements are twofold: if a belligerent violates the Protocol, then another party to the conflict has the right to retaliate with CBW, and the Protocol does not constrain a belligerent if the adversary has not signed up to the agreement, is not recognised as a sovereign state (e.g. a colony), or is a non-state entity (e.g. an insurgent group).

To emphasise the points, multiple governments expressed a reservation or added a clarification upon ratification or accession along the lines that they 'shall be bound by the Protocol only in relation to States that have ratified it or acceded to it and shall cease to be bound by the Protocol vis-à-vis any State whose armed forces or whose allies' armed forces fail to comply with the Protocol's provisions'.[2]

This situation stands in stark contrast to the 1972 Biological and Toxin Weapons Convention (BTWC)[3] and the 1993 Chemical Weapons Convention (CWC).[4] Each state party commits itself separately to those treaties. The formulation 'never under any circumstances' in both treaties points to the continued application of the prohibitions irrespective of the actions or violations by another party or non-party. Most parties have now withdrawn their reservations to the Geneva Protocol to avoid any contradiction with the disarmament agreements.

Notwithstanding its shortcomings, the Geneva Protocol represented a significant advance for the laws of war and international humanitarian law in the 1920s. It has held up the norm against CBW in the face of serious challenges over the following decades.

3.3. The 1919 Versailles Treaty and the League of Nations

The Armistice of 11 November 1918 ended fighting in the First World War. Within a few months, the Paris Peace Conference set out to craft the Covenant

of the League of Nations and negotiate the peace treaty with Germany. Both components became part of a single document, the 1919 Versailles Treaty.[5]

3.3.1. The principal bodies

The League of Nations comprised three principal bodies, the Council, the Assembly and the Secretariat. The Council supervised the implementation of the Covenant and handled international disputes as they arose by unanimously deciding on an agreed course of action. The Covenant foresaw five permanent Council members representing the victorious Great Powers of the First World War and four non-permanent members elected by a two-thirds majority of the Assembly. With the inclusion of smaller states as non-permanent members, unanimous decision-making safeguarded Great Power interests because it bestowed on any state sitting on the Council a *de facto* veto power.[6] As the US Senate failed to ratify the Treaty of Versailles in March 1920,[7] the four permanent members were Britain, France, Italy and Japan. In 1922, non-permanent membership rose to six, and the number expanded further over the next few years. Germany received a permanent seat, and Poland and Spain occupied the two newly created semi-permanent seats in 1926. Except in 1920, its first year of activity, the Council habitually met four times yearly.

The Assembly represented all League members. Each state appointed three delegates but only had one vote. The body's authority equalled that of the Council. However, contrary to the Council, which safeguarded Great Power interests, the Assembly represented all League members. They exerted their participative power by voting on candidate non-permanent Council members, focussing on a broad swath of issues, setting the Assembly's agenda through revising the proposal drawn up by the Secretary-General, and their ability to debate the urgent issues of the day. The press closely followed the Assembly's annual meetings, enabling its members to have a global impact on public opinion and exert pressure on national politicians and government officials.[8] The Assembly met annually in September, but one or more states could request an extraordinary session if a majority of League members endorsed the call.

Headed by a Secretary-General, the Secretariat was the League's administrative structure. Staffed by around 700 international civil servants, it served the Council and Assembly and supported the work of their many committees. One of the administrative units was the Disarmament Section, which arose

from the First Assembly's decision to set up a temporary commission to prepare reports and proposals for armament reductions. The Secretariat was headquartered in Geneva. Whereas previous inter-state conferences took place intermittently, it represented the institutional permanency of the novel international organisation.[9]

3.3.2. Subsidiary bodies

The League also set up a host of subsidiary bodies. For the present chapter, the principal ones were the Council's Permanent Advisory Commission for Military, Naval, and Air Questions, the six Committees of the Assembly, and the Temporary Mixed Commission that served both the Assembly and the Council.

Per Article 9 of the Covenant, the Council resolved to set up the Permanent Advisory Commission for Military, Naval, and Air Questions (also known as the Permanent Armaments Commission or PAC) on 19 May 1920. The states represented on the Council appointed a military, a naval, and an air representative, all military officers.

The Assembly had six principal committees, namely the

- First Committee: Constitutional Questions,
- Second Committee: Technical Organisations,
- Third Committee: Armaments and Blockade,
- Fourth Committee: Finances and Internal Organisation of the League,
- Fifth Committee: Humanitarian Questions, and the
- Sixth Committee: Enquiry into applications for admission of States to the League, and Political Questions.

Relevant to the present analysis are the Third and, in lesser degree, Sixth Committees.[10]

On 25 February 1921, the Council set up the Temporary Mixed Commission for the Reduction of Armaments by resolution to consider the disarmament problem from the military and social, economic, and political viewpoints.[11] The subsidiary body reported to the Council and the Assembly and received administrative support from the Secretariat's Disarmament Section.[12] Unique to the Temporary Mixed Commission was the appointment

of its members as private individuals who did not have to follow formal government instructions. Eventually, several key capitals increasingly objected to their lack of national accountability. The Commission wound up its activities in 1924.[13]

3.4. Early Consideration of CBW in the League of Nations

Nobody denies the role of the United Nations in negotiating multilateral disarmament and arms control treaties or further developing the laws of war and international humanitarian law. These goals were not part of the League of Nation's mission. According to the preambular paragraph of the Covenant, the League's mission is to promote international cooperation and achieve international peace and security through the concerted acceptance of established understandings of international law and actions in line with these understandings by the League's members.[14] Article 8 of the Covenant addressed the question of arms reductions, which, in the early 1920s, essentially meant lower national armaments, troop numbers and defence budgets. It also sought to curb the 'evil effects' of the 'manufacture by private enterprise of munitions and implements of war'.[15] The task at hand was 'to explore those aspects of the problem of disarmament which were not purely of a technical military character, but might properly be described as involving political and economical issues as well'.[16] At the outset of its activities, CBW were not part of the League's considerations.

Three factors contributed to CW entering the deliberations. First, Part V of the Versailles Treaty imposed strict military, naval and air restrictions on Germany. Articles 171 and 172 forbade Germany to possess, manufacture or import CW. It demanded that it disclose the 'nature and mode of manufacture of all explosives, toxic substances or other like chemical preparations used by them in the war'.[17] Both articles constituted a one-sided prohibition since all League members had also contracted to the peace arrangements with Germany. In view of the League's aim for an inclusive global association, states striving for coequal German membership (which happened in 1926) raised whether the ban affected their legal duties too. Indeed, the preambular paragraph of Part V of the Versailles Treaty connected Germany's demilitarisation requirements with one of the League's primary objectives when stipulating that the country undertook its obligations 'to render possible the initiation of a general limitation of the armaments *of all nations*' (emphasis added).[18]

Second, the 1921-1922 Washington Naval Conference yielded several arms limitation agreements, including one proscribing chemical warfare.[19] Because the United States was not a member, the gathering took place outside of the League. With only a limited number of invited states attending, the League immediately strove to extend the Washington Naval Treaty to its non-signatory members.[20] The Temporary Mixed Commission considered a similar initiative concerning poison gas use in war but decided against taking action because the US had not yet forwarded the treaty to the non-signatory States for adhesion (per Article VII), and it had not yet entered into force because not all signatory states had ratified it.[21] Misgivings about the provisions on submarines ultimately led France to refuse ratification.

The third factor was public opinion. Lord Robert Cecil, politician, diplomat, and one of the League's principal architects and supporters of its goals, was the first to pry open the door to allow consideration of the implications of chemical warfare. Great Britain submitted a question about using asphyxiating gases as a combat weapon to the newly created Permanent Armament Commission in July 1920.[22] Its initial arguments were humanitarian and aimed at mobilising the international scientific community to constrain new agents' development. As already noted, the PAC consisted entirely of military experts from the countries represented on the Council. The Commission resolved that 'employment of gases is a fundamentally cruel method of carrying on war; though not more so than certain other methods commonly employed, provided that they are only employed against combatants'. Against non-combatants, such use would be 'barbarous and inexcusable'. It maintained that prohibiting or limiting the production of toxic agents in peacetime would not restrict their use in war and that banning research in laboratories was out of the question. On preparing a regulation prohibiting the use of asphyxiating gases, the Commission posited that this was a question of international law and a problem for humanity and not one for it to consider.[23]

During the discussion of the Commission's recommendation, France suggested that the Council could not go any further than existing international law (notably, the 1907 Hague Convention and the disarmament articles in the Versailles Treaty). Still, it conceded that the body could not refrain from expressing an opinion because of the press's awareness of the agenda item. The Council, therefore, condemned the use of poisonous gases. It also referred

back to the Commission 'the consideration of the methods which might ensure an effective control of the production of gas'.[24] While the League remained seized of CW with this outcome, this early exchange held several implications for future discussions.

First, the PAC's report revealed the League's reluctance to develop the laws of war further. The military officers making up the advisory body had, at best, minimal interest in armament reductions or weapon restrictions on the battlefield. Regardless, a much wider group of politicians, diplomats and legal experts taking part in the meetings shared the disinclination to ameliorate the customs and laws of war. The Covenant foresaw no such mandate for the League. In contrast, its calls for national reductions in armaments and military spending, curtailing the private armaments industry, and international arms transfers were specific. Another reason for the hesitance was the rather exalted idea among multiple delegates that the League aimed for nothing less than the elimination of war as an instrument to settle disputes between states. Viewed from this angle, the international organisation had no reason to waste resources on regulating specific modes of warfare, such as the use of toxic agents. Still, the delegates' awareness of public and press interest meant that curtailing CW would eventually get back onto the table.

Second, the PAC expressed the view that targeting non-military persons with war gases is 'barbarous and inexcusable'. Moreover, during the Council meeting of October 1920, the Commission's President conceded that such gases harmed civilians as well as troops because they 'could not be regulated and limited to any well defined area'. Acknowledging the impossibility of preventing laboratory research and the production of combat gases, he underscored the PAC's recommendation that 'an examination into the employment of gases should be authorized so as always to be in a position to provide against their eventual illicit employment'.[25] This call for legitimising research into chemical defence and protection paired nicely with the military mind-set of the Commission's members. While supportive of the position not to engage with the further improvement of the laws of war, the allusion to defence and protection also implicitly acknowledged that characterising the evolving CW threats merited continuing scientific and technological investigation. This explication smoothed the path for reframing the humanitarian appeal.

The next year, Lord Cecil, this time sitting as representative of the Union of South Africa (then a self-governing Dominion of the British Empire) in the Assembly's Third Committee on armaments, pointed out the contradiction in the PAC's response to the British question on chemical warfare and the Council's lack of action. Utilising the Commission's points about poison gas being an evil of tremendous proportions and the inability to limit the consequences of its use to strictly military targets, he drove home that 'it has been stated that inventions have been made or perfected since the war whereby wholesale destruction of the civil population would be possible by the dropping of poison bombs and the like from the air, nor is there any reason to suppose that the limits of invention in these fiendish devices have been reached'. He used this frightful prospicience to call on the Temporary Mixed Commission to explore and consider an appeal to the scientific community to provide complete publicity for their research on war gases. Without secrecy, Lord Cecil argued, the shared knowledge among nations would render the employment of such weapons impracticable and, therefore, improbable. The Second Assembly unanimously adopted all resolutions put forward by the Third Committee, thereby tasking the Temporary Mixed Commission with the question of chemical warfare.[26]

Third, the delegates began to come up against the dual-use nature of toxic chemicals. It would still take some time before they characterised the challenge. However, the awareness that many toxicants used on the battlefields also have commercial applications fed into the reluctance to strengthen the laws of war. As French delegate René Viviani argued in the first meeting of the Sixth Committee of the Assembly, 'It would be impossible to prevent the use of poisonous gases without preventing their manufacture, and this, owing to the nature of their composition, would be even more difficult in the case of poisonous gas than in the case of guns and ammunition'.[27] His comment mirrored the Temporary Mixed Commission's task to consider arms reductions from the military and social, economic, and political viewpoints. As the Vice-Chairperson concluded that they had to await further instructions and data from the League Council, no further discussion took place in the Sixth Committee in 1920. However, by considering the poisonous substances as commercially manufactured goods and their economic relevance, the need to curb their production for military purposes and the international trade in

CW was to bring them under the agenda items on conventional weapons and munitions.

As chemical warfare was gradually insinuating itself as a security topic into the League's agenda, the United States was preparing the Washington Naval Conference. Its outcomes were to impact the poison gas deliberations that the League by itself would have never been able to achieve.

3.4.1. A treaty on limiting and banning the use of asphyxiating gases

In his invitation to the Washington Naval Conference (12 November 1921 to 6 February 1922), US President Warren G. Harding called for ambitious reductions in naval and land armaments. His opening address captured the dual ambition of war prevention and arms control:

> *I can speak officially only for our United States. Our hundred millions frankly want less of armament and none of war. Wholly free from guile, sure in our own minds that we harbor no unworthy designs, we accredit the world with the same good intent.*[28]

The League of Nations played no role in the organisation or conduct of the conference because the United States had not ratified the Versailles Treaty and was, therefore, not a member of the international organisation. Moreover, Washington had invited only nine countries, of which five took part in the naval arms limitation talks: France, Great Britain, Italy, Japan and the United States.[29] The conference also covered two other issue areas, namely territorial and political settlements in the Asia-Pacific region and the development of rules for control of new agencies of warfare, in separate committees. The latter forum set up three subcommittees to consider toxic weapons, aircraft and the rules of international law.

This choice of sub-committee themes reflected the doubts about the value of international laws of war among the delegates of the five principal powers. Their hesitancy recalled the Permanent Armaments Commission's negative stance on the League developing rules of conduct on the battlefield when is was considering the question of poison gas. Yet, public opinion, as invoked by President Harding in his opening address, left them with no choice but to consider the matter. This situation was also reminiscent of earlier discussions in the League.

Within the confines of the sub-committee rooms, public opinion held little sway. The one on aircraft concluded that it was impossible to prohibit aeroplanes in war or effectively limit the number of planes or pilots. A resolution declared that 'the use of aircraft in war should be covered by the rules of warfare as adapted to aircraft by a further conference which should be held at a later date'.[30] The sub-committee on chemical warfare developed a similar logic and noted the members' agreement in a memorandum presented in the Committee on the Limitation of Armament of 6 January 1922:

> (c) Research which may discover additional warfare gases cannot be prohibited, restricted or supervised.
>
> (d) Due to the increasingly large peacetime use of several warfare gases. It is impossible to restrict the manufacture of any particular gas or gases. Some of the delegates thought that proper laws might limit the quantities of certain gases to be manufactured. The majority of opinion was against the practicability of even such prohibition.
>
> [...]
>
> (f) The kinds of gases and their effects on human beings cannot be taken as a basis for limitation. In other words, the committee felt that the only limitation practicable is to wholly prohibit the use of gases against cities and other large bodies of noncombatants in the same manner as high explosives may be limited, but that there could be no limitation on their use against the armed forces of the enemy, ashore or afloat.[31]

The similarity to the arguments used in the Permanent Armaments Commission's opinion on chemical warfare is striking but perhaps less surprising when considering that the Great Powers in the League Council, also present in Washington, acquiesced in that position. However, the United States took exception to the conclusions in the memorandum. The chairperson of the Committee on the Limitation of Armament read out, on behalf of the US delegation, the report adopted by the advisory committee of the American delegation. It included the resolution 'That chemical warfare, including the use of gases, whether toxic or nontoxic, should be prohibited by international agreement, and should be classed with such unfair methods of warfare as poisoning wells, introducing germs of disease, and other methods that are abhorrent in modern warfare'. The advisory committee of the American delegation, therefore, recommended that 'Chemical warfare should be abolished

among nations, as abhorrent to civilization. It is a cruel, unfair, and improper use of science. It is fraught with the gravest danger to noncombatants and demoralizes the better instincts of humanity'.[32]

Elihu Root, a former Secretary of War and State and member of the US delegation, then indicated that the Committee Chairperson had asked him to prepare a resolution based on the opinion of the advisory commission of the American delegation. He explicitly cited Article 171 of the Versailles Treaty and referred to the Hague agreements on the use of poisons and asphyxiating gases before reading out the draft resolution:

> *The use in war of asphyxiating, poisonous, or analogous liquids or other gases and all materials or devices having been justly condemned by the general opinion of the civilized world and a prohibition of such use having been declared in treaties to which a majority of the civilized powers are parties—*
>
> *Now, to the end that this prohibition shall be universally accepted as a part of international law, binding alike the conscience and practice of nations, the signatory powers declare their assent to such prohibition, agree to be bound thereby between themselves, and invite all other civilized nations to adhere thereto.*[33]

Consideration of the statement continued the next day. Representatives from the other powers associated themselves with it, which, with a few minor editorial modifications, became Article V of the Treaty Relating to the Use of Submarines and Noxious Gases in Warfare.[34]

A year later, the Conference on Central American Affairs adopted the Convention for the Limitation of Armament. Five countries signed it on 7 February 1923 and the accord entered into force on 24 November 1924. Its Article V adopted the essence of the prohibition on chemical warfare in the Washington Treaty:

> *The contracting parties consider that the use in warfare of asphyxiating gases, poisons, or similar substances as well as analogous liquids, materials or devices, is contrary to humanitarian principles and to international law, and obligate themselves by the present convention not to use said substances in time of war.*[35]

In addition, the Fifth International Conference of American States, held in Santiago, Chile, from 25 March to 3 May 1923, recommended that participating states prohibit 'the use of asphyxiating or poisonous gases and analogous liquid material or devices as indicated by the Washington treaty of February 6, 1922'.[36] However, the text did not equal a legally binding instrument. On 11 April, Chile moved to exclude the topic of armaments limitation from the conference agenda. Instead, it proposed separate negotiations between the nations concerned and a declaration of principles based on the treaties concluded at the Washington Naval Conference.[37]

3.4.2. Addressing the CW threat in the League

1922 was the year in which chemical warfare began featuring more frequently in reports and discussions. The League Assembly pushed the agenda forward despite resistance in the Council and, more specifically, the Permanent Armaments Commission. The Council and the Assembly were coequal, but all League members made up the latter body, and each had one vote. Smaller countries could advance their interests by building coalitions. The Assembly's Third Committee on the reduction of armaments prepared key decisions for the full Assembly, while the Temporary Mixed Commission implemented the decisions by the Assembly and the Council. Lord Cecil continued to exert his considerable influence in the Assembly and its Third Committee to advance the cause against chemical warfare.

The two significant matters fuelling the debates in the League were, on the one hand, the outcomes of the Washington Naval Conference and, on the other hand, the rising apprehension about future modes of chemical warfare combined with the potential impact of science and technology on the development and production of novel toxic agents.

With the Washington Naval Conference having yielded a new international restriction on chemical warfare, the Third Committee looked into the possibility of extending the principles of the treaty to all League members. Following separate proposals by the delegates for Colombia and Australia, it resolved that 'the Assembly requests the Council to recommend the Members of the League and other nations to give their adhesion to the Treaty of Washington (February 6th, 1922) in relation to the use of asphyxiating gas and submarines in war and other similar matters'. Concrete action, however,

was impossible because not all signatory states had yet ratified the Washington Treaty. Therefore, the United States could not forward it to other states with an invitation for accession. The delegate for Colombia thus suggested to recommend the Assembly to draw up its own convention outlawing chemical warfare. The delegate for Norway opposed the step because humankind could only abolish war, not humanise it. The key was to seek armament reductions.[38] He furthermore argued that a thorough preparatory investigation of the subject matter should precede the transformation of the Assembly into a diplomatic conference mandated to draw up an international code of laws. The Assembly decided to refer the question to the Temporary Mixed Commission for further consideration.[39]

Meanwhile, concern had also increased among delegates about scientific and technological developments that could turn asphyxiating gases and other noxious substances into devastating weapons, especially if used against urban populations. The emergence of aeroplanes with more powerful engines extending their range and bombload fed this ominous vision. In the early 1920s, strategic thinkers on air power, such as Italian General Giulio Douhet and US General William 'Billy' Mitchell, were advocating the integration of chemical weapons in aerial warfare.[40] Their writings led some to envisage apocalyptic chemical bombing raids against cities, leading to human losses beyond anything experienced thus far. These appraisals especially helped Lord Cecil reframe the humanitarian arguments for action by the League.

As indicated earlier, the Second Assembly (1921) resolved that the 'Temporary Mixed Commission be asked to examine – in consultation with the Permanent Advisory Commission – whether it is advisable to address an appeal to the scientific men of the world to publish their discoveries in poison gas and similar subjects, so as to minimise the likelihood of their being used in any future war'.[41] The next year, the Temporary Mixed Commission examined how to implement the resolution. It addressed the question to the Committee on Intellectual Cooperation to advise how to enlist the cooperation of scientists. The committee responded that it could not suggest any 'methods by which scientific men throughout the world can be induced to publish their discoveries concerning poisonous gases and the development of chemical warfare'. Consequently, the Temporary Mixed Commission concluded that the proposed exercise served no valuable purpose and considered that even if such an appeal

to scientists were made, it would not contribute to achieving the Assembly's aim to minimise the likelihood of toxic agents being used in any future war.[42]

Lord Robert Cecil (South Africa) countered the setback. He pointed out possible future developments in chemical warfare and envisioned the discovery of even deadlier toxic agents:

> *Nor is poison gas the only example of the future development of chemical warfare; explosives grow yearly in strength and destructive effect; bombs which in the late war were regarded as formidable are already of insignificant power compared with those which will be used in future wars, and there is the whole department of bacteriological attack which may be developed as science progresses.*

He, therefore, appealed to his colleagues in the Temporary Mixed Commission to set up a small committee that could

> *collect, partly from existing publications and partly by enquiries from experts, the facts necessary for such an exposition without trending upon any secrets or giving information which might be utilised in undesirable ways. What is wanted is not information as to the technical methods by which these things can be made or employed, but as to what will be the result of their manufacture and use.*[43] *(Emphasis added)*

The underlined clause mattered because it moved the consideration of chemical warfare away from a ban under the laws of war and closer to some of the core issues under discussion in the League. Information sharing sought to appraise the public of the evolving threats and thus have governments counter them with necessary measures to protect the population. According to the reasoning, such steps would reduce the likelihood of chemical warfare. Hence, the Temporary Mixed Commission acquiesced to the requested small committee:

> *Resolution VII (a) The Assembly, having considered the report of the Temporary Mixed Commission on the subject of the development of chemical warfare, approves its action in establishing a special Sub-Committee to report on the probable effects of chemical discoveries in future wars, and requests the Council and the Temporary Mixed Commission to take every possible measure to secure the fullest publicity for the report of this Sub-Committee.*[44]

Lord Cecil's intervention was consequential for a different reason, too. It included the first reference to bacteriological warfare in publicly available League records. As cited earlier, the report of the advisory committee of the American delegation at the Washington Conference referenced the hostile use of germs in passing. Still, delegates there did not act on the topic. In contrast, Lord Cecil's intervention linked the feasibility of bacteriological warfare to scientific advancements, thereby providing a sufficient motive for the League to also investigate germ weapons.

The 'Special Committee on the probable effects of chemical discoveries', as the sub-committee was formally labelled, began its work in 1923. In his report to the Fourth Assembly, Edvard Beneš (Czechoslovakia) amplified the concerns about the impact of 'modern discoveries in the domains of chemistry and bacteriology' on the changing nature of warfare. 'War being in itself a relentless struggle for life, chemical and bacteriological weapons emphasise the inhuman quality of this struggle and heighten the dangers of war to such an extent as to threaten the very existence of mankind and civilisation.' For this reason, the Special Committee, consisting of Lord Robert Cecil (Great Britain again), Vice Admiral John Roderick Segrave (Great Britain), General Alberto de Marinis (Italy) and Lieutenant-Colonel Édouard Réquin (France), were consulting with eminent bacteriologists and chemists in preparing the report suggested by the Third Assembly.[45]

Despite the opposition to having scientists publish their latest innovations in chemistry and bacteriology to allow societies to prepare themselves for chemical and bacteriological warfare, the Special Committee solicited the opinions of thirteen internationally renowned researchers. Four of the eight invited chemists and all four bacteriologists responded:[46]

I. Chemists
   - Prof. Angelo Angeli, Institute of Higher Studies, Florence
   - Prof. André Mayer, Collège de France, Paris
   - Senator Emanuele Paternò, 9th Marquess of Sessa, University of Rome
   - Prof. Joaquin Enrique Zanetti, Columbia University, New York

II. Bacteriologists
   - Prof. Jules Bordet, Pasteur Institute, Brussels

- Prof. Walter Bradford Cannon, Harvard Medical School, Boston, MA
- Prof. Thorvald Madsen, State Serum Institute, Copenhagen
- Prof. Richard Friedrich Johannes Pfeiffer, University of Breslau (Wroc³aw)

The Special Committee's report summarised the experts' insights and opinions. It discussed the various modes of chemical warfare, described the effects of the different types of chemical warfare agents on humans, animals and vegetation, and looked into the possibilities of protection against chemical weapons. It considered the possible effects of fresh discoveries. Mainly because the agents used in the First World War were commonly used in industry during peacetime, the experts did not exclude but considered it unlikely that the possible discovery of new toxicants would affect other bodily functions. One expert also dwelt on the consequences of gas use on a country's sources of wealth. He reflected on the possible consequences of large-scale air-delivered gas bombs filled with toxic agents against cities, industrial sites or mine pits and galleries. While the scenario was not implausible, he thought it would no longer be a matter of purely chemical action, given the evolution of high explosives and the introduction of new incendiary materials.

The CW part of the report concluded that the problem of protecting the civil population still needed to be resolved. It also noted that a neighbour with a large chemical industry having hostile intentions could acquire immense superiority if it were to conduct secret research into injurious substances, then manufacture them in large quantities in any of its chemical works, and then launch an unexpected attack against any unprepared population. As such, the question of chemical warfare became one of international security and stability and, hence, one of the League's ultimate goals of war prevention.[47]

The much shorter section on bacterial warfare noted the absence of such weapon use in the First World War. Still, the experts could not exclude such a possibility in view of the future development of bacteriological science. With typhus, cholera or plague in mind, they had difficulty imagining the military utility of bacteriological warfare because the spread of germs could neither be measured nor localised. The pathogens would affect the civilian population and cross borders, and the epidemic might continue even after hostilities had ceased. They doubted the feasibility of preparing streptococci, staphylococci,

anthrax spores or glanders bacilli for the poisoning of weapons as the germs would lose their potency if prepared beforehand and allowed to dry on metallic surfaces. They also questioned whether the agent, if placed in a projectile, might resist the shock of discharge, heat and violence of an explosion. Only a release from an aeroplane of glass globes filled with germs presented a danger in their mind. There was less consensus in the group about the capacity to destroy a country's livestock or crops. In conclusion, the Special Committee posited that while the bacteriological arm could not paralyse an enemy's defences, scientific progress may yet turn it into a formidable future weapon and, therefore, had to be monitored.[48]

3.5. The end of the beginning of the League of Nations

1924 was a turning point for the League. It was the year governments ended the internationalist and broader societal representation in the organisation. They did not extend the mandate of the Temporary Mixed Commission and took charge of the weapon control agenda. Great Britain and France, in particular, thought that disarmament initiatives with their many security implications were governmental prerogatives and should not originate with a body whose membership, while appointed by countries, sat in their own name. Commission proposals had also often fallen foul of institutional opposition in capitals or got rejected by a new government after elections. The Permanent Armaments Commission, established under Article 9 of the Covenant and comprised of military officers answerable to their respective governments, also safeguarded national interests. The Temporary Mixed Commission had its supporters, mostly among smaller powers who could influence policy outcomes through their numbers and coalition-building strategies. It was where matters of weapon control not originally on the League's agenda could be explored and framed for diplomatic consideration. Yet, none of them came to fruition, the root cause being the League's lofty vision of war elimination based on the twin pillars of armament reductions to strictly minimal levels and mutual security assurances. In pursuing this grand ambition, the international organisation could not escape certain realities.

Foremost, the League did not enjoy universal membership. Non-members, such as Germany or the nascent Soviet Union, could pose serious present or future military threats because the arms reduction requirements did not apply to them. The United States, the great inspirer of the League's Covenant, had

failed to ratify the Versailles Treaty and resisted engaging with new diplomatic initiatives emerging from Geneva. Many League members, not the least France, continued to look at Washington as the premier guarantor of peace.

Second, countries had divergent threat perceptions. Great Britain, separated from the continent by a sea, had significantly reduced its military and naval power straight after the armistice and felt less concerned about European developments than the rising disturbances in its oversees territories. France and Belgium nurtured long-term fears of Germany's economic, industrial and military resurgence. They refused to draw down their military capacities or abolish conscription and were desperate for security assurances from their erstwhile allies. The First World War had broken up empires in the eastern part of Europe. Most new countries faced internal turmoil, fierce border disputes, or existential threats from big neighbours.

Third, the large powers, in particular, shunned the proposed mutual assistance commitments with their automatic obligation to rescue a third party or transfer of sovereign authority to declare war to supranational decision-making.

Finally, the League's quest for deep military cuts sat uncomfortably with smaller countries because their national industrial and scientific base was too small to mobilise sufficient resources to face off an aggressor in time. The League's recurrent efforts to curb international arms transfers and private weapon producers in line with Article 8 of the Covenant sharply exposed those vulnerabilities.

With these issues dominating deliberations one way or another, the League's achievements in security governance, armament reductions and arms traffic restrictions eyed poor at the end of 1924. The Special Committee of the Temporary Mixed Commission submitted its report on the probable effects of chemical discoveries to the Third Committee, which in turn had the Fifth Assembly request the Council 'if it considers it desirable, to publish the report of the Temporary Mixed Commission and, if advisable, to encourage the work of making information on this subject generally accessible to the public'.[49] The League never officially released the report.[50] During its meeting on 30 September, the Council agreed with the opinion of Mr Beneš, rapporteur, that the 'formal Assembly resolution is in itself the best way to draw public attention to this issue' and that, therefore, 'the Council has every right to hope

that the government delegates who unanimously voted for this resolution will make every effort to give it the widest possible publicity in their respective countries'.[51] With the termination of the Temporary Mixed Commission's mandate, consideration of chemical and bacteriological warfare had reached its endpoint.

In one of its priority issue areas, restricting the international arms trade, the League made little headway beyond bureaucratic efforts to register and publish national reports on arms transfers. When negotiating the Versailles Treaty in 1919, states had already determined the arms trade as a significant contributing factor to the outbreak of the First World War. In a parallel diplomatic process, they concluded a separate treaty, the Convention for the Control of the Trade in Arms and Ammunition (also known as the Convention of Saint-Germain-en-Laye).[52] Opened for signature on 10 September 1919, 28 countries inked the document, and more League members acceded in the following months. Despite its involvement in the negotiations, the United States withdrew from the multilateral engagements. It refused to ratify the Versailles Treaty and ignored the Convention of Saint-Germain-en-Laye. As a consequence, the latter agreement never entered into force. It no longer had any representation in Geneva, and the State Department left correspondence from the organisation unanswered.[53]

Realising that the Convention of Saint-Germain-en-Laye was not going anywhere and that the United States had to be part of an arms trade agreement, the League set out to craft a new treaty in 1923. On September 27, 1924 the Fifth Assembly of the League of Nations resolved to convene a conference of members and non-members on questions of security, disarmament, and arbitration with the special task of producing a draft convention regulating the international trade in arms. This agreed-upon draft was to be completed by December 1924, together with the world's governments' comments, so that it would be ready for consideration by a final acceptance conference in May or June 1925.[54]

3.6. The 1925 Arms Traffic Conference

The Conference for the Supervision of the International Trade in Arms and Ammunition and in Implements of War convened under the League's auspices in Geneva from 4 May until 17 June 1925. It ambitioned to finalise the Convention for the Supervision of the International Trade in Arms and

Ammunition and in Implements of War, whose draft the Temporary Mixed Commission prepared in 1924 after a Council recommendation adopted in December 1923.[55]

The new conference heralded US re-engagement with multilateral diplomacy. League members had bent over backwards to persuade Washington to participate, even stipulating that the new treaty was to avoid 'any clause which might render it difficult for the Government of the United States to ratify the Convention'.[56] Washington decided to observe the Temporary Mixed Commission's meetings in 1924.[57] In December, it announced its intent to participate in the conference. Congressman Theodore E. Burton was to lead the US delegation.

Under the presidency of Count Carton de Wiart (Belgium), the Conference held general discussions in plenary meetings at the opening and closing of the proceedings, namely on 4-6 May and again on 15-17 June. He also presided over the twenty-six sessions of the General Committee, which undertook a first reading of the draft arms traffic convention. Whenever a delegation raised a question of principle, the concerned draft articles were referred to the competent technical committee for further study or preliminary drafting. Four such technical committees were established in advance, two of which would address questions on CBW. The Military, Naval and Air Technical Committee, chaired by General Kazimierz Sosnkowski (Poland), examined matters connected with armaments and met nineteen times. The Legal Committee, chaired by Ambassador Petresco Comnène (Romania), considered legal questions and held seventeen sessions. At the outset, the General Committee also established some other subsidiary committees, but they have no bearing on the present discussion.[58] Appendix 1 offers a chronological overview of the various committees' discussions leading to the Geneva Protocol.

3.6.1. The US and Polish proposals concerning chemical and bacteriological weapons

In his opening statement during the second plenary meeting on 5 May, Theodore Burton announced that he would introduce 'certain constructive modifications and suggestions' at the appropriate moment, including an important one concerning 'additional measures to deal with the traffic in poisonous gases, with the hope of reducing the barbarity of modern warfare'.[59] The suitable setting was the General Committee, which, two days later, began

the first reading of the draft convention. Burton intervened before the delegates began reviewing draft Article I and expressed 'the very earnest desire of the Government and people of the United States that some provision be inserted in this Convention relating to the use of asphyxiating, poisonous, and deleterious gases'. Reinforcing the importance of this topic to his country, he added: 'This subject has been brought to the attention of our Chief Executive (President Coolidge) and prohibition of the exportation of these gases would meet with his express approval'. He then referred to the convention prohibiting the use of asphyxiating gases in warfare adopted by the Washington Naval Conference in 1922 and reminded the delegates that the agreement required the contracting powers to seek adherence by other states to the convention.

Before reading out the first version of the US draft proposal, he listed two significant difficulties. As the conference sought to control the international arms trade, the deliberations centred on weapon technologies rather than the moral and humanitarian implications of their use in war. Seeking to prohibit the exportation of deleterious gases, he noted the need to trace 'the dividing-line between gases used in warfare and gases used for legitimate industrial purposes' and therefore proposed submission of the technical matter to the Military Committee. The second difficulty concerned the quality between CW-producing nations and the denial for non-producing countries to equip themselves with such weapons as a consequence of the proposed arms trade restrictions. A political committee, he suggested, should consider this principle of equality.

He then read aloud the first draft of the US proposal to be submitted to the Military Committee:

> *The use in war of asphyxiating, poisonous or other gases and all analogous liquids, materials or devices has been justly condemned by the general opinion of the civilised world, and a prohibition of such use has been declared in treaties to which a majority of the civilised Powers are parties. The High Contracting Parties therefore agree absolutely to prohibit the export from their territories of any such asphyxiating, poisonous or other gases, and all analogous liquids, intended or designed for use in connection with operations of war*.[60]

Several countries endorsed and commented on the US initiative. General Kazimierz Sosnkowski (Poland) immediately proposed to add bacteriological

warfare, insisting that 'such action [is] absolutely indispensable in order to render war less terrible by prohibiting barbarous weapons the use of which is a disgrace to our civilisation'.

Associating himself with the US initiative, Joseph Paul-Boncour (France) commented that the Military Committee would have to 'define, if possible, the characteristics of gases and chemicals which cannot be utilised in war, or of those which can be utilised both for warlike and non-warlike purposes'. Rear-Admiral Augusto Carlos de Souza e Silva (Brazil) noted that to ensure the equality between producing and non-producing countries from the perspective of national security, 'the Convention on the control of the International Trade in Arms, Munitions and Implements of War must be supplemented by a Convention on the private manufacture of arms. If therefore we adopt the American proposals, it will be in the hope that the draft Convention will provide guarantees that there will be no inequality between the various countries as regards the employment of poison gases.' He proposed to submit the question to the Legal Committee.

A second substantive comment came from Hungary. Dr Zoltán Baranyai highlighted the importance of protection against asphyxiating gases and therefore advanced that means of defence against chemical warfare be excluded from the export prohibition. He was sensitive to the issue because, like Germany under Article 171 of the Versailles Treaty, Article 119 of the Treaty of Trianon forbade Hungary the possession, manufacture and importation of chemical weapons.[61]

By the next morning, the United States, Poland and Hungary had formally submitted their proposals. Burton introduced two alternatives. The first corresponded to the text he had read out the day before. The second one avoided references to other treaties and called for the exportation prohibition and adequate penalties to apply in all territories under a state's jurisdiction or control:

> *To the end of lessening the horrors of war and of ameliorating the sufferings of humanity incident thereto, the High Contracting Parties agree to control the traffic in poisonous gases by prohibiting the exportation of all asphyxiating, toxic or deleterious gases and all analogous liquids, materials and devices manufactured and intended for use in warfare under adequate penalties, applicable in all places where such High Contracting Parties exercise jurisdiction or control.*[62]

Poland, contending that 'the materials used for bacteriological warfare constitute an arm that is discreditable to modern civilisation', requested that 'any decisions taken by the Conference concerning the materials used for chemical warfare should apply equally to the materials employed for bacteriological warfare'.[63] Hungary, finally, requested to insert the following phrase at the end of the US amendment: '... it being understood that such import and export prohibition shall not apply to methods of defence against asphyxiating, poisonous, or other similar gases employed as a means of warfare'.[64]

The meeting then adopted the President's proposal to refer the texts to the Military and Legal Committees. It also accepted his suggestion that the Legal Committee start first because it did not yet have any work in hand.

3.6.2. Legal uncertainties

The Legal Committee formed a three-person sub-committee to study the CBW proposals on 11 May.[65] It reported back eight days later. Its members were unable to recommend a unified course of action. They proposed two alternatives. The first option would be to insert a special provision prohibiting the exportation of poisonous gases in the Arms Traffic Convention. The second one would be to abandon the drafting of an article. Instead, a provision under which the contracting parties undertake to prohibit the use of asphyxiating, poisonous and other deleterious gases could be inserted or annexed to the Final Act.[66]

A significant challenge had emerged during the deliberations. From a legal viewpoint, it did not seem possible to conclude that international law prohibited the use of toxic agents in war. Dr Titus Komarnicki (Poland) noted that the Washington Treaty banning asphyxiating gases amounted to a moral condemnation and attempted to embody the prohibition in international law. Baranyai (Hungary) accepted that the agreement had not yet entered into force but countered that all parties to the Treaty of Versailles 'were expressly prohibited from using such weapons' under Article 171. Allan W. Dulles contended that the US proposal was intended to remain within the limits of the draft Arms Traffic Convention because otherwise, delegates would be obliged to seek new instructions from their respective governments, thereby causing delays. As the United States had ratified the Washington Treaty, its position was clear.[67]

In the absence of a consensus view on the legal status of chemical warfare under international law, Mr Eduardo Cobian (Spain) reported the four main opinions back to the General Committee on 20 May with the request to either settle the matter directly or to communicate to the Legal Committee its decision on each one of the opinions with an indication how the Legal Committee should proceed. The options were:

(a) Prohibition by means of an Article in the Convention of the exportation of asphyxiating, poisonous or other similar gases, and all analogous liquids, materials or devices;

(b) A declaration, either in the Final Act or in a separate document, laying down that the use of the said gases in time of war is contrary to international law;

(c) A statement in a suitable Article of the Convention that the use of gases in war is prohibited by international law;

(d) To allow, in regard to the exportation of the means of defence referred to in the Hungarian amendment, an exception to be made to the conditions laid down in the Draft Convention.[68]

The Legal Committee would not again be involved in the consideration of CBW. Its report was significant for three reasons. First, the Legal Committee scrutinised the US proposal together with the Polish and Hungarian amendments in function of Article 3 of the draft Convention. This provision proposed authorising the High Contracting Parties to grant export licences for 'arms, munitions and implements of war' provided their 'use is not prohibited by international law'.[69] The unequivocal determination of whether CBW employment on the battlefield is illicit was, therefore, critical for integrating the US amendment into the Convention. The Legal Committee's hesitation implied that such a determination was wanting and a separate document or declaration might be necessary to prohibit their use expressly. Second, the technical committees were to advise the General Committee on an article-by-article basis. The preparation and transmittal of the report on the US proposal, separate from the article review, *de facto* implied that no universal legal norm against the use of asphyxiating gases in war was in force. Third, if the General Committee were to accept alternative (a), (b) or (c), the delegates could not avoid grappling with the dual-use nature of many toxic chemicals to prevent interference with their legitimate international trade.

3.6.3. Separation of chemical and bacteriological warfare from the main convention

As it turned out, the General Committee forwarded the options to the Military Committee with the specific request to examine suggestions (a) and (d), which took it up in its 15th meeting on 26 May. General Sosnkowski chaired the Military Committee. Hence, he could not advocate Poland's interests. Dr Komarnicki performed this function. Still, when presenting the General Committee's request, he noted that both options 'corresponded to the proposal of the United States of America and to the supplementary proposals of the delegations of Hungary and Poland,' even as the text did not refer to bacteriological weapons. He furthermore remarked that alternatives (b) and (c) deviated from the Military Committee's terms of reference, an opinion the United States shared.[70]

The delegates came straight to the point. They were virtually unanimous in their opinion that a ban on the trade in toxic chemicals had little to no value without an overall prohibition on chemical warfare. The greatest support for the US proposal came from countries that had signed the 1922 Washington Convention Relating to the Use of Submarines and Noxious Gases in Warfare and, perhaps surprisingly, Germany (which was bound by the CW prohibition in the Versailles Treaty). In 1925, the Washington Convention had not entered into force, nor had it been opened for signature to other states. Smaller powers, therefore, tended to distinguish between refraining from CW use in war and disarmament, implying non-production of CW. Having a Great Power not taking up the disarmament commitment signified that smaller countries would have to find means to manufacture poison gas for themselves if the US-proposed trade restrictions were to be adopted.[71]

General de Marinis, whose country, Italy, had signed the Washington Convention, discerned a hierarchy of importance between, on the one hand, the prohibition of gas and chemical warfare and, on the other hand, the prohibition of international trade in gas. Without the former, the gas-producing powers would gain a disproportionate advantage to the detriment of the non-manufacturing countries. He added that 'international law contained no provision prohibiting the use of gas by countries' and continued that 'to prevent trade in gas, it would be necessary for all States to undertake not to have recourse to chemical warfare'. He concluded that 'the prohibition of the traffic in toxic products was in reality of far less importance than the wider undertaking

— above all, from a practical point of view'. He was uncertain whether the Arms Traffic Conference could insert such a ban in the draft convention but noted that the Legal Committee left the option open.[72]

De Marinis's intervention shaped the subsequent discussion and prompted Komarnicki to propose a resolution for inclusion in the Final Act of the Conference:

> *That all delegates should request their respective Governments to grant to the delegates at the forthcoming Conference on the Manufacture of Arms and Implements of War the necessary plenary powers authorising them to take in the name of their Governments engagements tending to the absolute prohibition of the use of toxic gases and methods of bacteriological warfare.*
>
> *Furthermore, the Conference requests the League of Nations to place on the agenda of the forthcoming Conference on the Manufacture of Arms and Implements of War the question of the prohibition of chemical and bacteriological warfare.*[73]

In other words, Poland suggested moving the framing of an absolute prohibition on chemical and bacteriological warfare to an upcoming conference at the heart of the League's arms reduction mission. The delegates voiced their support for the idea.

The next morning, it was clear that the debate had taken a decisive turn. Delegates now had two draft resolutions in front of them. Great Britain and Italy had introduced a second text. In its essence, it corresponded with the Polish submission but recommended the convening of a special conference rather than transferring the question to the Conference on the Manufacture of Arms and Implements of War. During the meeting, Ambassador Hugh S. Gibson presented a new version of the original US amendment:

> *The use in war of asphyxiating, poisonous or other gases, and all analogous liquids, materials or devices having been justly condemned by the general opinion of the civilised world, and a prohibition of such use having been declared in treaties to which a majority of the civilised Powers are parties:*
>
> *The signatory Powers, to the end that this prohibition shall be universally*

> *accepted as a part of international law binding alike the conscience and practice of nations, declare their assent to such prohibition, agree to be bound thereby as between themselves, and further agree to prohibit the exportation and importation of all such asphyxiating, poisonous or other gases.*[74]

He acknowledged that certain parts fell outside the Military Committee's competence but thought that the General Committee could benefit from the body's insights.

Two new issues came to the fore: the adherence of all gas producers to a convention prohibiting chemical warfare and whether the current or a future conference should negotiate the agreement. As had been the case in many League meetings since its inception in 1920, Russia's position outside of the association drove the security preoccupations of many Nordic and East European members. While Germany was constrained by the CW clauses in the Versailles Treaty and was participating in the Arms Traffic Conference, and the other Great Powers had signed the Washington Convention on asphyxiating gases, Russia was not party to these arrangements. Ahead of the conference, Moscow had expressed reservations about restricting the arms trade and, in de Marinis's words, 'it would certainly make reserves concerning the use of toxic gases'. Russia's absence might impede the Arms Traffic Conference from concluding a convention. De Marinis also posited that the likelihood of Russia joining the Conference on the Manufacture of Arms and Implements of War, which Poland had suggested as the negotiation forum, was highly unlikely. Hence, he supported the Anglo-Italian call for a special conference, which Russia might be persuaded to join.

Switzerland challenged that the Polish and Anglo-Italian draft resolutions precluded any immediate progress on the CW question. Admiral de Souza e Silva (Brazil) observed that the Military Committee had already arrived at two important conclusions, namely (1) export restrictions would place non-producing countries at an enormous disadvantage and (2) a powerful nation remaining outside of the convention would also put producing countries adhering to the restrictions in a position of dangerous inequality. Meanwhile, the technical committee had not yet begun considering solutions. The Admiral proposed some practical steps.

Poland associated itself with the Anglo-Italian draft resolution after both

countries had accepted to include bacteriological warfare in their text. De Marinis put forward a new comprehensive draft resolution that included the committee conclusions as framed by Brazil and the call for a special conference to prohibit chemical and bacteriological warfare. Gibson expressed disappointment about the lack of a recommendation based on the US draft but understood that several aspects of the proposal fell outside the technical committee's terms of reference. He reserved the right to return to the matter in the General Committee. Switzerland did likewise regarding its concern about the lack of immediate action. With the acceptance of some textual modifications to reflect a factual rather than a political reality, all delegations unanimously adopted the resolution text. Still, some countries preferred the US proposal, and some voiced their misgivings about the special conference's prospective element.

The day ended with the appointment of a drafting committee for the report to the General Committee. The Military Committee unanimously adopted the report on 27 May.[75] At this point, it was all but certain that the Conference would not address the matter of chemical and bacteriological warfare in the Arms Traffic Convention.

3.6.4. Arriving at an open protocol

The General Committee considered the various chemical and bacteriological warfare proposals at its seventeenth meeting on 5 June. Colonel E. Lohner (Switzerland) took the floor ahead of General de Marinis, rapporteur of the Military Committee, to clarify the purpose of a new proposal to the Conference for insertion in the Final Act. While following closely the text adopted in the Military Committee, he wanted the document to transmit a more positive message and indicate that the delegates were making a 'definite advance'. He thus sought to draw closer to the ambitions the US expressed in its original proposal. As he argued:

> *The only real difference between the text proposed by the Rapporteurs and the suggestion which we have the honour to submit to you consists in the fact that, while the general report contains a formula by which the States signing the Convention on the trade in arms merely express their intention to secure the inclusion, at a later date, of the principle of the prohibition of chemical and bacteriological warfare in international*

> *law, we are of opinion that the Conference can proceed further and recognise the existence even now of this prohibition (at least as regards the means employed in waging chemical warfare) as a binding stipulation of international law.*[76]

De Marinis responded by summarising the work and unanimously adopted conclusions of the Military Committee, emphasising the constraints placed on the technical committee's terms of reference. He listed the main security concerns that limitations on the export of poisonous chemicals entailed, including that they would not affect states with important chemical industries, increase the insecurities of nations with a small or non-existent chemical industrial base, and the fact that one major state was not participating in the conference.

The Swiss intervention provoked a host of reactions. While Japan was ready to accept the proposal that came out of the technical committee, its delegate preferred the Swiss proposal to first condemn the use of asphyxiating gases as a military device. Ambassador Burton spoke next. He appreciated the Swiss opinion that

> *every effort should be made to conclude as far as possible a universal Convention codifying the principles of international law and laying down definite rules as to its application. His proposal goes further than the others in that he maintains that the use of asphyxiating gas is now forbidden by international law and that that law should be re-affirmed and generally accepted.*[77]

He then expressed the sentiment that it may not be necessary to convene a special conference because, with representatives of more than forty states present, it should be possible to prepare a resolution based on the text of Article V of the Washington Convention Relating to the Use of Submarines and Noxious Gases in Warfare. He concluded that in so doing, the delegates would have taken 'a very definite step towards the universal prohibition of gas warfare'. The document would also remain open for other countries to add their signature. If the Arms Traffic Conference could not act, he announced that US President Calvin Coolidge was ready to summon a special conference to conclude such an agreement.

Almost all states that spoke aligned themselves with the Swiss and US

proposals. Norway expressed its long-held view that the League should not regulate means of warfare but aim to abolish war. The delegate did indicate that he would not oppose the work of the conference. France echoed the Norwegian sentiments, adding its longstanding demands for collective security and assurances that any country initiating war would face the united strength of the civilised nations.[78]

The session ended with adopting Burton's proposal and its referral to a drafting committee to finalise the text.

3.6.5. Finalisation of the protocol

The twentieth session of the General Committee on 8 June began with considering the draft protocol prepared by the drafting committee. A couple of states suggested some minor amendments to the text.

However, General Sosnkowski, who had introduced the initial proposal to add bacteriological warfare to the original US amendment, noted its omission in the draft protocol. He argued most forcefully to have it reinstated.

> *The bacteriological weapon has, so far as production is concerned, several advantages over the chemical one. It can be manufactured more easily, more cheaply and with absolute secrecy. Furthermore, the bacteriological weapon is, by its very nature, capable of extending itself without constant regulation of the factors of time and space by those who are using it. It is sufficient to set this weapon in motion on a very small scale for its results to become more and more terrible and widespread. Unlike poison gas, the action of which is generally of short duration and restricted to a limited area, cultures of microbes, if once secretly let loose in any place, may, thanks to their speedy multiplication and their ever-increasing virulence, easily occasion epidemics affecting great masses of men, animals and even plants.*
>
> *Among the most deadly weapons in warfare against the human race, I might quote: cholera, typhoid fever, plague, tetanus, glanders and botulism. So far as animals are concerned, they may be infected in large numbers, for instance, by cultures of the germ of glanders, cattle plague, etc. Bacteriological warfare can also be waged against the vegetable world, and not only may corn, fruit and vegetables suffer but also the cultivation of useful plants, that is to say, vineyards, orchards and fields.*

> *Again, and this should be particularly emphasised, it is impossible to limit the field of action of bacteriological factors once introduced into warlike operations. The consequences of bacteriological warfare will thus be felt equally by the armed forces of the belligerents and the whole civil population, even against the desire of the belligerents, who would be unable to restrict the action of the bacteriological weapons to an area decided upon beforehand.*
>
> *How can we refrain from thinking of the horrors of future wars, horrors which will perhaps threaten whole races with extermination! We must set ourselves against that, in the name of civilisation and of humanitarian sentiment.*[79]

He concluded by proposing to reinstate the reference to bacteriological methods of warfare.

US Ambassador Burton replied that

> *The subject of bacteriological warfare is not included in the instructions of the United States delegation. The scope of our authority, however, is so vast that it is possible for us to reach a decision on this amendment immediately. Bacteriological warfare is so revolting and so foul that it must meet with the condemnation of all civilised nations, and hence my delegation, so far as its action may be concerned, accepts this amendment proposed by the Polish delegate*.[80]

Following the adoption of the Polish amendment, the General Committee accepted the protocol, subject to some final modifications by the drafting committee. Two days later, it adopted the final text unanimously (Appendix 2).

On 17 June, the delegates signed the *Protocol for the Prohibition of the Use of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare* on behalf of their country.

3.7. Conclusion: The Legacy of the 1925 Geneva Protocol

Article 8 of the Covenant of the League of Nations placed armament reductions at the centre of the new international organisation's mission. Members were to reduce their military capacities to the lowest levels needed for national security. However, states retained their fear that one country could secretly build up its armed forces and launch an attack, to which the invaded nation

could not respond anymore. There was a need for security guarantees and mutual assistance to prevent such a situation from arising. However, countries' threat perceptions varied considerably, and governments were not ready to surrender their sovereign decision capacity to declare war to an international organisation.

The League made little progress in resolving these matters. Chemical warfare was initially not on its agenda, nor did the Great Powers display much interest in the issue. It gradually crept up in discussions because it was possible to raise all matters of security importance in the Assembly. During these exchanges, bacteriological warfare emerged as a separate security concern. Given that the Assembly represented all League members and each had one vote, the Temporary Mixed Commission, whose members sat in their own name rather than as a government representative, investigated topics further and reported back to both the Assembly and the Council. Through a mix of manoeuvres, the Temporary Mixed Commission and the Assembly were able to circulate a report drawing on the expertise of leading chemists and bacteriologists on possible scientific and technological developments contributing to future chemical and bacteriological warfare.

The story of the early development of the CBW norm might have ended then. In 1924, League members abolished the Temporary Mixed Commission, and attention shifted to negotiating an Arms Traffic Convention and another treaty seeking to limit armaments and weapon production. The United States, which did not ratify the Treaty of Versailles and thus not the Covenant, resisted participating in the League's activities. However, it changed its position and joined the preparations and negotiation of the Arms Traffic Convention. At the outset of the Conference in May 1925, it submitted a proposal to restrict the trade in toxic chemicals, noting the difficulties distinguishing between their use for peaceful and warlike purposes. Poland immediately submitted to address bacteriological weapons, too.

The gambit had several ramifications. First, as a technical question, it confronted the delegates with the dual-use characteristics of toxic chemicals, and they had no good tools to distinguish between legitimate and illegitimate purposes.

Second, given the dual-use dilemma, the delegates realised they could not interdict the trade in toxic gases without a universal prohibition on their use

in war. The United States had introduced its proposal as a country that had signed and ratified the Washington Convention outlawing chemical warfare. Yet, that treaty had not yet and would never enter into force. This fact implied that the delegates had to craft a universal prohibition as part of the Arms Traffic Treaty, as a resolution inserted in the Final Act, or as a separate document.

Third, the question of restricting the export of toxic gases became entangled with national security concerns. Non-producing countries would have no reply when facing a rival with a big chemical industrial base. Powerful nations abiding by the international norm could face an attacker not party to any CW restraints. This realisation reinforced the need for a global norm to which all states had to adhere. Moreover, it brought to the fore that only disarmament—a global ban on CW development and production—could eliminate the threat for everybody. The Arms Traffic Conference had no disarmament mandate. The topic would be taken up in the preparations for the future disarmament conference, which was already under consideration in 1925.

Fourth, as delegates did not want to defer the establishment of a global norm to an unspecified future conference, they decided on a separate protocol that would be open to all states to sign. With that decision, they laid the foundation for disarmament and resolution of the dual-use dilemma. Technical League committees would investigate the many technical questions raised during the Arms Traffic Conference, and they would eventually come up with the General Purpose Criterion to distinguish between legitimate and proscribed purposes for the utilisation of toxic substances. The General Purpose Criterion is at the heart of the definition of a biological weapon in the BTWC and a chemical weapon in the CWC.

Fifth, Poland made sure that bacteriological warfare remained on the agenda. Initially, the proposal represented a mere technical addition to the US amendment submitted at the start of the Arms Traffic Conference. It required little explanation, and nobody opposed it. However, the evolving nature of the debates changed the context of how delegates were framing the challenges posed by chemical and, therefore, bacteriological weapons. When a reference to bacterial warfare was once again dropped from consideration in the final stages, General Sosnkowski rose to make an impassioned plea to have the weapon category reinserted. Given that the emerging Geneva Protocol was to be a universal declaration of a norm, bacteriological weapons required

clarification in line with what the League had been developing for chemical weapons over the preceding years. The inclusion of bacteriological weapons laid the foundations for the BTWC five decades later.

Sixth, the Geneva Protocol, as an accepted universal norm against chemical and biological warfare, offered the legal foundation for the UN Secretary-General to investigate alleged CW use in the Iran-Iraq war in 1987. This event eventually led the UN General Assembly and Security Council to adopt resolutions establishing the UN Secretary-General's investigative mechanism.

And finally, the 1998 Rome Statute establishing the International Criminal Court drew on the language of the Geneva Protocol to define CW use as a war crime. (An amendment later added BW use to the list of war crimes, but the phrasing was more general.)

NOTES

1 *Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare. League of Nations 1925*. Proceedings of the Conference for the Supervision of the International Trade in Arms and Ammunition and in Implements of War. Held at Geneva, May 4th to June 17th, 1925. Document A.13.1925. IX, Pg 75-84.

2 International Committee of the Red Cross, *Geneva Protocol.* International Humanitarian Databases, https://ihl-databases.icrc.org/en/ihl-treaties/geneva-gas-prot-1925/state-parties?activeTab=#footnote-2. Accessed 17 February 2025.

3 *Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction,* opened for signature on 10 April 1972 and entered into force on 26 March 1975. UN Office for Disarmament Affairs. Biological Weapons. https://disarmament.unoda.org/biological-weapons. Accessed 17 February 2025.

4 *Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction*, opened for signature in Paris on 13 January 1993 and entered into force on 27 April 1997. Organisation for the Prohibition of Chemical Weapons. Chemical Weapons Convention. https://www.opcw.org/chemical-weapons-convention. Accessed on 17 February 2025.

5 Treaty of Versailles between the Allied and Associated Powers and Germany (Versailles Treaty), signed on 28 June 1919 and entered into force on 10 January 1920. The Covenant also made up Part 1 of the Treaty of Saint-Germain-en-Laye between the Allied and Associated Powers and Austria (signed on 10 September 1919 and entered into force on 16 July 1920), the Treaty of Neuilly-sur-Seine between the Allied and Associated Powers and Bulgaria (signed on 27 November 1919 and entered into force on 9 August 1920), the Treaty of Trianon between the Allied and Associated Powers and Hungary (signed on 4 June 1920 and entered into force on 16 July

1920), and the Treaty of Sèvres between the Allied Powers and the Ottoman Empire (signed on 10 August 1920), replaced by Treaty of Lausanne between the Allied Powers and Turkey (signed on 24 July 1923). The Treaty of Lausanne did not include the Covenant.

6 Martyn Housden. *The League of Nations and the Organisation of Peace*. Harlow: Pearson Education. 31 October 2011. ISBN 1408228246, and, 33 *Papers Relating to the Foreign Relations of the United States*, The Paris Peace Conference 1919, and, *Vo*lume XIII *The Covenant of the League of Nations* (Art. 1 to 26).

7 William S. Holt, *Playing Politics with the League*. In Ralph A. Stone (ed.), *Wilson and the League of Nations*. Huntington, New York, Robert E. Krieger Publishing CO.1 June 1978. Pg 27-35.

8 Ibid. Housden (2012), Pg. 13-14.

9 Ibid. Housden (2012), Pg 14, and, United Nations Office at Geneva, *Main Organs of the League of Nations*. https://www.ungeneva.org/en/about/league-of-nations/organs. Accessed 23 February 2025.

10 League of Nations Official Journal, Section: *League of Nations Records to the Assembly*. UN University, https://archive.unu.edu/hq/library/leag_nat.htm. Accessed 30 December 2024.

11 *Resolutions Concerning the Permanent Advisory Commission for Military, Naval and Air Questions, Adopted by the Council of the League of Nations.* American Journal of International Law. Volume 14 Issue 4. Supplement: Official Documents, 363-365.19 May 1920, and, Hans Aufricht, *Guide to League of Nations Publications*. Columbia University Press, New York. 1951. Pg. 291.

12 After its establishment within the Secretariat in 1921, the Disarmament Section also provided administrative support for the PAC. Haakon A. Ikonomou, *The Administrative Anatomy of Failure: The League of Nations Disarmament Section, 1919–1925.* Contemporary European History Volume 30 Issue 3. 1 August 2021. Pg. 7.

13 Andrew Webster, *"Absolutely Irresponsible Amateurs": The Temporary Mixed Commission on Armaments, 1921–1924*. Australian Journal of Politics and History. Volume 54 Issue 3. 28 August 2008. Pg. 374 and 387.

14 Versailles Treaty, *Part I: The Covenant of the League of Nations*. 1919.

15 Versailles Treaty, *Part I, Article 8*. 1921.

16 League of Nations. *Report of the Temporary Mixed Commission on Armaments*. A.81/C.321. 1921. Pg. 2.

17 Versailles Treaty, Part V: *Military, Naval and Air Clauses, Articles 171 and 172*. 1919.

18 Versailles Treaty, Part V. *Military, naval and air clauses, Section 1 Military clauses, Chapter II Armament, munitions and material.* 1919.

19 A Treaty Between the Same Powers, in Relation to the Use of Submarines and Noxious Gases in Warfare, signed at Washington on 6 February 1922 and never entered into force, Article V.

20 League of Nations, *Report of the Temporary Mixed Commission on Armaments. A.31/C.631, Annex V: Draft Convention for the Extension of the Washington Naval Treaty to the Non-Signatory Powers of the League of Nations*. 1922. Pg. 78-82.

21 League of Nations, R*eport of the Temporary Mixed Commission on Armaments*.1922. Pg. 20-21.

22 *Procès-verbal of the Eighth Session of the Council of the League of Nations*, San Sebastian. 30 July-5 August 1920. Pg. 135.
23 Procès-verbal of the Tenth Session of the Council, Brussels, 20-28 October1920, *Resolutions of the Permanent Advisory Commission for Military, Naval and Air Questions,* Resolution VIII, 1 Asphyxiating Gases, Pg. 105.
24 *Ibid.* Pg. 37.
25 *Ibid.* Pg. 37 and Pg. 105.
26 League of Nations . *The Records of the Second Assembly, Twenty-seventh Plenary Meeting, Annex A. Reduction of Armaments. Report of Committee No. 3 of the Assembly*, 1921. Pg. 654-655 and Pg. 657.
27 League of Nations. *The Records of the First Assembly, Meetings of the Committees, Sixth Committee, First meeting*. 18 November 1920. Pg. 249.
28 Warren G. Harding, *Opening Speech of the Conference on Limitation of Armament*, Miller Center, University of Virginia, 12 November 1921. http://millercenter.org/president/harding/speeches/opening-speech-of-the-conference-on-limitation-of-armament
29 Belgium, China, the Netherlands and Portugal joined the five core countries for the other issue areas.
30 Raymond Leslie Buell. *The Washington Conference.* New York: D. Appleton and Company. 1922. Pg 210.
31 US Senate. *Conference on the Limitation of Armament*. 67th Congress, 2nd Session. Washington, DC: Government Printing Office, 1922. Pg. 384-385.
32 *Ibid.* Pg. 386.
33 *Ibid*. Pg. 388. .
34 *Ibid*. Pg 815-817
35 *Convention for the Limitation of Armaments*, signed by Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua on 7 February 1923 and entered into force on 24 November 1924. American Journal of International Law. Volume17 Issue 2, Supplement: Official Documents. April 1923. Pg. 116.
36 US Department of State. *Report of the Delegates of the United States of America to the Fifth International Conference of American States*, Held at Santiago, Chile, March 25 to May 3, 1923. Washington, DC: Government Printing Office. Pg. 21.
37 *The Fifth Pan-American Congress*. Current History. Volume 18 Issue 2. May 1923. Pg. 188.
38 League of Nations, *Records of the Third Assembly*, 1922. Pg. 12-13.
39 *Ibid*. Pg. 28-29.
40 Giulio Douhet, *The Command of the Air*. Translated from Italian by Dino Ferrari (New York: Coward-McCann, 1942), reprinted in Project Warrior Studies, Office of Air Force History, Washington, DC, 1983, 58. 'Air Service plea fails to get funds', *New York Times,* 29 January 1921, Pg. 1.
41 League of Nations, *Records of the Second Assembly*, 1922. Pg. 648.
42 League of Nations, Records of the Third Assembly, Volume I, Annex 2 *Report of the Temporary Mixed Commission for the Reduction of Armaments, Special Questions, VI, Use of Toxic Gas in War*, 1922. Pg. 75-77.
43 *Ibid*. Pg. 76.

44 *Ibid. Reduction of Armaments: Report of Third Committee. Continuation of the Debate. Resolutions, Pg. 288.*

45 League of Nations . Records of the Fourth Assembly, Minutes of the Third Committee, Annex 10 (Part II): *Reduction of Armaments, Report of the Third Committee to the Fourth Assembly,* 1923. Pg. 216.

46 League of Nations. *Report of the Temporary Mixed Commission for the Reduction of Armaments. A.16.1924.IX* (30 July 1924), Pg. 25. League of Nations. *Disarmament, R187-8 Dossier 6055, Review of the consequences of toxic gases in war* (Correspondence with the experts), 1923, via UN Archives Geneva, https://archives.ungeneva.org/. ' *League asks facts on gas in warfare*', New York Times, 17 July 1923, Pg. 7.

47 League of Nations, *Report of the Temporary Mixed Commission*, 1924. Pg. 25-29.

48 *Ibid*. Pg. 29-30.

49 League of Nations, *Records of the Fifth Assembly, Text of the Debates. Twenty-Second Plenary Meeting* . 27 September 1924. Pg. 182-183.

50 *Email correspondence with Pierre-Étienne Bourneuf*, Scientific Advisor, UN Library and Archives, Geneva, 18 March 2025.

51 Société Des Nations.,*Procès-verbal de la trentième session du conseil, tenue à Genève du vendredi 29 août au vendredi 3 octobre 1924. Dix-septième séance, mardi 30 septembre 1924*. Journal Officiel . October 1924. Pg. 1363-1364.

52 *Convention for the Control of the Trade in Arms and Ammunition, and Protocol.* American Journal of International Law, Volume 15 Issue 4. October 1921. Supplement Official Documents, Pg. 297-313.

53 Constance Drexel (1933). *The Munitions Traffic*. The North American Review .Volume 236, Issue 1. July 1933. Pg. 66-68.

54 League of Nations , *Proceedings of the Conference*, 1925. Pg. 7.

55 League of Nations, Minutes of the Third Committee (Reduction of Armaments), *Annex 1. Report of the Temporary Mixed Commission for the Reduction of Armaments, I. Control of the International Trade in Arms, Munitions and Implements of War,* 1924. Pg. 98-101.

56 League of Nations, Proceedings of the Conference. *Document 3: Draft Convention for the Control of the International Traffic in Arms, Munitions and Implements of War, Submitted by Admiral the Marquis de Magaz to the Temporary Mixed Commission.* January 21st, 1924. C.758.M.258.1924.IX. (Geneva), Pg. 61.

57 League of Nations, *Minutes of the Third Committee, Annex 1, Appendix II: Letter from the Minister of the United States in Berne to the Secretary-General of the League of Nations*. Legation of the United States of America (Berne, February 2nd, 1924), Pg. 103.

58 League of Nations, *Proceedings of the Conference*, 1925. Pg. 9.

59 *Ibid*. Pg. 130.

60 *Ibid*. Pg. 155.

61 *Ibid*. Pg. 155-157.

62 *Ibid*. Pg. 161.

63 *Ibid*. Pg. 161.

64 *Ibid*. Pg. 161.

65 *Ibid*. Pg. 577.

66 *Ibid*. Pg. 597.
67 *Ibid*. Pg. 597.
68 *Ibid. Part III Annexes, Annex 10. Reports of the Legal Committee, I. Chemical Warfare,* Pg. 745.
69 *Ibid. Text of the Draft Convention Submitted to the Conference*, Article 3, Pg. 18.
70 *Ibid*. Pg. 528.
71 *Ibid*. Pg. 528-531.
72 *Ibid*. Pg. 531-532.
73 *Ibid*. Pg. 532.
74 *Ibid*. Pg. 536.
75 *Ibid*. Pg. 537-542 and 548.
76 *Ibid*. Pg. 307.
77 *Ibid*. Pg. 310.
78 *Ibid*. Pg. 312-315.
79 *Ibid*. Pg. 340.
80 *Ibid*. Pg. 341.

4

BTWC: The History of Early Negotiations

Dr. Anshu Joshi

4.1. Introduction

There was a prevailing belief that the menace of biological weapons had diminished with the advent of globalization, the rise of sophisticated technologies, and a neo-liberal movement that encouraged cooperative economic development among nations. In a landscape characterized by intricate interdependence and multilateral relations, the question arose: who would be inclined to engage in warfare against one another? Furthermore, even in scenarios where conflict might arise, the use of lethal biological weapons that could wreak havoc on both the aggressor and the target seemed implausible. However, the emergence of COVID-19 fundamentally altered this perspective and transformed the global landscape indefinitely. Regardless of the ongoing discourse surrounding whether the pandemic was the result of a deliberate biological attack, an accidental release, or a natural outbreak, it is evident that biological agents possess the potential to irrevocably reshape the world.

The historical context reveals that biological agents possess the capacity to dismantle the political, social, and economic structures of nations entirely. Once deployed, these agents become uncontrollable, rendering the extent of their destructive impact unpredictable and incalculable. Furthermore, their

clandestine application and prolonged effects enhance their potential for devastation. Biological weapons have consistently been regarded as 'unethical' tools employed by rogue states or organizations, leading to their rejection on international platforms due to their uncontrollable ability to wreak havoc. In light of these considerations, an international normative framework was established to create a robust defence against the production, stockpiling, use, and transfer of biological weapons.

Over the past five decades, the Biological Weapons Convention (BWC), formerly known as the Biological and Toxic Weapons Convention (BTWC), has endeavoured to establish a robust framework for the prevention of biological and toxic weapons. Although, various challenges and opportunities have emerged that warrant thorough discussion and effective resolution. However, despite these obstacles, the BWC presents a beacon of hope and potential advancements for the global community, aiming to foster comprehensive security measures against the threats posed by deadly biological agents.

The BWC remains into debate due to certain gaps concerning the dual-use dilemma and verification protocols. However, it is important to acknowledge that it still continues to serve as a significant platform for nations to denounce the use of biological weapons. The UN has consistently viewed the BWC as an effective normative framework aimed at curbing the proliferation and utilization of biological weapons. "The BWC effectively prohibits the development, production, acquisition, transfer, stockpiling and use of biological and toxin weapons. It was the first multilateral disarmament treaty banning an entire category of Weapons of Mass Destruction (WMD). It a key element in the international community's efforts to address WMD proliferation and it has established a strong norm against biological weapons. The Convention has reached almost universal membership with 184 States Parties and four Signatory States."[1]

This appears to be appropriate given the efficacy of the BWC in ensuring that member states recognize the importance of adhering to established norms regarding the development, production, or use of biological weapons. With key 10 articles, BWC puts a holistic ban on any kind of development, production, stockpiling, usage and transfer of biological weapons. It also asks the member countries to "consult bilaterally and multilaterally and cooperate in solving any problems which may arise in relation to the objective, or in the

application, of the BWC; and to request the United Nations Security Council to investigate alleged breaches of the BWC, and undertaking to cooperate in carrying out any investigation initiated by the Security Council."[2]

The BWC, which succeeded the earlier BTWC that came into effect on March 26, 1975, can be regarded as an advanced iteration of the Geneva Protocol. The Geneva Protocol primarily restricted the use of chemical and biological weapons but lacked comprehensive measures to prohibit the research, development, production, stockpiling, and transfer of such agents for malicious purposes. Consequently, the protocol fell short of offering a robust normative defence against biological weapons. Subsequently, the BTWC incorporated these essential provisions to address these gaps. It is certainly fascinating to journey through the annals of history to comprehend the evolution of BTWC throughout the years.

The Geneva Protocol was signed in Geneva in June 1925 and came into effect in February 1928. It marked a significant step towards a comprehensive prohibition of biological weapons by banning their use. Although, numerous States ratified the Protocol with certain reservations concerning its applicability and the potential use of chemical or biological weapons in acts of retaliation. These reservations effectively transformed the Geneva Protocol into a no-first-use agreement.[3]

The disarmament negotiations that took place initially included discussions on both biological and chemical weapons. However, these negotiations failed to produce meaningful outcomes for a considerable duration. It was not until the successful finalization of the Nuclear Non-Proliferation Treaty (NPT) negotiations in 1968 that a United Kingdom (UK) initiative was introduced, which helped to advance the previously stagnant discussions on the prohibition of chemical and biological weapons. Ultimately, the UK put forth a working document that proposed a differentiation between biological and chemical weapons, recommending an initial concentrated effort on addressing biological weapons.[4]

4.2. Negotiations after World War I

World War I observed an unparalleled deployment of toxic chemicals in combat, marked by the initial significant assault utilizing chemical weapons at Ieper, Belgium, on April 22, 1915. By the conclusion of the War,

approximately 124,200 tonnes of chlorine, mustard gas, and various other chemical agents had been unleashed, resulting in the agonizing deaths of over 90,000 soldiers due to their exposure. Additionally, nearly one million individuals emerged from the battlefields with blindness, disfigurement, or severe injuries.[5]

Following the extensive deployment of chemical weapons during World War I, and their devastating effect, it was collectively agreed upon to implement a prohibition on the use of chemical and toxic weapons. The nations engaged in negotiations that led to the establishment of the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, commonly known as the Geneva Protocol. Although it was a direct successor to the agreements made at the Peace Conferences, the Protocol emerged as a result of the conference focused on regulating international arms and ammunition trade, convened in Geneva under the League of Nations from May 4 to June 17, 1925.[6]

The Conference for the Reduction and Limitation of Armaments was convened by the League of Nations in 1932. The discussions during the Conference were grounded in Article 39 of the Draft Convention developed by the Preparatory Disarmament Commission, which stated that the High Contracting Parties undertake, subject to reciprocity, to abstain from the use in war of asphyxiating, poisonous or similar gases and of all analogous liquids, substances or processes. He also mentioned that they undertake unreservedly to abstain from the use of all bacterial methods of warfare. Notably, the stipulation regarding reciprocity was absent in the commitment concerning bacterial warfare methods. Ultimately, no legal agreement emerged from the negotiations, and the Conference remained inactive until its formal dissolution in 1937.[7]

It is important to highlight that the original proposal and its associated processes were primarily focused on the prohibition of toxic gases. However, at the suggestion of Poland, the proposal's scope was broadened to encompass a ban on biological warfare techniques as well. As a result, the Protocol created a link between chemical and biological weapons, designating both as forbidden methods of warfare.[8]

4.3. Negotiations after World War II

The aftermath of World War II was characterized by substantial initiatives in both declarations and institutional structures focused on the goal of achieving universal and total disarmament. Numerous proposed principles, frameworks, and draft treaties aimed to impose prohibitions on biological and chemical weapons. These efforts went further than the current limitations on the employment of such weapons in armed conflict, as stipulated by the Geneva Protocol, promoting instead the establishment of all-encompassing bans.

The endeavour to harmonize the differing drafts culminated in the Joint Statement of Agreed Principles for Disarmament Negotiations in September 1961, commonly referred to as the McCloy-Zorin Declaration, named after John McCloy, who served as President Kennedy's chief disarmament adviser and negotiator, and Valerian Zorin, the Soviet Union's Ambassador to the UN. Notably, paragraph 3(b) of the Joint Statement called for the elimination of all stockpiles of nuclear, chemical, bacteriological, and other weapons of mass destruction and cessation of the production of such weapons, a provision that was reiterated in a joint document presented in May 1962 by the Soviet and American delegations to the Conference of the Eighteen-Nation Committee on Disarmament.[9] Also, during the negotiations, the Soviet Union held the view that the most critical aspect of Resolution 1378 (XIV) was the section pertaining to general and complete disarmament, expressing confusion over the US' decision to exclude this element from its proposal. Furthermore, Mr. Zorin emphasized that the Soviet stance had been formally documented, asserting that all forms of weaponry should be eliminated, with the retention of specific types of armaments for military forces being justified solely for the purpose of maintaining internal security. He reiterated that this principle was considered a fundamental component of a comprehensive disarmament initiative.[10]

After this significant development, in the context of biological weapons, the UN was prompted to engage in discussions following several proposals presented to the General Assembly in 1966. This culminated in the adoption of a resolution that separated the issue of chemical and biological weapons from the broader agenda of general and complete disarmament. The resolution emphasized the necessity for all States to adhere strictly to the principles and objectives outlined in the Geneva Protocol, as reflected in General Assembly resolution 2162 B (XXI) dated 5 December 1966, along with the Secretary-

General's report titled "Chemical and Bacteriological (Biological) Weapons and the Effects of Their Possible Use".[11]

The BTWC was finally negotiated in Geneva, Switzerland, by the Eighteen Nation Committee on Disarmament (ENDC) and the Conference of the Committee on Disarmament (CCD) between 1969 and 1971. The interplay between two types of weapons of mass destruction emerged as a considerable hurdle in the negotiation efforts. It wasn't until the 1971 session of the Conference of the Committee on Disarmament, formerly recognized as the Eighteen-Nation Committee on Disarmament, that a significant consensus was achieved. This consensus suggested that it was possible to commence discussions on a draft convention aimed at biological and toxin weapons while concurrently advocating for robust measures to ban the development, production, and stockpiling of chemical weapons. On August 5, 1971, delegations from both the Soviet Union, accompanied by six allied nations, and the US submitted separate but identical drafts of the proposed convention. This draft received the endorsement of the General Assembly, which called upon the depositary governments to expedite the signing and ratification process as soon as possible. It received adoption from the United Nations General Assembly on December 16, 1971, as part of resolution 2826 (XXVI). This resolution was passed with unanimous support, receiving 110 votes in favour and one abstention. Following this, four additional delegations later communicated to the Secretariat their desire to have their votes officially recorded as supporting the draft resolution. The Convention was initially opened for signature on April 10, 1972, and it officially came into effect on March 26, 1975, following the ratification by twenty-two governments, which included those designated as the Convention's Depositaries, as stipulated in Article XIV (3).[12]

Article XIV of the BWC stipulates that the Convention will come into effect following the deposit of ratification instruments by twenty-two governments, which must include the governments acting as Depositaries of the Convention, namely the UK, the US, and that time's Soviet Union. The Convention came into force on 26 March 1975, following the deposit of the required ratification measures. During a signing ceremony held in Washington, D.C., on 22 January 1975, the US President Gerald Ford emphasized the importance of the occasion, stating that he was signing the ratification

instruments for two significant treaties aimed at limiting arms and mitigating the horrors of war. Subsequently, the Soviet Union ratified the Convention on 11 February 1975 in Moscow, while the UK completed its ratification on 2 March 1975 in London.[13]

On the day the BTWC officially took effect, at a ceremony in London, David Ennals, the Minister of State for Foreign and Commonwealth Affairs, highlighted the Convention's importance as the first post-World War II measure aimed at the destruction of existing biological weapons. He noted that biological warfare represented a particularly alarming form of conflict. With over 40 states now parties to the Convention, these nations had renounced this category of weapons and committed to preventing their future development through appropriate national actions. Ennals expressed that all governments for whom the BTWC entered into force should take pride in their contribution to reducing the likelihood of biological weapons being employed in future conflicts.[14]

Thus, to pursuing meaningful advancements toward comprehensive disarmament, which encompasses the prohibition and eradication of all forms of chemical, biological and toxic weapons, BTWC finally entered into force. It has been working to ban the development, production, and stockpiling of chemical and biological weapons, along with their elimination through robust measures, to aid in achieving general disarmament under stringent international oversight. Also, it has been unanimously recognized that the Geneva Protocol has played a vital role in development of BTWC and in alleviating the mayhems of chemical and biological weapons.

Reaffirming their commitment to the principles and goals outlined in BTWC, there has been a continuous call for all nations to adhere strictly to its tenets. In the pursuit of fostering trust among nations and enhancing the overall international climate, there is a shared aspiration to further the aims and principles of the UN Charter. Recognizing the pressing need to eliminate chemical or biological weapons, through effective measures, it is understood that adhering to the tenets of BTWC could serve as a foundational step toward establishing effective measures for banning the development, production, and stockpiling of chemical weapons, with a steadfast commitment to continue negotiations in this regard. The following are the articles of the Convention:

- ***Article I***

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

1. microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;
2. weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.

- ***Article II***

Each State Party to this Convention undertakes to destroy, or to divert to peaceful purposes, as soon as possible but not later than nine months after the entry into force of the Convention, all agents, toxins, weapons, equipment and means of delivery specified in Article I of the Convention, which are in its possession or under its jurisdiction or control. In implementing the provisions of this Article all necessary safety precautions shall be observed to protect populations and the environment.

- ***Article III***

Each State Party to this Convention undertakes not to transfer to any recipient whatsoever, directly or indirectly, and not in any way to assist, encourage, or induce any State, group of States or international organisations to manufacture or otherwise acquire any of the agents, toxins, weapons, equipment or means of delivery specified in Article I of the Convention.

- ***Article IV***

Each State Party to this Convention shall, in accordance with its constitutional processes, take any necessary measures to prohibit and prevent the development, production, stockpiling, acquisition or retention of the agents, toxins, weapons, equipment and means of delivery specified in Article I of the Convention, within the territory of such State, under its jurisdiction or under its control anywhere.

- ***Article V***

The States Parties to this Convention undertake to consult one another and to cooperate in solving any problems which may arise in relation to the objective of, or in the application of the provisions of, the Convention. Consultation and cooperation pursuant to this Article may also be undertaken through appropriate international procedures within the framework of the United Nations and in accordance with its Charter.

- ***Article VI***

1. Any State Party to this Convention which finds that any other State Party is acting in breach of obligations deriving from the provisions of the Convention may lodge a complaint with the Security Council of the United Nations. Such a complaint should include all possible evidence confirming its validity, as well as a request for its consideration by the Security Council.
2. Each State Party to this Convention undertakes to co-operate in carrying out any investigation which the Security Council may initiate, in accordance with the provisions of the Charter of the United Nations, on the basis of the complaint received by the Council. The Security Council shall inform the States Parties to the Convention of the results of the investigation.

- ***Article VII***

Each State Party to this Convention undertakes to provide or support assistance, in accordance with the United Nations Charter, to any Party to the Convention which so requests, if the Security Council decides that such Party has been exposed to danger a result of violation of the Convention.

- ***Article VIII***

Nothing in this Convention shall be interpreted as in any way limiting or detracting from the obligations assumed by any State under the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, signed at Geneva on 17 June 1925.

- ***Article IX***

Each State Party to this Convention affirms the recognised objective of effective prohibition of chemical weapons and, to this end, undertakes to continue negotiations in good faith with a view to reaching early agreement on effective measures for the prohibition of their development, production and stockpiling and for their destruction, and on appropriate measures concerning equipment and means of delivery specifically designed for the production or use of chemical agents for weapons purposes.

- ***Article X***

The State Parties to this Convention undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the use of bacteriological (biological) agents and toxins for peaceful purposes.

Parties to the Convention in a position to do so shall also co-operate in contributing individually or together with other States or international organisations to the further development and application of scientific discoveries in the field of bacteriology (biology) for the prevention of disease, or for other peaceful purposes.

This Convention shall be implemented in a manner designed to avoid hampering the economic or technological development of States Parties to the Convention or international co-operation in the field of peaceful bacteriological (biological) activities.[15]

Thus, apart from putting a stringent and absolute ban on development, production, acquisition, transfer, stockpiling and use of biological and toxin weapons, BTWC also made it sure that the member countries meet once in every five years to review the progress of BTWC, the upcoming challenges in the light of the new global and technological developments, and ways to address the same. The past review conferences have faced few basic hindrances related to the nature and usage of biological weapons. First and foremost, there is a big issue of dual use dilemma associated with biological weapons. The same agents that are used to produce medicines or cosmetics can be used as biological weapons. Botulinum toxin is a classic example here, usually used as 'Botox' for cosmetic treatments. However, it is one of the deadliest poisons in the world, and can create unbelievable destruction if used.[16] This provides a safe

escape to the country that want to develop biological weapons from the Convention, as it is almost impossible for the Convention to make out if the particular country is developing some medicines or biological weapons.

Due to this dual use dilemma, BTWC faced a big shortcoming it terms of verifying the purpose of research and development of any such biological agent by any member country. Then, the Convention covers 184 countries, however cannot include any terrorist organizations into the normative framework. Terrorism has expanded its feet across the globe in past few years with organized terrorist groups that possess sophisticated technologies, well-managed organizational structure and huge funds. Next-generation technological advancements have also added to the apprehensions of usage of biological agents by terrorist organisations for the obvious reasons. They are cheaper, deadlier and can be covertly used.

It is essential to recognize that, in addition to established norms and normative frameworks, both technology and civil defence play a significant role in creating a robust defence against biological weapons. However, it is equally important to acknowledge that these norms offer a multilateral platform for member states to collaborate and collectively pursue their objectives while advancing technological development and enhancing civil defence measures. The BTWC, which has since evolved into the CWC framework and the BWC, presents an opportunity for nations to unite in the critical endeavour of eradicating biological and chemical weapons globally.

After traveling an extensive journey characterized by negotiations and the subsequent division into CWC and BWC, the Convention currently finds itself at a critical crossroads, as the world grapples with a multitude of crises and challenges. The COVID-19 pandemic has revealed the vulnerabilities of even the most advanced nations, such as the US and Italy, in effectively managing large-scale biological threats. The various lethal waves of the epidemic have underscored the urgent necessity for a comprehensive global defence strategy against biological attacks. This strategy must encompass a robust normative framework, the advancement of innovative technologies, the research and production of broad-spectrum vaccines, the fortification of public and community health systems, and the promotion of general awareness to enable individuals to respond effectively to such threats at the grassroots level. Additionally, establishing a global mechanism for prompt communication

with relevant stakeholders during emergencies is essential. Achieving this level of preparedness will require significant funding and a foundation of mutual trust. The forthcoming review conferences of the BWC should address these critical issues to ensure its relevance and comprehensiveness. A thorough evaluation of the current situation, coupled with the formulation of a forward-looking roadmap, can enhance the BWC's significance, strength, and effectiveness.

NOTES

1 "*Biological Weapons Convention*", United Nations Office for Disarmament Affairs (UNODA), Date, https://www.un.org/disarmament/biological-weapons/

2 *Ibid.*

3 "*History of the Biological Weapons Convention*", United Nations Office for Disarmament Affairs (UNODA), https://disarmament.unoda.org/biological-weapons/about/history/

4 *Ibid.*

5 "*History*", Organisation for the Prohibition of Chemical Weapons Website, https://www.opcw.org/about-us/history

6 *Ibid*

7 Stockholm International Peace Research Institute, "*The Problem of Chemical and Biological Warfare*", CB Disarmament Negotiations 1920-1970, vol. IV, 1971, Pg.122-135, 9780391002036

8 Bureau of International Security and Non-proliferation, "*Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare (Geneva Protocol)*", US Department of State, June 17, 1925, https://2009-2017.state.gov/t/isn/4784.htm

9 Bakhtiyar Tuzmukhamedov, "*Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction*", United Nations (UN), 10 April 1972, https://legal.un.org/avl/ha/cpdpsbbtwd/cpdpsbbtwd.html

10 Office of the Historian, U.S. Department of State, "*Memorandum of Conversation, New York, September 14, 1961, 3 p.m., John J. McCloy and Valerian A. Zorin*," Foreign Relations of the United States, 1961–1963, Volumes VII, VIII, IX, Arms Control; National Security Policy; Foreign Economic Policy, Microfiche Supplement, Document 52, U.S. Department of State, September 14, 1961, https://history.state.gov/historicaldocuments/frus1961-63v07-09mSupp/d52

11 Bakhtiyar Tuzmukhamedov, "*Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction*", United Nations (UN), 10 April 1972, https://legal.un.org/avl/ha/cpdpsbbtwd/cpdpsbbtwd.html

12 *Ibid*

13 "*History of the Biological Weapons Convention*", United Nations Office for

Disarmament Affairs (UNODA), https://disarmament.unoda.org/biological-weapons/about/history/

14 *Ibid*

15 Office on Genocide Prevention and the Responsibility to Protect, "*The BTWC Charter*", The UN, 10 April 1972, https://www.un.org/en/genocideprevention/documents/atrocity-crimes/Doc.37_conv%20biological%20weapons.pdf

16 "*Botulism*", World Health Organisation (WHO), 25 September 2023 https://www.who.int/news-room/fact-sheets/detail/botulism

5

Countering the Continuing Danger from Toxin Weapons: A Role for the Biological and Toxin Weapons Convention and the Chemical Weapons Convention

Prof. Malcolm Dando, Dr. Alexander Kelle, and Dr. Michael Crowley

5.1. Introduction

The *Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction* (BTWC) is often known and referred to as the Biological Weapons Convention (BWC). This shorthand, and the related focus just on pathogens, can lead to a grave misunderstanding of the continuing importance of toxins as weapons. Article I of the Convention makes this clear by stating that:

> *'Each State Party to this Convention undertakes never in any circumstances to develop, produce, stockpile or otherwise or acquire 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.' (Emphasis added)*

When the Convention was negotiated in the 1970s the dangers from toxin

weapons were well understood. The 1997 United States *Textbook of Military Medicine* noted, for example, that during the 1960s Staphylococcal enterotoxin B (SEB):[1]

> *'...was especially attractive as a biological agent because much lower quantities were needed to produce the desired effect than were required with synthetic chemicals. The dose that is incapacitating for 50% of the human population exposed...was found to be 0.0004μg/kg, and the dose that is lethal for 50% of the human population exposed...was estimated to be approximately 0.02μg/kg, both by the inhalation route.'*

As we shall discuss later (in section 4) SEB functions by disrupting of the victim's immune system.

Moreover, experimental tests indicated just how large an area could be covered by the agent. One well-known example was described in the 1999 book titled *The Biology of Doom.* This example concerned a test carried out by the United States in the late 1960s when a F4 Phantom jet equipped with a special dissemination system sprayed the SEB agent along a line and the agent spread on the wind to affect monkeys across the test area. The report of the test stated:[2]

> *'The agent proved to be stable and did not deteriorate during storage, aerosolization, or downwind travel...'*

And the report concluded additionally that:

> *'...A single weapon was calculated to have covered 2400 square km, producing 30 percent casualties for a susceptible population under test conditions. No insurmountable problems were encountered in production-to-target sequence.'*

Significantly, the author of *The Biology of Doom* commented that '[T]wenty-four hundred square kilometers was equal to 926.5 square miles, an area roughly twice the size of metropolitan Los Angeles' at the time the book was written in 1999. The 1997 United States *Textbook of Military Medicine*[3] also had chapters on Ricin Toxin, Botulinum Toxins, Trichothecene Mycotoxins, and a final chapter 35 on 'Medical Challenges in Chemical and Biological Defense for the 21st Century' which had a short section on 'Bioengineered Toxin Production.'

5.2. What are Toxins

Scientists generally understand toxins to be defined as:[4]

(a) Any poisonous substance of plant or animal origin, and

(b) A microbial product which is poisonous to animals or plants...

And it is understood further that:

> *'...Toxins usually act at specific sites in the body [of the victim] (e.g., Neurotoxins affect nerves, enterotoxins affect the gut).'*

While accepting the complication caused by the definition of bioregulators in relation to the BTWC (see section 3 below), the important point here is that as toxins act at specific sites, they are likely to be active in very low concentration. For example, predators and prey may have engaged in many years of an arms race so that snake venoms can become very precise in targeting a particular receptor in the body of their victims and therefore extremely poisonous.

In its Chapter on 'Defense Against Toxin Weapons', the 1997 United States Textbook of Military Medicine noted that:[5]

> *'The most toxic biological materials known are protein toxins produced by bacteria.... Botulinum toxins...the staphylococcal enterotoxins, and tetanus toxin are well-known examples of bacterial toxins.... The botulinum toxins are so very toxic that lethal aerosol MCBW [Mass Casualty Biological Weapon] weapons could be produced with quantities of toxin that are relatively easily attainable with present technology...'*

Interestingly, in regard to current research and concerns, the chapter also notes that:

> *"A number of the toxins produced by marine organisms, or by bacteria that live in marine organisms, might be used in terrorist biological weapons (where less agent would be needed to achieve the desired effect) .... Saxitoxin, the best-known example of this group, is a potent neurotoxin found in shellfish such as mussels, clams, and scallops...."*

Saxitoxin functions through a quite different mechanism than SEB. The chapter notes that '[S]axitoxin is a sodium channel-blocking agent and is more toxic by inhalation than by other routes of exposure.' Two constant themes in toxin research, markedly in recent years, have been the search in ever more remote

locations (such as the deep sea) for new toxins with unusual properties, and the use of modern biotechnology techniques to elucidate their mechanisms of action in great detail. Such research has facilitated many benign results, for example, in the search for new drugs, but it could clearly also be misused.

5.3. The Question of Bioregulators

Early on in modern discussions of biological threats Kagan, in 2001, defined bioregulators as follows:[6]

> *'Bioregulators are naturally occurring organic compounds that regulate diverse cellular processes. Unlike traditional disease-causing biowarfare agents that take hours or days to act, many bioregulators act within minutes of administration...' (Emphasis added)*

And for the purposes of his paper, he noted that:

> *'...The main groups of bioregulators discussed are cytokines; eicosanoids, neurotransmitters, hormones, and proteolytic enzymes. Because advances continually are being made in their development, bioregulators should be considered as weapons with increasing bioterrorism potential.'*

So bioregulators are clearly not living organisms, but are they toxins that come within the scope of the BTWC? The 2004 World Health Organisation Second Edition of *Public Health Response to Biological and Toxin Weapons* answered this question in the following way:[7]

> *'In the sense of the Biological and Toxin Weapons Convention, "toxin" includes substances to which scientists would not normally apply the term. For example, there are chemicals that occur naturally in the human body that would have toxic effects if administered in large enough quantity. Where a scientist might see a bioregulator, say, the treaty would see a poisonous substance produced by a living organism, in other words a toxin...'*

And to reinforce this point it argued that:

> *'...nor is this unreasonable. Wasp venom, for example, is clearly a toxin, yet its active principle is histamine, which is also a human bioregulator. Although histamine might not itself be made into an effective weapon, the same cannot necessarily be said for other bioregulators.'*

On these grounds, many lists of potential biological agents contain numerous examples of bioregulators that might be subject to hostile misuse.[8] However, there has not to date been a formal agreement of this point amongst States Parties to the BTWC.

5.4. The Evolution of Toxin Research: Defence or Offense

A recent review of modern research on toxins suggested that it had gone through an evolution in four stages.[9] From the 1930s to the 1980s work moved from just identifying the organs targeted by toxins to identifying targets of toxicity at an increasingly finer level of cellular organisation (Stage 1). Then beginning in the 1980s the availability of techniques to study gene expression allowed the cloning and characterisation of genes associated with cellular protection and biotransformation of xenobiotics [chemicals from a different species, for example a predator] in Stage 2. Progressively in the 1990s more advanced gene expression techniques allowed more comprehensive study of the effect of a toxicant on the transcriptional regulation of multiple gene targets [how the toxic chemical affected the operation of the genes of the target organism] and the availability of various transgenic and gene knockout mice enabled the study of the functions of specific genes in mediating cellular toxicity and metabolism (Stage 3). Then by the start of this century understanding the role of epigenetic changes [alterations in gene expression or function rather than in the genetic code] in mediating toxicity, the data explosion and the development of genome editing tools has further transformed the capabilities of toxicologists (Stage 4).

In that context it is not surprising that an official contribution by the United Kingdom to the review of science and technology for the 1996 Fourth Review Conference of the BTWC noted that:[10]

> *'Much more is now known about the structure-function relationship of various toxin groups. The combination of electrochemical and other biophysical techniques with molecular biology approaches is expected to lead to the resolution of the molecular mechanisms of cell penetration by protein toxins...'*

Thus, the text continued:

> *'...There is now a substantial amount of research on hybrids of toxins*

> *and toxin subunits with antibodies and viruses, often with the long-term objective of specifically destroying diseased cells such as cancer cells. In this type of therapy an antibody-toxin complex would be injected into the blood stream; the antibodies attach to receptors on the target cells which are subsequently eliminated by the action of the toxin, while healthy cells elsewhere in the body are unaffected.'*

It should also be understood that this was before the massive impact of the information technology revolution on biology and the growing availability of massive searchable database of toxicological information.[11]

So today it is clear that Botulinum neurotoxins (BoNTs) are the most lethal substance known. There were thought to be seven serotypes that all function by inhibiting the release of the neurotransmitter acetylcholine at neuromuscular junctions and thereby creating relaxation and paralysis of our muscles which in can result in death. Very intensive study has elucidated the details of the mechanism that brings this about. However, as a 2018 review pointed out:[12]

> *'... BoNT classification remained stagnant for the last 50 years until, via bioinformatics and high-throughput sequencing techniques, dozens of BoNT variants, novel serotypes as well as BoNT-like toxins ... have been discovered....'*

Moreover, as BoNTs are proteins which can easily now be subject to bioengineered alterations, the authors noted:

> *'...studies show how a few substitutions in amino acid sequence can functionally affect BoNTs biological activities, and how versatile BoNTs are to generate novel toxins with new and improved pharmacological features...'*

Little wonder then that the authors describe work on BoTNs as a 'blooming field' of research with many new avenues to be explored.

The mechanism of action of many other toxins have also been investigated in detail. For example, a recent update on *Staphylococcus aureus* toxins summarised how its superantigens (SAgns) work. Normally our bodies have antigen-presenting cells (APCs) of the immune system that ingest foreign antigens and display them on their surface so that the immune system's T-cells

are subsequently able to identify these particular foreign antigens using highly variable regions of the T-cell receptor (TCR) and then deal with the foreign material. However, superantigens (SAgns) can directly link to TCRs and thus trigger T-cell activation and proliferation without any antigen processing. This then;[13]

> *'...causes pro-inflammatory cytokines...to become overactive and release a multitude of side effects and symptoms, including the possibility of multi-system organ failure that...'*

Indeed, it is now possible to produce a classification of the range of different mechanisms found in natural toxins.[14]

Bacteriological toxins have been extensively investigated both in order to deal with the diseases they cause,[15] but also because they have provided many tools for research[16] due to their specificity. Similarly, known animal toxins have proved to be very useful in drug discovery research.[17] However, there are clearly many animal toxins that are yet to be discovered let alone characterised. Indeed, it has been argued that most animal toxicology has previously been focused on snakes, scorpions and spiders, but this concentration:[18]

> *'...will lessen in the near future and the "new" venoms and toxins will prevail, due to subject saturation. Research of unexplored—or neglected—species of animals and their venoms and secretions should become dominant, since they contain a myriad of molecules displaying relevant biological effects on human illnesses, diseases, degenerative disorders, injuries, pain, tumors and infections (viral, bacterial and fungal), either as medicines or diagnostics tools.'*

The authors of this paper then reviewed the possible toxins that could be available from lizards, amphibians, marine animals in general, sea urchins, molluscs, sting rays, and sea anemones. They point out that '[M]ore than 480,000 species of marine animals have been discovered and identified,' and that there have been estimates to suggest that there could be 700,000 marine species. Little wonder then that there are intensive efforts to investigate the toxins produced by these species for benign reasons.

A considerable amount of research around the world has produced our current understanding of toxins and their mechanisms of action. For example, in 2023 a summary of 50 years of animal toxin research by Russian scientists

at the Shemyakin-Ovchinnikov Institute of Bioorganic Chemistry in Moscow was published in the *International Journal of Molecular Sciences*.[19] The article had four major sections in addition to the introduction and conclusion. These sections covered Structural Studies of Animal Toxins, Three-Finger Proteins from Snake Venoms in Research on nAchRs [an acetyl choline receptor type], Other Snake Venom Toxins, and Marine Toxins Acting on Ligand- or Voltage-Gated Ion Channels. The authors concluded that:

> *'...Briefly summarized in this review is the work on animal toxins carried out at our institute in earlier years; in more detail, we present the recent achievements. The reviewed publications illustrate a very long journey from the first primary structures to the present-day role of peptide and protein neurotoxins in research on nAChRs and on different types of ion channels. Apart from neurotoxins, diverse toxins acting on various biological targets have been studied as well...'*

And they continued:

> *'...We also hope that the ongoing research is presented in sufficient detail. It should be emphasized that many excellent labs in the world were and are working on protein and peptide neurotoxins, and the fruitful collaboration of IBCh [Institute of Bioorganic Chemistry] with them is mentioned in the text and is reflected in the author names in the References.'*

Nevertheless, some research on toxins can raise dual-use concerns (see Section 3). Certainly, in late 2024 the United States sanctioned the Federal State Budgetary Institution of Science Institute of Bioorganic Chemistry named after Academicians M.M. Shemyakin and Yu.A. Ovchinnikov, Russian Academy of Sciences, stating that it was amongst a group of Russian entities that:[20]

> *'... have engaged in research, production, and/or attempted procurement of materials in support of Russia's chemical and biological warfare (CBW) program. These activities are contrary to U.S. national security and foreign policy interests....'*

Unfortunately, the problems of potential dual-use applications are pervasive in toxin research. Moreover, it is not difficult to find work carried out by

militarily-related organisations on diverse toxins and bioregulators that could be a cause of concern in other countries. For example, a detailed 2022 review noted that there were activities that could raise such concerns in all six countries investigated.[21]

5.5. Addressing Toxins under the Chemical Weapons Convention and the United Nations Secretary General's Mechanism for Investigating CBW Use

The Chemical Weapons Convention in Article II defines toxic chemicals as:

> '*Any chemical which through its chemical action on life processes can cause death, temporary incapacitation or permanent harm to humans or animals. This includes all such chemicals, regardless of their origin or of their method of production, and regardless of whether they are produced in facilities, in munitions or elsewhere*.'[22]

As biological toxins are toxic chemicals produced by living organisms (or their synthetic analogues), they clearly are covered by the CWC. For verification purposes, Schedule 1 of the CWC Annex on Chemicals specifically mentions two toxins, saxitoxin and ricin.[23] This notwithstanding, the provisions contained in the CWC, including the general purpose criterion in its Article II apply to all toxins.

As saxitoxin and ricin are specifically mentioned on Schedule 1, the customary 30-day notification period applies before a transfer between two States Parties can take place. In case of saxitoxin, which is the source of paralytic shellfish poisoning (PSP), it became clear shortly after the CWC had entered into force that this provision was at odds with the public health needs of states in which an outbreak of PSP was suspected. The OPCW in1999 therefore decided to exempt the transfer of small quantities of saxitoxin for diagnostic purposes with a change to Part VI of the CWC's Verification Annex.[24] Similarly, ricin production plants were exempted from the declaration requirements of Schedule 1 production facilities.[25]

Apart from such "teething problems" in the early stages of CWC implementation, priority during the first two decades of the operation on the Convention was obviously given to the elimination of the huge stocks of declared CW stockpiles, and the problem of natural toxins was given much

less attention. Given the focus of the BTWC on pathogens, some observers argued that rather than there being a double coverage of natural toxins there was in fact a gap in the coverage of these dangerous potential agents.[26]

More recently, the recognition of the dangers of misuse of toxins was amply illustrated by the creation of a Temporary Working Group (TWG) on Biotoxins of the Science Advisory Board (SAB) of the Chemical Weapons Convention in 2023.[27] The report's authors define the relevance of toxins:

> *'…in investigations of alleged use, based on a series of criteria … Among the criteria are historical use, availability, toxicity/activity, and stability. The list contains nine biotoxins or biotoxin families deemed most relevant, with a wide range of toxicological effects, and includes both LMW [Low Molecular Weight] and HMW [High Molecular Weight] biotoxins.' (Emphasis added).*

The report concluded that:

> *'Based on the factors outlined by the TWG, the OPCW's efforts to develop its capabilities for investigation of alleged biotoxin use should focus on the nine 'most relevant' biotoxins listed below. Recognising that seven of these nine biotoxins are not listed on Schedule 1 in the Annex on Chemicals to the Convention, the OPCW should plan to draw on sophisticated biotoxin analysis capabilities that may exist in other fields. The 'most relevant' biotoxins are:*
>
> *(a) abrin;*
> *(b) aflatoxins;*
> *(c) botulinum toxins;*
> *(d) epsilon toxin;*
> *(e) ricin;*
> *(f) saxitoxin;*
> *(g) Staphylococcus aureus enterotoxins;*
> *(h) T-2 toxin; and*
> *(i) tetrodotoxin.'*

So, while today the resources and expertise of the OPCW are not adequate to deal with an investigation of the possible use of even the most relevant toxins, the problem has been identified and remedial action has been initiated. In

addition to developing the in-house expertise for biotoxins, this includes potential collaboration with the UN Secretary General's Mechanism (UNSGM) for Investigating Alleged Use of CBW.[28]

The UNSGM was established by a UN General Assembly Resolution in 1987. Under the mechanism, the UN compiles and maintains lists of qualified experts, expert consultants and analytical laboratories nominated by Member States. As of July 2024, over 630 qualified experts and more than 90 analytical laboratories were nominated by member states.[29] Based on technical investigation guidelines and procedures that were updated in 2007, the last decade has witnessed different attempts to ensure that experts are well trained and the laboratory component of the mechanism can provide reliable analytical results. With respect to the latter, a 2015 workshop report notes that under the UNSGM:

> *'…investigations cannot afford to report false positive or negative results. For this type of investigation quality assurance and validation of methods and procedures is of utmost importance. Furthermore, laboratories must adhere to rigid administrative and reporting requirements, and demonstrate a strict chain-of-custody of samples.*'[30]

The report further states that:

> *'A peer-to-peer network of designated laboratories carrying out confidence-building exercises would enhance mutual trust in the validity, accuracy and traceability of reported results.*'[31]

The most recent, ninth report of the series of workshops on UNSGM Designated Laboratories notes 'an impressive set of recent activities and developments' including related to the 'analysis of toxins.'[32] In this context, the report notes the efforts to harmonize the approach for toxin analysis and reporting by UNSGM designated laboratories, and provides an overview of recent and planned OPCW activities in this area following the above-mentioned 2023 TWG report on biotoxins.[33]

5.6. Conclusion: Towards a Concerted Effort to Address the Potential Misuse of Toxins

The review of recent engagement in the context of CWC and UNSGM with the problem of toxin misuse clearly shows an increased awareness and efforts

to address deficiencies in investigating potential toxin use scenarios. Judging by the final document of the most recent BTWC Review Conference in late 2022, no comparable awareness is visible in this context. The document contains 16 references to 'Toxin Weapons', all of which are verbatim quotes from the treaty's full title in various documents referenced, and none of which have any substantive connotations.[34] Similarly, the working paper on the 'Draft Terms of Reference and Rules of Procedure toward the Development of a BWC Science and Technology Advisory Proces' contains only a single 'Toxin'-reference, which is in the header of the document's front page.[35] While it could be argued that the generic references to science and technology of relevance to the Convention include both biological pathogens and toxins, the failure of this document to explicitly mention of toxins, to us indicates a continued prioritization of the former over the latter. Explicitly including toxins in the context of the mandate of a future S&T advisory process could therefore serve as a first step in acknowledging the toxin-dimension of the BTWC, and thus provide the basis for a more constructive engagement of BTWC States Parties with ongoing developments in the CWC and UNSGM context.

NOTES

1 Ulrich, R. G. *et al Staphylococcal Enterotoxin B and Related Pyrogenic Toxins* Chapter 31 in Sidell, F. R. *et al* (Eds) Medical Aspects of Chemical and Biological Warfare. Washington, D. C.: Borden Institute 1997. pp 621 – 630.

2 Regis, E. *The Biology of Doom: The History of America's Secret Germ Warfare Project*. Henry Holt and Company: New York. 1993, pp. 205 – 206.

3 Sidell, F. R. *et al* (Eds) *Medical Aspects of Chemical and Biological Warfare*. Washington, D.C.: Borden Institute 1997.

4 Allaby, M. (Ed.) *Oxford Dictionary of Zoology*. 4th Edition. Oxford: Oxford University Press 1991. p. 631.

5 Franz, D. R. Defense Against Toxin Weapons Chapter 30 in in Sidell, F. R. *et al* (Eds) Medical Aspects of Chemical and Biological Warfare. Washington, D. C.: Borden Institute 1997. pp 603 – 619.

6 Kagan, E. *Bioregulators as instruments of terror.* Clin Lab Med, **21**(3) 607 – 18, 2001.

7 World Health Organisation *Public Health Response to Biological and Chemical Weapons*. 2ND edition, Geneva: World Health Organisation, 2004, p.216.

8 See, for example, A. Kelle, *et al* Table 3.1 of Chapter 3 *Threats to the CBW Prohibition Regimes: The Revolution in the Life Sciences in Preventing a Biochemical Arms Race.* Stanford: Stanford University Press, 2012, p.57.

9 Supratim Choudhuri, *et al From Classical Toxicology to Tox21: Some Critical Conceptual and Technological Advances in the Molecular Understanding of the Toxic Response Beginning from the Last Quarter of the 20th Century.* Toxicological Sciences, **161**(1), 5 – 22. 2018, p. 5.

10 Secretariat *Background Paper on New Scientific and Technological Developments Relevant to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction*. BWC/CONF.IV/4*, United Nations, Geneva. 30 October, 1996. https://docs-library.unoda.org/Biological_Weapons_Convention_-_Fourth_Review_ Conference_(1996)/BWC_CONF.IV_04.pdf. p.11.

11 See, for example, Giulia Zancolli, *et al Web of venom: exploration of big data resource in animal toxin research*. GigaScience, **13**, 1 – 14, 2024.

12 Domenico Azarnia Tehran and Marco Pirazzini, *Novel Botulinum Neurotoxins: Exploring Underneath the Iceberg Tip*. Toxins, **10**, 190, 2018. pp.1, 9, 10.

13 N. Ahmad-Mansour *et al, Staphylococcus aureus Toxins: An Update on their Pathogenic Properties and Potential Treatments*. Toxins, **13**, 677, 2021. p. 5.

14 G. C. Clark *et al, Friends or Foes? Emerging Impacts of Biological Toxins.* Trends in the Biochemical Sciences. **44**(4), 365 – 379, 2019.

15 MR Popoff, *Overview of Bacterial Toxins from Pathogenic Bacteria: Mode of Action and Insights into Evolution.* Toxins, **16**, 182, 2024.

16 G. Schmidt, *Some Examples of Bacterial Toxins as Tools*. Toxins, **16**, 202, 2024.

17 V. Herzig *et al, Animal toxins – Nature's evolutionary-refined toolkit for basic research and drug discovery.* Biochemical Pharmacology, **181**, 114096, 2020.

18 GR Coelho *et al, Neglected Venomous Animals and Toxins: Underrated Biotechnological Tools in Drug Development.* Toxins, **13**, 851. 2021. p. 16.

19 V. Tsetlin *et al, Fifty Years of Animal Toxin Research at the Shemyakin-Ovchinnikov Institute of Bioorganic Chemistry RAS*, International Journal of Molecular Sciences, **24**, 13884, 2023.

20 Federal Register *Addition and Revisions of Entities to the Entity List*, Rule by the Industry and Security Bureau, pp. 87261 – 87279, Washington D.C., I November, 2024.

21 See Chapters, 3 -8, pp 47- 197 in Crowley, M. and Dando, M.R., *Toxins and Bioregulator Weapons: Preventing the Misuse of the Chemical and Life Sciences.* Palgrave Macmillan, Springer/Nature: Cham, Switzerland. 2022.

22 OPCW, Article II- Definitions and Criteria.https://www.opcw.org/chemical-weapons-convention/articles/article-ii-definitions-and-criteria

23 OPCW, Annex on Chemicals, Schedule 1. https://www.opcw.org/chemical-weapons-convention/annexes/annex-chemicals/schedule-1.

24 See OPCW, *Report of the Organization on the Implementation of the Convention (1 January – 31 December 1999)*, The Hague: OPCW, document C-V/5, 17 May 2000, https://www.opcw.org/sites/default/files/documents/CSP/C-V/en/C-V_5-EN.pdf p.3.

25 See OPCW, *Decision: Reporting of Ricin Production*, The Hague: OPCW, document C-V/DEC.17, 18 May 2000.

26 J. Perry Robinson, *Bringing the CBW Conventions Together*. The CBW Conventions Bulletin, **80**, 1 – 4. 2008

27 Scientific Advisory Board, *Analysis of Biotoxins: Report of the Scientific Advisory Board's Temporary Working Group*. SAB/REP/1/23. Organisation for the Prohibition of Chemical Weapons, The Hague, April, 2023. P. 5 and 4.

28 See "Secretary-General's Mechanism for Investigation of Alleged Use of Chemical and Biological Weapons (UNSGM)", available at https://disarmament.unoda.org/wmd/secretary-general-mechanism/.

29 UNODA, *Fact Sheet. The Secretary-General's Mechanism for Investigation of Alleged Use of Chemical and Biological Weapons*, New York: UN, available at https://front.un-arm.org/wp-content/uploads/2024/07/SGM-Fact-Sheet-July2024-002.pdf.

30 Spiez Laboratory, *UNSGM Designated Laboratories Workshop Report*, Spiez, November 2015, p.5.

31 Ibid.

32 Spiez Laboratory, *UNSGM Designated Laboratories Workshop Report*, Spiez, November 2024, p.5.

33 Ibid., pp.17-18.

34 See *Final Document of the Ninth Review Conference*, Geneva: United Nations, 22 December 2022, document BWC/CONF.IX/9*, available at https://documents.un.org/doc/undoc/gen/g22/617/94/pdf/g2261794.pdf.

35 See *Draft Terms of Reference and Rules of Procedure toward the development of a BWC Science and Technology Advisory Process*, Geneva: United Nations, 19 December 2022, available at https://documents.un.org/doc/undoc/gen/g22/614/16/pdf/g2261416.pdf.

6

Biological and Toxin Weapons Convention: Evaluating the Review Conferences

Mr. Abhishek Verma

6.1. Introduction

In the past few decades, progress in the field of biotechnology and bacteriology has been rapid. With the experience of global COVID-19 pandemic and the related costs to human life, there is a fair understanding of dangers associated with the dissemination of disease causing organisms or toxins. In the words of the President of the BTWC's ninth review conference, "When we think of biological weapons, we should not just think of human beings being targeted. You can target a crop, and there are countries whose economies rely almost entirely on one crop. If you want to damage them, that's enough. So, you don't even have to infect human beings with a pathogen, you can just infect a plant. There are many ways."[1]

The negotiations on the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction (Commonly known as Biological Weapons Convention) started in 1969, opened for signature on 10 April 1972 and entered into force on 26 March 1975. United Kingdom's the then Minister of State for Foreign Affairs, in a statement mentioned that "States Parties to the Convention have both renounced this entire class of weapons and

undertaken to prevent their future development, by appropriate national measures."[2] Recognizing the significance of Geneva Protocol 1925 in mitigating the horrors of war, the convention aimed at progressing effectively towards general and complete disarmament. It was the first international disarmament treaty that banned the entire category of weapons of mass destruction, establishing a strong norm against biological weapons.[3] The convention bans the development, stockpiling, acquisition, retention, production and transfer of microbial or biological agents and toxins "of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes". It also bans weapons, equipment, and delivery vehicles (and transfer thereof) "designed to use such agents or toxins for hostile purposes or in armed conflict."[4] Further, in order to ensure that the preamble and provisions of this convention are realized, a conference of state parties shall be held every five years or earlier if requested by a majority of the state parties. As of December 2024, the convention has 187 member states, four signatories and six States (including Israel) who have neither signed nor ratified the BWTC.

6.2. The Genesis of Review Conferences to the Treaties/ Conventions

In the post war world, the two types of conferences to the agreements/treaties gained significance. One for the implementation and enforcement mechanism, while another for the amendment and revision procedure of the multilateral agreement. The concept of review conference was first incorporated in Antarctica treaty[5] (under Article XII). The article not only mandated the States Parties to convene a conference to review the operations of the treaty after 30 years from entry into force, but also to suggest amendments to the treaty. Hence, Antarctica Treaty envisaged a review conference with a mandate for both revision and amendments to the treaty. During 1960s and 1970s, major arms control treaties such as nuclear non-proliferation treaty (1968), seabed arms control treaty (1971) and the Convention on the prohibition of military or any other use of environmental modification technique (1977), started convening periodic conferences to review the operations of the treaty with respect to the realization of outlined preamble and provisions. Similarly, nuclear non-proliferation treaty (NPT) provides for a conference of parties to the Treaty every five years after the treaty's entry into force. Under NPT, a grand bargain was envisaged in which the non-nuclear weapons states agreed to

renounce nuclear weapons in exchange for the peaceful nuclear technology and disarmament negotiations. As pointed out by Carnahan, non-nuclear weapons states wanted a mechanism to evaluate whether nuclear weapon states are observing their commitment with respect to the disarmament agreement.[6] Hence, it was decided to establish preparatory committee which will assume the responsibility of convening the meetings in between the two review conferences.[7] Other debatable issues included whether the review conferences would be convened mandatorily and automatically after every five years or with some flexibility. After the proposals of Romania, United Kingdom and Italy advocating mandatory periodic review conference, it was Swedish proposal which finally reached a consensus. The Swedish proposal included a language wherein the majority of the States Parties may convene the conference by submitting a proposal to the Depository States.[8] Subsequently, Conference on Disarmament also instituted review conferences on similar lines as that of NPT. The mandate of all these conferences was to review the operations of the Treaty or Convention so as to ensure purpose of the preamble has been realized. The tested pattern of review conferences were replicated in other WMD related Treaty or Conventions such as Biological and Toxin Weapons Convention and Chemical Weapons Convention.[9]

As for the BTWC, the pattern, Organisation and general modalities of a review conference follow the precedent established by NPT's first review conference (1975). The standard process includes the passage of United Nations General Assembly resolution authorizing the UN Secretariat to provide administrative support to the proposed conference. Subsequent to this, meeting of preparatory committee has to be arranged, agendas and rule of the procedure to be drawn, and committee structures to be formulated before appointing the President and other members of the conference bureau. As far as the decision making is concerned, the precedent established by NPT Review Conference of 1975 remains the benchmark. For the purpose of elections and procedural matters, simple majority of the member states, while on substantive matters an agreement or consensus became a norms for most of the treaties and conventions. The provision for consensus required for final declaration over substantive matters ensures that the consensus document does not condemn states parties to a particular treaty including BTWC. Here, this procedural phenomenon follows the dictum given by Elihu Root who states that the world opinion is the chief sanction behind compliance with international

law.[10] As discussed before, the debate surrounding the concept of review and revision of the treaty or convention is perpetual. However, when it comes to arms control negotiations with direct implications over the security of a state, revising a treaty might become extremely difficult. During the phase of 1970s when the cold war rivalry was at its peak, amending a treaty which has been established after years of negotiation remained a herculean task. Hence, periodic review was considered to be a propitious tool to examine the functioning and maintainability of the agreements. Over the years, such conferences have gained a unique significance in a sense that they help create a normative language regarding the general trends towards disarmament of weapons of mass destruction.

The functioning of BTWC review conference also reflects the general pattern established in NPT. Under Article XII of the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction (from here on, 'Biological and Toxin Weapons Convention'), a conference of States Parties to the Convention shall be held in Geneva, Switzerland five years after the entry into force of this Convention, or earlier if it is requested by a majority of Parties to the Convention by submitting a proposal to this effect to the Depositary Governments. In these conferences, States Parties will review the operation of the Convention, with a view to ensuring that the purposes of the preamble and the provisions of the Convention are being realised. All such considerations must take into account any new scientific and technical developments relevant to the Convention. There were several major themes that have been of great importance for the effective implementation of the conventions provisions as well as to achieve its objectives. One of the major recurring issues has been the confidence building measures (CBMs), which was introduced in 1986, and that the members are required to submit as a way to instill transparency in the implementation of the BTWC's provisions. Despite the evolution of modalities of submitting CBMs during the third and seventh review conference, submissions made by the state parties are abysmally low. According to the documents submitted by Implementation Support Unit (ISU) during preparatory committee meetings in April 2022, "the overall level of participation remains low with less than half of all States Parties having regularly exchanged information and data. It was only in 2021 that the submissions made by States Parties reached fifty per cent for the first time (see

Fig. 6.1)."[11] Another important issue and a major limitation of the BTWC has been the lack of verification mechanism. In this regard, the third review conference led to the formation of an ad hoc group to negotiate a legally binding protocol for the convention aimed at establishing effective compliance mechanism. However the negotiations fell through primarily due to US opposition to the on-site verification and to protect the interest of their pharmaceutical industries. In the subsequent section, the nine BTWC review conferences (till 2025) have been analysed considering the broader geopolitical landscape prevailing through the corresponding times.

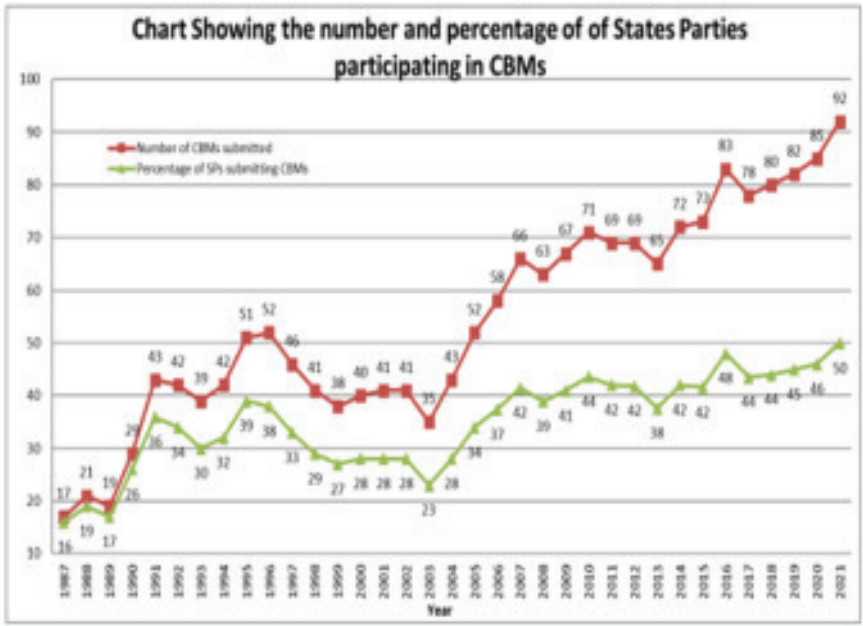

Figure 6,1: Chart Showing the number and percentage of States Parties participating in CBMs

Source: https://documents.un.org/doc/undoc/gen/g22/005/32/pdf/g2200532.pdf

As discussed above, one of the important forums for building consensus during the review conference is the preparatory committee meetings. The Preparatory Committee (PrepCom) meetings of the Biological and Toxin Weapons Convention (BTWC) are essential gatherings held before the BTWC Review Conferences to set the agenda, procedural rules, and key focus areas for discussions. These meetings bring together state parties to assess compliance,

review scientific and technological developments, and strengthen the implementation of the treaty. Over the years, structural changes have been introduced to enhance the effectiveness of the PrepCom. Notably, efforts have been made to improve transparency, increase participation from scientific and civil society organizations, and establish mechanisms for better verification and enforcement. Additionally, there have been proposals to institutionalize the committee with a permanent secretariat or technical body to support long-term treaty implementation and address emerging biological threats. These structural adjustments aim to make the BTWC more adaptable to modern challenges, including advances in biotechnology and the risks of bioterrorism.

6.2.1. First Review Conference

The first review conference to BTWC, presided over by Ambassador Oscar Vaerno of Norway was convened in Geneva from 3 March to 21 March 1980. Fifty-three States Parties to the convention participated in the conference, along with several other signatories. The significance of the first review conference was the establishment of structures, framework and the conduct of future review conferences.[12] The conference decided to establish a 'committee of the whole' to deliberate in greater detail the substantive issues concerning the convention. Subsequently, the conference established a drafting committee for the purpose of preparing and submitting (to the plenary) the entire text of the final document of the conference. The conference, in its final document, unanimously reaffirmed the provisions of the convention, as important for maintaining international peace and security. While affirming the importance of consultation and cooperation (on implementation of convention's provisions) among state parties under Article V, the conference acknowledged the differing views of the members and asked them to consider these views at an appropriate time.

With an aim to secure international peace and security, as well as the elimination of weapons of mass destruction, the outcome document acknowledged the creation of an ad hoc working group on chemical weapons by the committee on disarmament. The review conference set the stage for subsequent meetings by providing mechanisms to address future challenges and promoting the international norms against biological warfare.

6.2.2. Second Review Conference

The second review conference to BTWC was held in Geneva from 8 September to 26 September 1986. The conference was presided over by Ambassador Winifried Lang of Austria. The conference was attended by 63 States Parties to the convention, in addition to four signatory states (not ratified) and one non signatory state. Besides the states parties, three non-governmental organisations also participated in the conference. One of the major highlights of the conference was the decision to strengthen Article V of the convention. Article V allows the states parties to pursue consultation and cooperation in achieving the objectives, and implementing the provisions of the convention. In order to facilitate the consultation process, it was agreed to promptly convene a meeting on the request of any state party for further clarification on implementation of covention's provision or any technical assistance.[13] Further, the conference listed several measures to reduce the occurrences of ambiguity, doubts and suspicion, as well as to improve cooperation in the field of peaceful bacteriological activities. These measures include exchange of data of research centers and laboratories with high international safety standards. Due to the nature of these research laboratories which handles biological materials that poses high individual and community risk. Besides this, exchange of information on all outbreaks of infectious diseases, publication of results of biological research in scientific journals and the potential of joint bacteriological research involving scientists from different countries can also be explored.

To formulate a streamlined and standardized procedure of such exchange of information, the conference decided to hold an ad hoc meeting of the state parties on enhancing confidence building measures in March-April 1987. After seven plenary sessions convened during the Ad Hoc Meeting, the final report was adopted in 15 April 1987. It was decided that the state parties were required to provide data on each research center or laboratory based on the criteria of maximum containment unit specified in 1983 World Health Organisation (WHO) Laboratory Biosafety Manual.[14] With respect to the exchange of information on outbreak or an epidemic, the report suggested state parties to take guidance from WHO's guidelines. In conclusion, the second review conference to BTWC emphasized on substantially streamlining the modalities and procedure for the exchange of confidence building measures.

6.2.3. Third Review Conference

The third review conference to BTWC was convened from 9 September to 27 September 1991 under the Presidency of Ambassador Roberto Garcia Moritan of Argentina. The conference was attended by 78 States Parties to the Convention and six states which have signed the convention but not ratified it. Apart from the signatories and non-signatories, two specialized agencies of UN and 11 non-governmental organisations and institutes participated in the conference. The third review conference was held against the backdrop of the conclusion of Mendoza agreement between Argentina, Brazil and Chile, signed on 5 September 1991. Under the agreement, the three countries agreed to a total commitment not to develop, produce or acquire in any way, stockpile or retain, transfer directly or indirectly, and not to use chemical or biological arms.[15] The conference reaffirmed its commitment towards complete elimination of weapons of mass destruction as well as irresponsible use of relevant scientific and technological developments in the field of microbiology, genetic engineering and biotechnology.

The major highlight of this conference was the extraordinary and collective efforts by States Parties to explore possibilities of compliance and verification measures for the BTWC. Hence, this conference established an ad hoc group of government experts, also known as Verification Experts Group (VEREX), to examine the feasibility of the verification measures. The mandate of this group was to identify the means to determine whether a State Party is producing, developing, stockpiling, acquiring or retaining microbial or other biological agents or toxins, of types and in quantities unjustified for peaceful use. It also had to affirm that no state party is acquiring means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict. The group submitted its final report in September 1993 emphasizing the need to enhance transparency of dually capable biological facilities such as bio-defense labs and biotechnology plants. With respect to the implementation of consultation on confidence building measures, the conference established and strengthened CBM procedure by mandating states parties to exchange information regarding defensive as well as offensive biological research programs and issues related to vaccine development.[16]

6.2.4. Fourth Review Conference

The fourth review conference to BTWC, held from November 25 to December 26, 1996 in Geneva under the presidency of Ambassador Sir Michael Weston. This conference took place during the phase when negotiations on a legally binding instrument to strengthen the convention were still ongoing. This was also the time when International security environment and arms control landscape witnessed an optimistic underpinning. The most important Treaties and Conventions that were mandated to secure international peace through prevention of the use of weapons of mass destruction were increasingly gaining legitimacy among the international community. In May 1995, Nuclear Non-Proliferation Treaty which was enforced in 1970 was indefinitely extended with more than 170 states parties approving the extension. Similarly, with overwhelming approval of the UN General Assembly, the Comprehensive Test Ban Treaty (CTBT) was opened for signature and was signed by the five declared nuclear weapon states. With regards to the chemical weapons convention, signatories were depositing there instrument of ratification rendering the treaty's entry into force in April 1997.

Although international non-proliferation and arms control landscape appeared optimistic, the events concerning the proliferation of biological weapons were not very encouraging. In March 1995, Tokyo witnessed a coordinated, simultaneous and multi-point assault by the members of the Aum Shinrikyo cult. Not only the deadly nerve agent 'sarin' was used, but the investigations revealed that the cult had large scale chemical weapon production facility.[17] In another major jolt to the BTWC, Deputy Foreign Minister of Russia Gregory V. Berdennikov declared in April 1992 that "Soviet Union was violating this convention [BWC] and was running a program in the sphere of offensive biological research and development, which has been declared unlawful by the convention."[18] On top of these, United Nations Special Commission formed to verify Iraq's compliance with UNSC Resolution 687 which required Iraq to unconditionally to destroy and to undertake never to use, develop, construct or acquire non-conventional weapons or ballistic missiles with a range greater than 150 km. The Commission found large quantities of biological weapons agents being produced and weaponised.[19]

The ad hoc group of governmental experts (VEREX group) formed in 1991, to examine the potential for verification measures, submitted its report and a special conference of States Parties was convened in September 1994.

Considering the complex nature of the issue that involved scientific, technical and commercial standpoints, the special conference adopted more gradual approach towards regime formation. As an outcome, a further ad hoc group was established with a mandate to define the lists of bacteriological agents and toxins, promote further confidence building measures & transparency, as well as consider non-discriminatory, non-intrusive compliance mechanism. The conference underlined the importance of inspection and verification regime to enhance compliance with the convention, while at the same time avoid hindrances to the spread of useful, peaceful technology to the developing countries. Some participants advocated the national export licensing system as a necessary means to implement the obligations of article IV. Further, the conference appreciated the ongoing procedure at the ad hoc group level.

6.2.5. Fifth Review Conference

The fifth review conference to BTWC was held from November 19 to December 7, 2001. Hungarian Ambassador Tibor Toth was the President of this conference. The conference was attended by 91 of the 144 States Parties to the BWC. Like most of the conferences, this conference was also conducted against the backdrop of major global geopolitical tensions, especially 9/11 attack on September 11, 2001. One of the major aspirations and expected outcomes from the conference was the approval of a formal mechanism for checking compliance with the BWC. However, the review conference could not produce the final outcome document. Following the concerns over the use and possession of biological weapons by countries like Iraq, an Ad Hoc Group was established in 1994 for all the parties to negotiate a legally binding protocol which among others, mandated introducing effective compliance provisions. The actual negotiations on draft protocol started in 1997. The basic conundrum among the negotiators was to devise an on-site inspection mechanism which was intrusive enough to give confidence among other States Parties while at the same time protect national security interests and trade secrets of pharmaceutical industries and their biotechnology. In the Ad Hoc Group's 24th meeting, the United States announced its rejection of the draft Protocol. The United States rejected the draft Protocol based on its inadequacy to detect secret bioweapons proliferation and threats to their bio-defense program as well as commercial proprietary secrets.

This is how the negotiation over a legally binding protocol for checking

compliance with the BWC fell through due to lack of consensus, especially from the United States. The interests of Pharmaceutical industries of the United States stalled any meaningful progress on the draft protocol. As a result, one of the key agendas of the fifth review conference was to identify alternative strategies for strengthening the convention.[20] After the breakdown of negotiations over legally binding instrument, the conference was adjourned for a year. Even after a year, no alternative strategies could be devised for implementation and strengthening the convention. To strengthen the BTWC compliance, procedural initiatives were taken instead of any concrete steps. A program of work was initiated, which involved a meeting of experts and a meeting of States Parties each year for the next three years (2003-2005). Hence, despite the urgency, the conference failed to reach a final consensus document, particularly due to the breakdown of negotiations regarding a legally binding compliance protocol.

6.2.6. Sixth Review Conference

The sixth Review Conference to the BTWC, presided over by Ambassador Masood Khan of Pakistan, was held at Geneva from November 20 to December 8, 2006. This was the first conference after the debacle of the BWC protocol negotiations failure in the fifth review conference that shattered the possibility of imposing a binding inspection and verification measures. This conference also took place in the backdrop of major international geopolitical turbulence like American invasion of Iraq, threat of rise of terrorism post 9/11 attack and most importantly first North Korean nuclear weapons test on October 9, 2006. In the run up to the sixth review conference, important proposals came out of the meetings of States Parties. These specific topics included adoption of national measures for effective implementation of prohibitions underlined by the convention; national security and oversight mechanisms over pathogenic microorganisms and toxins; enhancing capabilities to investigate or respond to effects of cases of alleged use of biological or toxin weapons or suspicious outbreaks of disease; and the content, promulgation and adoption of code of conduct for scientists. One of the major highlights of the conference was the establishment of "Implementation Support Unit" (ISU) with three full time staff members housed within the Geneva Branch of the United Nations Department for Disarmament Affairs. The creation of ISU replicates similar corresponding bodies such as Organisation for the Prohibition of Chemical

Weapons (OPCW) in Chemical Weapons Convention and International Atomic Energy Commission (IAEA) in nuclear non-proliferation treaty. While OPCW[21] is responsible for implementing the provisions of chemical weapons convention to achieve the vision of world free of chemical weapons, IAEA, on the other hand, "has a specific role, under Article III and Article IV of NPT, as the international safeguards inspectorate and as a multilateral channel for transferring peaceful applications of nuclear technology."[22] as well as the ISU was mandated to provide administrative support to the meetings agreed by the review conference as well as assist in exchange and implementation of Confidence Building Measures. The unit would further submit a concise annual written report to the State Parties which would then be reviewed in subsequent review conference. As regards the intersessional program 2007-2010, there were four annual meetings of the State Parties commencing in 2007 of each lasting one week. These meetings will discuss ways to enhance national implementation, regional and sub-regional cooperation on implementation of convention, biosafety & biosecurity measures, and effective oversight, education and awareness about the advancement and use of bio-science and bio-technology research for the purpose prohibited under the convention.

Integrating the mandate of ISU and the process of implementing confidence Building Measures, the conference decided that ISU will coordinated the development and submission of the electronic format of the existing CBM forms. Further, in order to make the process smooth, States Parties shall designate a national point of contact in charge of preparing the submission of CBMs, the contact details of whom shall be sent to the ISU. In conclusion, the sixth review conference was relatively a successful but the desired outcome was miniscule and an important issue, the binding inspection and verification measures, remained off the conference agenda. On the positive side, the conference's final document was able to produce an article-by-article review of BWC (could not be achieved in Fifth review conference); agreement on promoting universalization of BWC membership; creation of Implementation Support Unit and implementation of intersessional meetings from 2007-2010 on topics of relevance to the convention.

6.2.7. Seventh Review Conference

Seventh Review Conference to BTWC took place from December 5 to December 22, 2011, in which 103 states parties participated, besides five

signatories and 47 NGOs & research institutes. The conference was presided over by Ambassador Paul van den Jessel of the Netherland. During the preparatory committee meetings before the conference, it was decided that the key focus of the seventh review conference would be on assessing the implementation of decisions and recommendations agreed upon at the sixth review conference; progress on obligations of the State Parties under the convention, and the new scientific and technological developments relevant to the convention. From the beginning of the conference, it was clear that the most contentious issue of the BTWC, the issue of verification protocol, would not be on the conference agenda due to the opposition of some of the most powerful countries of the planet. Rather the main agenda points were universalization of the convention, fine-tuning the Confidence Building Measures, interpretation and implementation of Article X in the light of recent scientific and technical developments in the field of biotechnology. Apart from mentioning the need for universalization of the convention, the conference failed to issue an action plan with a data-driven target to improve the low level of adherence to the convention.

The minor technical step that the conference adopted was the revised reporting forms as the basis for CBM submissions by the States Parties. The U.S. Secretary of State Ms. Hillary Clinton, while addressing seventh review conference on December 7, 2011, emphasized the new-age challenges such as the growing risk of bio-terrorism or terror attacks by non-state organisations using biological weapons. Apart from the risk of bio-terrorism, the emphasis was placed on responsible use of life science and bioscience in the field of health and security, while at the same time transparently reporting the useful information in order to ensure the effective compliance with the convention.

6.2.8. Eighth Review Conference

The eighth review conference of the BTWC was convened from 7th November to 25th November 2016 in Geneva, Switzerland. The review conference was presided over by Ambassador György Molnár from Hungary. Over 900 participants from 124 states parties participated in the conference, besides four signatory states, two non-signatory states, four UN organisations, nine international organisations and 33 NGOs. One of the important and constructive steps taken during the conference was the renewal of the mandate of the Implementation Support Unit (ISU) which was extended in Seventh

Review Conference for the period from 2017-2021. Additionally, ISU's annual report will be considered by the annual meetings. Besides this, the conference took note of the need for all the states parties to deal effectively with the compliance issues. In this regard the conference stressed on the exchange of information through the confidence building measures. These Measures have been instrumental in enhancing transparency. However, as discussed earlier, the reporting of these information by the states parties have been abysmally low. Therefore, the conference recognised the urgent need to increase the number of States Parties participating in CBMs and calls upon all States Parties to participate annually.[23] Furthermore, the technical difficulties experienced by some states in completing full and timely submissions, can be assisted through trainings or workshops upon request. While the conference highlighted the growing threats posed by bioterrorism and the potential misuse of biotechnology, it also underscored the need for increased transparency, cooperation, and the responsible application of life sciences. Despite the progress in several areas, the eighth review conference, like previous ones, struggled to make substantial headway on the establishment of a robust verification regime, a long-standing contentious issue within the convention.

6.2.9. Ninth Review Conference

Ninth Review Conference to the BTWC was held in a tumultuous global security environment with a major ongoing conflict between Russia and Ukraine. This conference was also held in the backdrop of Tenth Review Conference of Nuclear Non-Proliferation Treaty, held in August 2022, which could not come up with a final consensus document. The conference took place in Geneva (Switzerland) from 28 November to 16 December 2022, marking fifty years since the draft convention opened for signature. Mr. Leonardo Bencini, Ambassador and Permanent Representative-Designate of Italy to the Conference on Disarmament presided over the conference that was held in the backdrop of accusations and counter accusations between Washington and Moscow of the use of chemical or biological weapons or assisting in production of it.[24] In total 137 state parties participated in ninth review conference along with 2 signatories and four non-signatories that were granted Observer status. In addition to these states, five United Nations organizations, twelve international organizations and 48 non-governmental organizations and research institutes also participated in the conference.

The major highlight of the conference was the establishment of a working group to strengthen and institutionalize the convention in all its aspects.[25] Like other disarmament treaties and conventions, verification, inspection and compliance regimes proved to be the most contentious issue. As mentioned earlier, after six years of negotiations on the draft legally binding protocol, the negotiations fell through due to U.S. rejection. In the ninth review conference, for the first time in two decades the state parties agreed to formally discuss verification and compliance related issues. In this regard, the President Mr. Leonardo Bencini stated in a conversation with Arms Control Today that "at this review conference, we established a working group, which is mandated to deal with basically every aspect of strengthening the convention, including verification and other key aspects. So, I think that we've succeeded in breaking the deadlock and set out a very good plan of action."[26] The mandate of the working group was to address concerns related to international cooperation and assistance under Article X; confidence building and transparency; compliance and verification, and assistance commitments under Article VII, among others.[27] In order to produce a consensus report containing (among other details) conclusion and recommendations, fifteen days were allocated to the newly formed Working Group every year from 2023 to 2026. The report will then be considered by the state parties in the tenth review conference to BTWC. In another important step towards enhancing the capacity of the administration to implement the provision of the convention, the conference renewed the mandate of Implementation Support Unit (ISU) for the period from 2023-2027, while also establishing one new full time staff position within ISU. Although, the states parties finally converged on consensus document, they didn't agree on article by article review of the convention.

6.3. Bioterrorism and Emerging Technology as new challenges-

As per US National Institutes of Health, "Bioterrorism is the intentional release or threat of release of biologic agents (i.e. viruses, bacteria, fungi or their toxins) in order to cause disease or death among human population or food crops and livestock to terrorize a civilian population or manipulate the government."[28] The concept and prospects of bioterrorism has been in existence since decades. As discussed before, instances like the use of nerve agent 'sarin' by Aum Shinrikyo cult in Japan and use of anthrax spores in USA, present cases of bioterrorism. In recent times COVID-19, caused by the coronavirus, wrecked-

havoc across the world. The complicated challenge involved in bioterrorism is the presence of multiple agents and delivery means, variable incubation period, wide contamination and proliferation potential as well as lack of instant detection and cure. Under its provisions, BTWC has formulated detailed structures to address concerns related to bioterrorism. Article 1(2) of the treaty explicitly prohibits development and production of weapons, equipment or means of delivery designed to use microbial or other biological agents, or toxins for hostile purposes or in armed conflict. Moreover, under the Article V, the States Parties, through the submission of CBMs, remain abreast of the ongoing biotechnological and microbiological programs within the state parties.

Prevention of biological weapons from proliferating along with achieving the technical advancement in the biological science has always been a contentious mix for the purpose of formulating policy frameworks. While on one hand, the advancement in genetic engineering, microbiology and biotechnology has disseminated information about genetic (de)-formation and made the process simpler, cheaper and accessible, on the other hand it has exponentially increase the chances of misuse of technology to cause greater and wide scale devastation. The emerging technologies such as artificial intelligence, robotics and 3D printing have a dual and dangerous use case.[29] Such emerging technologies remain a cause of concern for various reasons including their dual use applicability[30] and swiftness as it replaces the human efforts, as well as predominant engagement of civilian and the private sectors. All these factors could play a crucial role in bolstering the development and production of biological weapons as well as their delivery system. The emerging technologies also present an immitigable challenge of converging governance structures with that of the awareness of these technologies. For instance, most of the international treaties, mechanisms, national governance structures tend to interact with the each other without having substantial understanding or taking cognizance of the technological disruption occurring at the grassroots level and its implications for the proliferation of malicious biological agents. Hence any measure that aims to address the development and proliferation of biological weapons must take cognizance of the factors where a conspicuous convergence of new and emerging technologies as well as biotechnology is established.

All the review conferences subsequent to the first review conference of 1980, have defined the scope of Article I to include scientific and technological developments in the field of biotechnology, microbiology and genetic engineering. The conferences have further recognized that there are possibilities for the use of these biotechnologies for the purposes inconsistent with the preamble, provision and objectives of the convention. Moreover, the third and fourth review conference urged the scientific communities of the States Parties to lend their support to the scientific endeavours consistent with the provisions of the convention.[31] In the ninth review conference to BTWC, a working group was established to "identify, examine and develop specific and effective measures, including possible legally binding measures, and to make recommendations to strengthen and institutionalize the Convention in all its aspects."[32] Among other things like international cooperation and assistance, institutional and financial issues, the working group was tasked to address scientific and technological developments relevant to the conventions.

Table 6.1: Review Conferences of Biological and Toxin Weapons Convention at Glance

Review Conferences	*Chair Country*	*Participating States Parties/Total State Parties*	*Consensus Document*	*Remarks*
1st RevCon	Norway	51 out of 81	Adopted	• Building structures and framework
2nd RevCon	Austria	63 out of 100	Adopted	• Enhancing information exchange by Strengthening confidence building measures
3rd RevCon	Argentina	78 out of 113	Adopted	• Worked towards streamlining compliance and verification measures. • Verification Expert Groups formed
4th RevCon	United Kingdom	97 out of 137	Adopted	• Underlined the importance of compliance through inspection and verification mechanism
5th RevCon	Hungary	103 out of 146	Failed to adopt	• Breakdown of negotiation over protocol on Compliance mechanisms due to US rejection.
6th RevCon	Pakistan	103 out of 155	Adopted	• Establishment of Implementation Support Unit (ISU).
7th RevCon	Netherlands	106 out of 165	Adopted	• Emphasized on assessing the implementation of provisions of

Review Conferences	*Chair Country*	*Participating States Parties/Total State Parties*	*Consensus Document*	*Remarks*
				the convention and decisions. • Discussed new scientific and technological development
8th RevCon	Hungary	124 out of 178	Failed to adopt	• Emphasis was given on increasing participation in the conference as well as in submission of confidence Building Measures.
9th RevCon	Italy	137 out of 184	Failed to adopt	• Establishment of a working group to strengthen and institutionalize the convention. • Consensus on restarting discussion on verification and compliance related issues

6.4. Conclusion

During the last 45 years nine Review Conferences to the Biological and Toxin Weapons Convention (BTWC) have taken place. The evolution of the conference during these years reflects changing global security landscape and the ongoing challenges in strengthening and enforcing the convention's provisions. The first review conference in 1980 marked the beginning of a structured review process, with States Parties focusing on assessing the operation of the convention and setting the foundation for future conferences. Over the next few decades, significant issues such as confidence-building measures (CBMs) and verification mechanisms emerged, with the second and third conferences in the 1980s and early 1990s addressing the need for better transparency and compliance monitoring. The failure of the legally binding protocol negotiations at the fifth and sixth review conferences underscored the contentious nature of verification, with the U.S. rejection of inspection measures being a key obstacle. In the 2000s, the BTWC's focus shifted toward improving national implementation and reinforcing the administrative capacity of the convention, culminating in the establishment of the Implementation Support Unit (ISU) in 2006. The eighth and ninth review conferences brought renewed attention to verification and compliance, with the latter establishing a working group to institutionalize the convention and address the deadlock on these critical issues. The ninth conference in 2022 marked a pivotal moment,

with the working group set to produce a comprehensive report by 2026, reflecting ongoing efforts to adapt the BTWC to new scientific and geopolitical challenges.

NOTES

1 "Assessing the Ninth BWC Review Conference: An Interview with Conference President Leonardo Bencini" *Arms Control Association,* January 2023, https://www.armscontrol.org/act/2023-01/features/assessing-ninth-bwc-review-conference-interview-conference-president-leonardo, accessed on 11 January 2025

2 "The BWC Ninth Review Conference: an overview of outcomes, outlooks and national implementation", *Vertic,* 2023, https://www.vertic.org/wp-content/uploads/2023/03/VERTIC-Brief-35_FINAL.pdf, accessed on 9 January 2025.

3 United Nations Office for Disarmament Affairs, "Biological Weapons" https://disarmament.unoda.org/biological-weapons, accessed on 9 January 2025.

4 Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction https://front.un-arm.org/wp-content/uploads/2020/12/BWC-text-English-1.pdf, accessed on 9 January 2025.

5 "The Antarctica Treaty", Secretariat of the Antarctica Treaty, https://www.ats.aq/e/antarctictreaty.html accessed on 11 February 2025

6 Burrus M. Carnahan, "Treaty Review Conferences. The American Journal of International Law, Vol. 81, No. 1, 1987, pp. 226–230.

7 Mohamed Shaker, *The Nuclear Non-Proliferation Treaty: Origin and Implementation 1959-1979,* London: Oceana Publications Incorporation, 1980, p. 874

8 "Treaty on the Non-Proliferation of Nuclear Weapons (NPT)", *United Nations Office for Disarmament Affairs,* 1970 https://disarmament.unoda.org/wmd/nuclear/npt/text/ accessed on 17 February 20205.

9 Organisation for the Prohibition of Chemical Weapons, "Conference of the States Parties Setting the OPCW's strategic direction" https://www.opcw.org/about/conference-states-parties#:~:text=The%20Review%20Conference%20 occurs%20once,next%20five%20years%20and%20beyond. accessed on 15 February 2025.

10 Elihu Root, 'The Sanction of International Law', in Leo Gross (ed), International Law in the Twentieth Century, New York: Appelton Century Crofts, 1969, p. 143.

11 "Ninth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction", History and operation of the confidence-building measures, 2022, https://documents.un.org/doc/undoc/gen/g22/005/32/pdf/g2200532.pdf , accessed on 11 January 2025.

12 First Review Conference of the Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction, https://unoda-documents-library.s3.amazonaws.com/Biological_Weapons_Convention_-_First_Review_ Conference_(1980)/BWC_CONF.I_10.pdf, accessed on 23 January 2025

13 "Second Review Conference of the Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction", 1980, https://meetings.unoda.org/bwc-revcon/biological-weapons-convention-second-review-conference-1986, accessed on 12 January 2025.

14 "Ad Hoc Meeting of Scientific and Technical Experts from States Parties to the Convention on the Prohibition on the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction", 1987, https://unoda-documents-library.s3.amazonaws.com/Biological_Weapons_ Convention_-_Ad_Hoc_Group_on_Confidence-Building_Measures_(1987)/BWC_CONF.II_EX_02.pdf, accessed on 22 January 2025.

15 Mendoza Agreement, 1991 https://www.nti.org/wp-content/uploads/2021/09/mendoza_agreement.pdf, accessed on 15 January 2025.

16 Third Review Conference of the Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, https://docs-library.unoda.org/Biological_Weapons_Convention_-_Third_Review_Conference_(1991)/BWC_CONF.III_23.pdf accessed on 18 January 2025.

17 Kyle B. Olson, "Aum Shinrikyo: Once and Future Threat?" *Emerging Infectious Diseases*, Vol. *5* No. 4, 1999, pp. 413-416.

18 Department of State, Government of the United States of America (2022), "Adherence to and compliance with Arms Control, Non-proliferation, and Disarmament Agreements and commitments". 2022, https://www.state.gov/wp-content/uploads/2022/04/2022-Adherence-to-and-Compliance-with-Arms-Control-Nonproliferation-and-Disarmament-Agreements-and-Commitments-1.pdf, accessed on 21 January 2025.

19 "The Fourth BWC Review Conference, *Arms Control Association* at https://www.armscontrol.org/act/1997-01/features/fourth-bwc-review-conference, accessed on 21 January 2025

20 "The Fifth Review Conference of the Biological and Toxin Weapons Convention (BWC)" *Nuclear Threat Initiative* at https://www.nti.org/analysis/articles/biological-and-toxin-weapons-bwc/, accessed on 21 January 2025.

21 Organisation for the Prohibition of Chemical Weapons, "Mission: A World Free of Chemical Weapons" https://www.opcw.org/about-us/mission accessed on 18 February 2025

22 International Atomic Energy Agency, "Key Roles" https://www.iaea.org/newscenter/focus/npt/key-roles accessed on 19 February 2025.

23 Eighth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, https://www.the-trench.org/wp-content/uploads/2016/11/BTWC-8th-RevCon-Final-doc-Scan.pdf , accessed on 20 January 2025.

24 "Assessing the Ninth BWC Review Conference: An Interview with Conference President Leonardo Bencini" *Arms Control Association,* January 2023. https://

www.armscontrol.org/act/2023-01/features/assessing-ninth-bwc-review-conference-interview-conference-president-leonardo, accessed on 11 January 2025.

25 "Ninth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction". https://meetings.unoda.org/bwc-revcon/biological-weapons-convention-ninth-review-conference-2022 accessed on 10 January 2025.

26 "Assessing the Ninth BWC Review Conference: An Interview with Conference President Leonardo Bencini" *Arms Control Association,* January 2023, https://www.armscontrol.org/act/2023-01/features/assessing-ninth-bwc-review-conference-interview-conference-president-leonardo, accessed on 11 January 2025.

27 "Ninth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction". https://meetings.unoda.org/bwc-revcon/biological-weapons-convention-ninth-review-conference-2022 accessed on 10 January 2025.

28 "Bioterrorism: A Public Health Perspective" https://pmc.ncbi.nlm.nih.gov/articles/PMC4921253/#:~:text=In%20the%20recent%20past%2C%20mycotoxins,the%20 threat%20of%20bioterrorism%20today. accessed on 18 February 2025.

29 "How emerging technologies increase the threat from biological weapons" *World Economic Forum,* 28 March 2019, https://www.weforum.org/stories/2019/03/how-emerging-technologies-increase-the-threat-from-biological-weapons/ , accessed on 18 February 2025

30 "Science and Technology under the Biological Weapons Convention", United Nations Office for Disarmament Affairs, https://disarmament.unoda.org/biological-weapons/science-and-technology/ accessed on 19 February 2025.

31 "Meeting of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction" BWC/MSP/2018/MX.2/2 https://docs.un.org/en/bwc/msp/2018/mx.2/2 accessed on 18 February 2025.

32 Ninth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, "Final Document of the Ninth Review Conference," BWC/CONF.IX/9, December 22, 2022.

SECTION III

NEGOTIATION AND VERIFICATION

7

Negotiating the Protocol to the BWC: An Indian Perspective

Amb. DB Venkatesh Varma

7.1. Introduction

The Biological Weapons Convention (BWC) of 1972 was the first international treaty to ban an entire category of weapons of mass destruction. The United States and the Soviet Union were its prime movers as the military utility of bioweapons was considered more unwieldy than nuclear deterrence and in fact complicated war fighting doctrines of the major powers. However, there were lingering doubts as to whether the treaty had achieved its main objective of truly eliminating biological weapons globally. These doubts where further strengthened when new evidence became available after the end of the Cold War of a clandestine bio-weapon program in the Soviet Union. Through the need for verification protocol to the BWC was discussed during the later part of the Cold War, the proposal was not initially accepted. At the 1991 BWC Review Conference—the first after the end of the Cold War—however established a group of experts to study the technical feasibility of potential verification measures to the BWC.

This group called the VEREX group submitted its report[1] in 1993 proposing 21 verification measures that could be considered as part of an international instrument to verify compliance with the main provisions of the BWC. A Special Conference convened in 1994 endorsed a mandate to establish

an Ad Hoc Group to negotiate a legally binding instrument—a Protocol—to strengthen the effectiveness and improve the implementation of the Convention. The mandate was not merely focused on verification of compliance measures, but also included CBMs, definitions and objectives, and measures to strengthen Article X of the Convention.

7.2. Ad Hoc Group and its Mandate

The decision of the 1994 Special Conference to establish an Ad Hoc Group[2] was reflective of the optimistic international situation at that time. With the end of the Cold War, the intense rivalry between the United States and the Soviet Union, latter the Russian Federation had subsided. Under the Clinton Administration which took office in 1992, America played an active leadership role on global non-proliferation efforts as well as in promoting international agreements such as pushing forward the CTBT and creating the consensus necessary for taking forward future negotiations on FMCT. The first Gulf War revealed clandestine WMD programs of Iraq. The successful completion of the negotiations for the Chemical Weapons Convention (CWC) in 1994 added new momentum in the arms control and non-proliferation field. This period was the highpoint in multilateralism in the field of non-proliferation and disarmament.

The mandate for the launch of negotiations for a Protocol to the BWC was broad based because there was a general sense of optimism that in addition to verification measures to ensure compliance with the disarmament aspects of the BWC, the prospects for the proposed Protocol and hence for the universality of the BWC would be enhanced. Under the able Chairmanship of Ambassador Tibor Toth of Hungary negotiations began in 1997 based on a rolling text. The negotiations were conducted in three sessions annually at the UN premises in Geneva. At the end of every session, a new version of the rolling text would be produced which would reflect not only areas of agreement but also issues on which disagreement persisted which was reflected in the form of bracketed language. The negotiations were well attended with at least 30 to 40 delegations actively participating in drafting. At any one point of time, there would be at least 80-100 member states in the room. The Chair was assisted by Friends of Chair (FOCs) from various countries (including from India) on various topics to facilitate the negotiating process. The member states were organised into regional groups. The NAM group along with China

was of course the largest. The Western group consisted of the United States, the European Union and its allies such as Japan, Australia and Canada. The EU often acted as a separate group. Though Russia belonged to the East Europe group, it largely acted on its own.

The largest delegations, where fielded by the United States and the Russian Federation, consisting of not only of diplomats from their Geneva mission, but also from capital and included many representatives from their respective ministries of defence and scientific establishments. The other delegations, which had experts of long-standing included Germany, the United Kingdom, France and China among others. It was clear that technical expertise on biological weapons was more easily available to those delegations from countries which had developed advanced bioweapons programs in the past. They were many non-government organisations (NGO) who took keen interest in the progress of the negotiations. Though a vast majority of them where in some form or another supported the western perspective their contributions to documentation and acting as platforms for dialogue were invaluable. Many of the experts had spent a lifetime studying the subject.

7.3. India's Brief and Delegation

The negotiations on behalf of India were coordinated by the Disarmament and International Security (DISA) Division of the Ministry of External Affairs, which worked closely with the Indian mission to Conference on Disarmament in Geneva, which until 2000 was part of the Indian Mission to the UN. (Thereafter, a separate Indian Mission was established under a separate PR to the CD—the first incumbent was Rakesh Sood who had earlier headed the DISA Division in MEA.) Between 1994 and 2001, the Indian Permanent Representatives in Geneva were: Satish Chandra, Arundhati Ghose, Savitri Kunadi and Rakesh Sood. The Indian diplomats who participated in the negotiations were Ajit Kumar, Navtej Sarna, Hamid Ali Rao, JS Mukul, and TP Seetharaman. The author was part of the negotiations between 1997 and 2000. Ajit Kumar who had earlier been posted in Geneva was given the role of leading the negotiations as Director and then JS in the DISA division for the Protocol negotiations. Navtej Sarna played a key role in the original drafting of the mandate. There were representatives from Department of Biotechnology and DRDE Gwalior who made significant contributions.

The brief for the negotiations was initially drew on lessons from the just concluded CWC negotiations in the CD. There was a learning process as the negotiations progressed. Initially, the Indian position was reactive in many instances on the core issues of declarations and verification. India had an interest in intrusive verification measures to be directed against countries of concern, particularly in our neighbourhood but was equally keen that there were strong safeguards against frivolous investigation requests based on false allegations of non-compliance. This duality continued till the end of the negotiations.

The CWC was seen by India as the gold standard of multilateral treaties. It was universal and non-discriminatory and gave the State Parties the primary role in addressing non-compliance concerns rather than for instance the UNSC. India was also keen that following the example of the CWC, the Executive Council of the proposed Treaty body and the Conference of State Parties have the primary responsibility for approving verification visits or investigations of alleged use. Though Article VI allowed for alleged use of Bioweapons to be referred to the UNSC, India's preference was that this be done after due deliberation and approval of the Executive Council.

Nationally and as part of the NAM group India played an active role in supporting the strengthening of Article X of the BWC even while striking a balance with the obligations under Article III. India also took an active lead on Article VII relating to assistance in case of BW attack. Within NAM, India also took the lead in forming likeminded groups on specific issues. At that time, India had a fairly negative stance on export control regimes such as the Australia Group but was not as radical as Cuba or Iran in asking for its complete disbandment prior to the conclusion of the Protocol.

On issues relating to definitions and objectives India saw it as specific to differences between US and Russia even though the Russian argument that the general-purpose criteria in Article I of the BWC was ill suited for detailed verification measures had some merit. India had a flexible position on the issue of thresholds supported by Russia which the US interpreted as creating carve outs for its national bioweapon programme. Like Russia, India was concerned about unusual outbreaks of disease as a ploy to foist false allegations against State Parties.

By and large the Indian negotiating position improved over time. India

was considered one of the key delegations in the Protocol negotiations. It was well prepared and tough in negotiations but never to the extent as to be seen as obstructive. India was always consulted on both procedural and substantive aspects of the negotiations. With time, the quality of inter-ministerial consultations in Delhi also improved. It may be mentioned that this period also coincided with the 1998 Pokhran tests and the diplomatic fall out which was also felt in Geneva. It is to the credit of our diplomacy—both in capital and in Geneva—that the Protocol negotiations were largely insulated from the political fallout of the nuclear tests.

7.4. Breakdown in Negotiations

In early 2001, after 23 sessions of negotiations, the Chairman Amb Timor Toth, after due consultations with delegations, took the decision to table a composite draft[3] reflecting his suggestions for compromise on key issues, even though there over 1000 brackets still remaining in the rolling text. His decision was well intentioned, but it precipitated a crisis in the BWC.

The US had been unhappy with the Protocol negotiations for a while as it was unable to reconcile the differing and often conflicting strands in the mandate in a manner that would pass muster with the Pentagon and the Congress. In addition, the political ground had shifted considerably since the mid-1990s. Relations with Russia had become less friendly. China's biotech industry had grown over the years. In addition, the US felt less attracted to the verification mechanisms in the Protocol when it had developed other national means to monitor bioweapon programmes of concern of its adversaries. Its own biotech industry and biodefence programmes were so extensive, it felt that the Protocol would be a burden in terms of protecting national security and commercial proprietary information. The US also had a problem with using the CWC as a standard for the BWC Protocol on the grounds that chemical precursors had identifiable infrastructure that can be verified while the same type of cataloguing was not possible under the BWC. Besides the US felt threatened that the NAM demands for Article X implementation was converting a disarmament treaty into a trade treaty. The advent of the Bush Administration with John Bolton as Under Secretary of State hardened the US position on on-site verification more generally.

US Ambassador Donald Mahley, who had led the American delegation made a detailed statement on July 25, 2001, setting out the reasons why the

US would no longer support negotiations based on the mandate of the Ad Hoc Group. Ambassador Mahley's statement was heartfelt even though the conclusion was categoric. This contrasted with the statements made by John Bolton who used harsh language and threatened to stop the further meetings of the BWC if there was criticism of the US position.

While the US took an upfront position and hence most of the public blame for breakdown of the negotiations, there were other national positions that were major obstacles to reaching consensus. Russia's position on definitions and thresholds was one such issue. Russia was also opposed to investigation of unusual outbreak of disease. The relationship between Article III and Article X also became problematic as four countries—China, India, Pakistan and Iran felt that there should be multilaterally agreed criteria in the Protocol to apply to national export controls on biomaterials and technology transfers. This went against the rationale for the more exclusive Australia Group (AG) controls that were applied by Western countries. While India's approach was to negotiate as hard as possible short of blocking consensus, China and Iran had a more hardline approach. Eventually, within a decade, India moved away from this position to engage bilaterally with the AG to finally becoming its member in 2013. The failure of the multilateral process under the Protocol negotiations to offer benefits made India to look for pragmatic solutions to cater to its growing chemical and biotech industry needs by engaging with the US and others and in joining the Australia Group.

On the surface there was unity in the Western Group but there were deep divisions between US and the EU. While major European delegations were keen to have a tight fit between declarations and verification visits, the US was not prepared to go as far as it had done in the CWC. The US was willing to accept declarations of large facilities and visits for transparency purposes but not for verification, which was not palatable to the EU. In the end, the lack of transparency and consultations between US and the EU created a lot of heartburn in the EU which felt betrayed and angry when the Protocol negotiations broke down.

7.5. Lessons

While right from the commencement of the Protocol negotiations there were considerable differences in how key delegations read the agreed mandate of 1994, it was remarkable that all delegations, in particular the major countries

made patient efforts to bridge differences and build common ground between 1997 and end 2000. This was truly the high point of multilateral disarmament negotiations. Compromise solutions were attempted even on contentious issues such as definitions, nature and frequency of challenge inspections, the correlation between Article III and Article X, incorporating some of the lessons of the CWC and in fleshing out mechanisms such as the cooperation committee to investigate complaints of developing countries on restrictive transfers of biotechnology. While consensus on key issues was still elusive, the rolling text made slow but steady progress. This was due to the patience shown by countries investing in the multilateral process despite persistent differences. This experience of intense negotiations created better understanding on issues that otherwise left state parties talking past each other in the past. Gradually, a BW community emerged—of diplomats, technical experts, military personnel and academic experts including NGOs which lasts even today. Even though senior participants have retired or passed on, the younger generation of experts have carried the baton.

For India, the BWC Protocol negotiations were a coming of age of its disarmament diplomacy. India viewed the CWC as the gold standard of universal, non-discriminatory disarmament instruments with verification and tried to model the BWC Protocol negotiations as far as possible on those lines. However, there were significant differences especially about the implications of declaration and verification on chemical and biotech industries. In addition, India was determined not to make the mistake of the CWC negotiations in accepting oral commitments of fair treatment for state parties on transfers. Hence its strong negotiating position in the Protocol negotiations on Article III and Article X. There was also greater maturity and diplomatic skill in our negotiating position. India was a prominent and respected part of the Protocol negotiations.

It's now almost 25 years since the end of the Protocol negotiations. Along with a vast majority of state parties, including many from the Western Group, India continues to support the objective of a comprehensive, legally binding Protocol to strengthen the effectiveness and improve the implementation of the BWC. The prospects for this remain very dim but it would be a mistake to let go of this objective in the future.

Besides the sharp deterioration in the political situation, the biotech landscape has changed dramatically including with the advent of new

technologies that not only have the potential to increase the virulence of existing pathogens but also technologies that hasten the speed with which novel organisms and pathogens can be created, making verification, already a complex factor in the BWC context, doubly more difficult. Convergence between Chemical and Biological weapon technologies is another grave concern. New tech also offers new options for monitoring and verification.

Despite near death experience in 2001, the BWC process has recovered over the years with substantial work being undertaken in the Inter-sessional process. This has helped build common understandings and cooperation formats including in areas such as biosafety and bio security, addressing threats of bio terrorism, peer review mechanisms, data bases on Article X and VII, the latter in fact proposed by India and France, science-tech review, strengthening of the Implementation Support Unit (ISU) amongst others. With steady progress on universality there is also greater outreach to biotech industry which has grown considerably in the last two decades. China has emerged as a major player.

Piecemeal efforts are useful to build a patchwork but to build a mosaic there still need for a comprehensive instrument in the form of a Protocol to the BWC. Perhaps the ambition of the 2001 Protocol negotiations outpaced the political conditions of that time. Hence, reducing ambition- the Protocol need not be perfect in the first instance, and following a step-by-step process, of improving common understandings through CBMs, a common template of declarations, a menu of verification measures that can be improved over time and use of new technologies may be the path forward.

The experience gained during the Protocol negotiations and the community it fostered have been crucial links in sustaining interest in the BWC, which India values and has contributed to. The absence of an international instrument that reinforces the norm against bioweapons, deters potential violators and rewards those with clean track records is still sorely missed.

NOTES

1 BWC, Ad Hoc Group of Governmental Experts to identify and examine potential verification measures from a scientific and technical standpoint, Summary Report, BWC/CONF.III/VEREX/8, 24 September 1993, https://undocs.org/BWC/CONF.III/VEREX/8,

2 BWC, Special Conference, Final Report, BWC/SPCONF/1, 30 September 1994, https://undocs.org/BWC/SPCONF/1

3 BWC, Ad Hoc Group, Protocol to the Convention on the Prohibition of the Development, production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, BWC/AHG/CRP.8, 30 May 2001, https://undocs.org/BWC/ADHOCGROUP/CRP.8.

8

The BWC Working Group: Advancing Discussion Around Compliance and Verification

Dr. James Revill

8.1. Introduction

The mandate of the Working Group on the Strengthening of the Convention includes the topic of compliance and verification among its agenda items. As such, the Working Group presents an important window of opportunity to revisit work on verification under the BWC after a gap of more than two decades. However, some of the issues that contributed to this long pause in the discussion persist and efforts to strengthen the BWC through the development of a mechanism to verify the Convention will continue to face several challenges. Moreover, the Working Group is operating in a tense geopolitical environment in which progress in several areas of arms control and disarmament, including the BWC, has become difficult.

This paper begins with a short overview of the genesis of the BWC and past verification-related efforts over the course of the last 50 years, specifically through the work on a draft protocol to the BWC. The paper then proceeds to examine how discussion around BWC verification has evolved in the early 2020s, with a particular focus on the activities of the BWC Working Group established at the Ninth BWC Review Conference. The paper concludes with

some thoughts on what is required to advance verification over the course of the next 50 years.

8.2. The Negotiation of the BWC and the Verification Deficit

Verification was considered in the negotiations that led up to the finalisation of the BWC. However, those leading early proposals recognised the difficulty of verifying biological weapons-related activities; as the British Ambassador noted in 1968, "we cannot offer a fully effective system of verification and we believe it is beyond the wit of man to devise one".[1] Indeed, the verification of biological activities presents specific challenges, as agents are highly dual-use in nature and can be scaled quickly, among other factors.

Of particular concern at the time—and now—was the prospect of on-site verification activities, which "could not possibly be effective without also being extraordinarily intrusive".[2] In this regard, there were concerns about national sovereignty and potentially exposing sensitive information about biodefense programmes and legitimate industrial activities.

The difficulties of verifying the BWC, combined with the perception of States, such as the United States, that biological weapons were of "questionable utility" to powerful states,[3] meant that the BWC was born without any verification mechanism. However, a provision was included for States Parties to consultant and cooperate on any issues within the Convention through Article V and, in the event of a violation of the Convention, "lodge a complaint with the Security Council of the United Nations" under Article VI.

8.3. The BWC Protocol and earlier efforts towards Verification

Several states were disappointed with the final text of the BWC, including the verification deficit, an issue France and Sweden both raised.[4] Such concerns were exacerbated by allegations of BWC non-compliance at early Review Conferences: following the agreement on a consensus final document at the First BWC Review Conference in 1980, the United States raised concerns over an incident at the "Biological Warfare Institute" in Sverdlovsk;[5] and at the Second BWC Review Conference in 1986, some states expressed concern over the allegations of "Yellow rain".[6]

Concerns over non-compliance led some states to call for a renewed examination of the BWC verification architecture. However, meaningful

progress remained elusive until the easing of Cold War tensions created a more favorable environment for advancing the BWC. By the time of the Third Review Conference in 1991, several states expressed support for further work on verification. Others, however, continued to argue that the convention was inherently unverifiable. As a result, verification emerged as the "single most contentious issue" of the 1991 Review Conference.[7]

In an attempt to find compromise around this contentious issue, the Third BWC Review Conference concluded with an agreement to assess the feasibility of verification measures from a scientific and technical perspective through a decision to establish "an Ad Hoc Group of Governmental Experts open to all States parties to identify and examine potential verification measures from a scientific and technical standpoint", otherwise known as VEREX.[8]

Between 1992 and 1993, this governmental expert process identified and evaluated 21 potential measures for their suitability in any future BWC verification regime. VEREX concluded that:

> "*Some of the potential verification measures would contribute to strengthening the effectiveness and improve the implementation of the Convention, also recognizing that appropriate and effective verification could reinforce the Convention.*"[9]

Following this initial review, negotiations were carried out through the Ad Hoc Group from 1994 to 2001, which focused on developing a legally binding protocol for Convention. This is covered in more depth by other scholars in this volume.[10] However, for this chapter some details are important to set the scene: a key component of this protocol was a verification mechanism, partially modelled on the framework established for the Chemical Weapons Convention. By the mid to late 1990s, the group appeared to be making progress, developing a rolling text of the draft protocol that outlined the contours of a BWC verification mechanism and the broader institutional architecture envisioned. In addition to verification, the draft protocol included provisions to strengthen other aspects of the Convention, such as international cooperation.[11]

This was, as noted by Amb. Varma elsewhere in this volume, "truly the high point of multilateral disarmament negotiations". By the turn of the century, however, negotiations were beginning to stall with positions becoming deeply entrenched around several issues on which there were "strong conceptual

differences in views".[12] The Chair of the Ad-Hoc Group, Ambassador Tibor Tóth of Hungary, developed a 210-page compromise text (usually referred to as "the composite text"), which contained his "best guess" on several pending issues.[13] Despite his best efforts, this ultimately proved insufficient, with states raising a significant number of requests for change, some of which were mutually exclusive.[14]

Ultimately, in the 24th session of the Ad-Hoc Group in July 2001, the United States collapsed the process, concluding that "the current approach to a Protocol to the Biological Weapons Convention ... is not, in our view, capable of achieving the mandate set forth for the Ad Hoc Group, strengthening confidence in compliance with the Biological Weapons Convention". This step, which, as alluded to by Ambassador Varma in an earlier chapter, concealed a much broader set of objections to protocol from a far wider range of states. Regardless, the step sealed of any path for multilateral discussions on a verification system for the years to come.

8.4. Changing Tone: the Ninth BWC Review Conference

Following the collapse of the protocol negotiations in 2001, the topic of verification was firmly removed from the BWC formal agenda for more that two decades as states pursued a range of other topics through successive intersessional processes. Although many states continued to express support for returning to the protocol negotiation;[15] others sought to avoid any serious discussion around verification at all, and yet others still focused on concrete short-term objectives whilst aspiring to some form of verification mechanism in the future, although not necessarily through the resurrection of the work of the protocol *per se*.

It was not until 2021 that a subtle but significant shift in the policy of the United States appeared to pave the way for cautiously revisiting discussion around verification. In her remarks to the United Nations First Committee in October 2021, the Under Secretary of State for Arms Control and International Security, Ambassador Bonnie Jenkins, stated the United States would:

> *... take action to break the two-decade deadlock over strengthening the Biological Weapons Convention. At the upcoming Review Conference, we must bring the Convention into the 21st century. The United States will propose that BWC States adopt and implement specific measures to*

> *strengthen the BWC in key areas and take steps to intensively explore measures to strengthen implementation and promote compliance.*[16]

Later, at the delayed 2020 Meeting of States Parties—which took place in November 2021—Jenkins proposed the Ninth BWC Review Conference should "establish a new expert working group to examine possible measures to strengthen implementation of the Convention, increase transparency, and enhance assurance of compliance".[17]

The Ninth BWC Review Conference took place, as described by its President, Italian Ambassador Leonardo Bencini, "against the backdrop of an international context that could have hardly been more challenging".[18] While the geopolitical circumstances were undoubtedly difficult, global events—most notably the COVID-19 pandemic—had underscored both the immense potential of biological threats to cause harm and "how dangerously underprepared we are to deal with biological threats".[19] Although states were careful not to link COVID-19 to biological weapons, the pandemic appeared to quietly generate momentum for strengthening the BWC.

By the time of the Review Conference, several states had proposed language advocating for some form of experts working group, and interest in verification had grown significantly. This shift was evident to seasoned BWC commentator Dr. Richard Guthrie, who observed a notable change in the tone of discussions on verification, remarking that "for the first time in many Review Conferences, [delegates] used the term 'verification measures' in a positive context."[20]

As the conference progressed, support coalesced around the establishment of an expert group tasked with examining a range of measures, including compliance and verification. Despite challenges in the final stages of negotiations, the proposal was retained in the conference's final document, which stipulates:

> *Determined to strengthen the effectiveness and to improve the implementation of the Convention in all its aspects, the Conference decides to establish a Working Group open to all States Parties. The aim of the Working Group is to identify, examine and develop specific and effective measures, including possible legally-binding measures, and to make recommendations to strengthen and institutionalise the Convention in all its aspects, to be submitted to States Parties for consideration and*

> *any further action.... In this context, the Working Group will address the following.... Measures on compliance and verification....*[21]

In this regard, Ninth BWC Review Conference in 2022, has (re)opened a path for discussion on a verification system under the BWC.

8.5. Compliance and Verification in the BWC Working Group

As of this writing, the BWC Working Group has convened for a total of six days to discuss compliance and verification under the leadership of the Friends of the Chair on this topic, Amb. Robert in den Bosch of the Netherlands and Alonso Martínez Ruiz of Mexico. The group's second session in December 2023 included three days of discussion on the topic, which featured several presentations by international organizations and other actors. This marked a constructive breakthrough, overcoming the two-decade impasse caused by the failed verification protocol negotiations of 2001. Notably, States Parties recognized the transformative advancements in science and technology and their potential to strengthen the 21 measures proposed by VEREX over 20 years ago.

However, this session, along with subsequent discussions held in the fifth session of the Working Groupin December 2024, have also revealed challenges and divisions among BWC States Parties regarding verification. These include a lack of conceptual clarity around verification, issues with definitions and thresholds of biological agents, concerns over resource availability, differing perspectives on key verification tools, and varying understandings of the evolving biological threat landscape. The following section explores these issues in greater depth.

8.5.1. Conceptual clarity

The absence of discussion around BWC verification in the multilateral context for two decades meant that the first discussion on the topic was characterized by a lack of conceptual cohesion around verification, with questions around the meaning, scope and purpose of BWC verification. As much was recognized by the Friends of the Chair on compliance and verification, who in their remarks towards the end of the discussion in 2023 noted that "[a]greement on their scope and purpose is an important basis for identifying examining and developing effective and substantive measures".[22]

By December 2024, States still diverged around conceptual issues but there was nonetheless an emerging sense of greater conceptual clarity around the concept, with several working papers articulating views on the scope and purpose of verification. For example, France identified three functions of verification in a working paper co-sponsored by Belgium, Hungary, Morocco and the UK: building confidence in compliance,; minimizing distrust among States Parties, and deterring non-compliance.[23] Germany presented a working paper that laid out several purposes of verification and suggested "articles I, II, III and IV seem to be of particular relevance" in terms of the scope of verification.[24] Furthermore, Switzerland provided a definition of "verification as the process of collecting and assessing data to be in a position to make an informed assessment of compliance with treaty obligations set out in Article I of the Convention".[25] As such, States Parties may not have achieved conceptual cohesion around verification. However, the submission of written material and the nature of the discussion suggest an important evolution of understandings and the development of foundations for moving verification forward.

8.5.2. Definitions and thresholds

The Chemical Weapons Convention, like the BWC, has an intent-based definition of chemical weapons. In the case of the CWC, this intent based definition has been augmented by lists and permitted thresholds of chemicals that States Parties have developed to "identify chemicals for the application of verification measures according to the provisions of the Verification Annex". A similar model of a schedule of biological agents and equipment was envisaged by some in the Protocol negotiations, as outlined by Ambassador Varma elsewhere in this publication.

Accordingly, throughout the Working Group discussions, some states have shown interest in developing lists of biological agents to support a BWC verification mechanism. For example, in 2023, a Russian Federation working paper noted that the wording of Article I creates "ambiguity and remain[s] open for various interpretations" adding that "Lists of biological agents and toxins developed by the Ad Hoc Group can be used as a basis and reviewed by experts in terms of their universalization".[26]

There is a clear logic to developing such lists for verification purposes, as they could also support broader national implementation efforts. However,

some States Parties have raised concerns about the challenges such lists present. Negotiating them would be time-consuming, and as science advances, static lists risk becoming outdated or excluding emerging threats. Similarly, efforts to quantify specific permissible amounts of an agent would also be complex and difficult to enforce "because the self-replicating nature of microorganisms means that an agent amount at or below a threshold could be exceeded within a matter of hours".[27]

8.5.3. Verification tools

Verification methods represent a third area of divergent views. Presentations by the IAEA and OPCW during the December 2023 Working Group meeting demonstrated that routine on-site industry inspections can be a viable component of a disarmament verification system. For instance, the IAEA conducted 2,975 verification missions in 2022;[28] and before the pandemic the OPCW carried out 241 facility inspections annually—though maintaining this level of oversight has become increasingly challenging.[29]

Several countries, including the Russian Federation and China, have expressed support for incorporating routine on-site industry inspections into any BWC verification mechanism, recognising such inspections are often considered a cornerstone of traditional disarmament verification regimes. Additionally, several other states have shown interest in visits. This term emerged during the latter stages of the protocol negotiations as an alternative to "inspections" which were deemed unsuitable to the BWC context. For example, a Swiss working paper stated: "We believe that regular visits would be a useful source of supplemental information" adding that "Dedicated work would be necessary to spell out which facilities would be the subject of visits and their frequency".[30]

In contrast, other countries, such as the United States, have raised doubts about the value of routine on-site inspections within the BWC framework. This scepticism partly stems from the sheer scale of life sciences research globally and the uncertain efficacy of any such measures in assessing compliance in dual-use facilities. The policy of the United States appeared to shift slightly on this issue. For example, a 2024 working paper indicated openness to an "Annual program of familiarization visits" to "familiarize, through on-site briefings and tours, the Technical Secretariat with such facilities and their regulatory oversight, while promoting transparency".[31]

Convergence on the issue of a routine inspections or visits is one area where further discussion is needed. It is also an area that would benefit from pilot tests to determine whether some form of visits can effectively enhance confidence in compliance and, if so, how much a useful system for visits would cost.

8.5.4. Resources

In addition to the factors above, the costs associated with any verification mechanism will be a critical consideration. Any such mechanism would require, among other elements, some form of suitably resourced organisation. The current four-person BWC Implementation Support Unit (ISU), operating with an annual budget of USD 2.1 million, is already stretched thin and unlikely to contribute significantly to verification efforts in its current form. A review of the costs of verification mechanisms in other regimes (see Figure 8.1) suggests that an effective system would likely require a budget several orders of magnitude greater than that of the current ISU team.

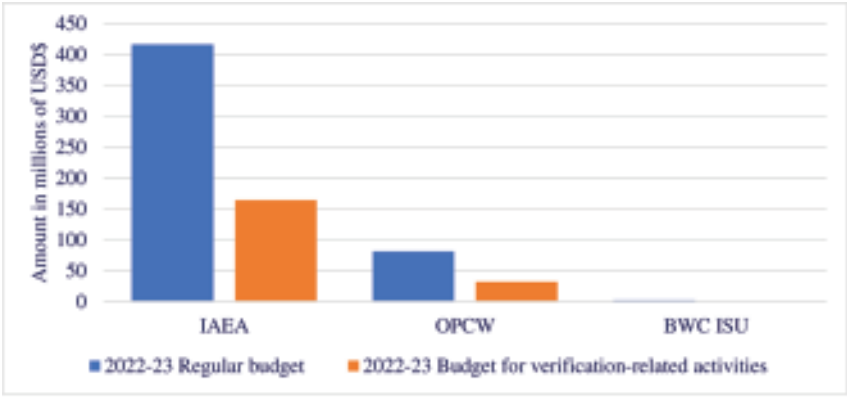

Figure 8.1: Comparison in Organizational Budgets[32]

8.5.5. An evolving biological threat landscape

The 2024 Working Group discussion on BWC verification exhibited new interest and understanding of the "biological threat landscape". This understanding is an important first step if states are to develop and effective mechanism that address present and future threats. As noted by the Friends of the Chair "given the rapid development in science and technology, we will need a fresh and future-proof approach to ensure strengthening of the Convention in a meaningful way."[33]

Whilst BWC States Parties have not entered into a systematic discussion on the biological threat landscape, several working papers recognized the importance of clarity around this threat landscape.[34] For example, a working paper by Germany mentioned that "it will be necessary to take into account the scientific and technological state of the art and the chances and risks associated with it from a verification point of view" further adding that a "mechanism to review and assess scientific and technological developments of relevance to the BWC (S&T Mechanism) could play a role in this regard".[35]

8.6. Momentum Lost?

During the Fifth Working Group session in 2024, States appeared to make progress toward establishing two mechanisms: one focused on International Cooperation and Assistance (ICA) and the other on Science and Technology (S&T). By the end of the two-week session, discussions had shifted from technical details to political fine-tuning, signalling a step forward in consensus-building, with both mechanisms forming a key point of the Chair's roadmap for advancing the BWC[36] which recommend that:

> *"From its establishment until the Tenth Review Conference in 2027, the Science and Technology Advisory Mechanism will focus exclusively on providing scientific and technological advice to the Working Group on possible compliance and verification measures. In this regard, the Science and Technology Mechanism will evaluate tools and methods to enhance compliance and verification measures".*

Although there were initial concerns that a politically sensitive verification focus might overwhelm the S&T mechanism, the proposal had a clear rationale. While BWC verification is inherently a political process, any effective mechanism must be grounded in a strong scientific understanding of both the threats and the technological opportunities available to detect non-compliance.

This logic appears to have help building momentum around the Chair's proposal. However, on the penultimate evening of the Fifth Session of the Working Group it became clear during informal consultations that one state had a different understanding of the Working Group mandate developed at the Ninth BWC Review Conference. As the Italian President of the Ninth BWC Review Conference, Ambassador Leonardo Bencini, stated the following morning:

> *"...one delegation opposed the proposal for a special conference to adopt the two mechanisms, arguing that ... the Final Document allows for the convening of a special conference only when this Working Group completes its work and agrees on a report. In other words, we should agree on all the items in the WG's mandate before convening a special conference".*[37]

The outcome was that the Working Group was unable to agree on the Chair's roadmap, much to the frustration of the Chair—whose opening remarks on the final day remain "the most furious" many commentators have ever heard in a diplomatic forum - and many BWC States parties who had supported the establishment of the mechanisms through the convening of a Special Conference in 2025.[38]

8.7. Looking Ahead to the Tenth BWC Review Conference

At the time of writing, the fate of the Chair's proposal remains uncertain, as does the prospect of reviving the significant momentum generated by the Working Group. If this momentum is not regained, the BWC will suffer a serious setback, as the establishment of the two mechanisms could have significantly strengthened multiple aspects of the Convention in its fiftieth year.

Moreover, the envisioned focus of an S&T mechanism on "possible compliance and verification measures," as outlined in the Chair's roadmap, could have provided crucial technical input into the verification debate. This would have included examining new and emerging technological opportunities to enhance confidence in compliance. Over time, the S&T mechanism—or even expert groups—could have facilitated an in-depth technical analysis of specific verification measures, such as routine inspections or site visits, to assess their potential role in a future verification framework. Such an approach would offer a more empirically grounded evaluation of these methods' utility.

While technical discussions alone cannot resolve what is ultimately also a political and financial issue, they could help foster a more informed debate on verification mechanisms suited to the challenges of the 21st century. If States genuinely seek to strengthen the BWC, they would do well to reflect on lessons from past initiatives like VEREX and the Ad-Hoc Group. However, the scientific, technological, political, and institutional landscape has evolved considerably. Simply retracing past efforts is unlikely to provide a viable solution to today's challenges.

Instead, States Parties must define a clear and realistic vision for what verification can achieve within the BWC framework in the modern era, taking into account the Friends of the Chair's call for any systems to be "politically palatable, technologically, feasible, financially, viable and sustainable".[39] This will require careful preparation, including assessing the evolving threat landscape, rigorously testing the effectiveness of verification methods, validating technologies and agreeing upon procedures, and ensuring that the BWC is supported by an adequately resourced institutional framework. Such steps are not easy, especially in the current geopolitical context, but nor is it beyond the capacity of States Parties to develop a mechanism capable to provide greater confidence in compliance with the BWC.

NOTES

1 UN. *Final Verbatim Record of the Conference of the Eighteen-Nation Committee on Disarmament, Meeting 387*. Ann Arbor, MI: University of Michigan. August 6, 1968. https://digitallibrary.un.org/record/1626926?ln=en&v=pdf pg, 7

2 Chevrier, M. I. "The Politics of Biological Disarmament." In *Deadly Cultures*, edited by M. Wheelis, L. Rozsa, and M. Dando, 324. Massachusetts: Harvard University Press. 2006. pg, 324.

3 Chevrier, M. I., "The Politics of Biological Disarmament." In *Deadly Cultures*, edited by M. Wheelis, L. Rozsa, and M. Dando, 324. Massachusetts: Harvard University Press. 2006. pg, 232.

4 Littlewood, Jez. 2005. *The Biological Weapons Convention: A Failed Revolution.* Ashgate. Pg16.

5 UN. "Summary Records of the Twelfth Meeting." *BWC/CONF.I/SR.12*, March 21, 1980. Geneva. http://www.opbw.org/rev_cons/1rc/docs/conf/BWC_Conf.I_10_ PartIVa_E.pdf. pg, 3

6 Cole, L. A. "Sverdlovsk, Yellow Rain and Novel Soviet Bioweapons: Allegations and Responses." In *Preventing a Biological Arms Race*, edited by S. Wright. London: MIT Press. 1990. pg, 199.

7 Moodie, M. "Bolstering Compliance with the Biological Weapons Convention: Prospects for the Special Conference." *Chemical Weapons Convention Bulletin*, no. 25 September, 1994. http://hsp.sussex.ac.uk/new/_uploads/bulletin/CWCB25.PDF . pg, 2.

8 UN. *Third BWC Review Conference Final Document*. BWC/CONF.III/23. Geneva: United Nations. 1991. https://docs-library.unoda.org/Biological_Weapons_ Convention_-_Third_Review_Conference_(1991)/BWC_CONF.III_23.pdf.

9 UN. *Summary Report of the Ad Hoc Group of Governmental Experts (VEREX)*. BWC/CONF.III/VEREX/8. Geneva: United Nations. 1994. https://docs.un.org/BWC/CONF.III/VEREX/8. pg 8.

10 For a detailed account, see Littlewood, Jez. *The Biological Weapons Convention: A*

Failed Revolution. Ashgate. 2005.

11 http://www.sussex.ac.uk/Units/spru/hsp/documents/cbwcb37.pdf

12 The March Ad Hoc Group session saw a further useful development in that the individual Friends of the Chair categorized the remaining square brackets in the text for which they are responsible into three categories including those issues on which there were "strong conceptual differences in views" UN. *Procedural Report of the Ad Hoc Group of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, Part II, Annex IV: Proposals for Further Consideration by the Chairman and Friends of the Chair*. Geneva: United Nations. 2000. https://documents.unoda.org/wp-content/uploads/2021/07/BWC_AHG_54-converted.pdf. pg 3

13 UN. *Ad Hoc Group of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, 23rd Session, Geneva,* Geneva: United Nations. 23 April–11 May, *2001*.https://documents.unoda.org/wp-content/uploads/2021/07/BWC_AHG_54-converted.pdf.

14 Brugger, Seth. "Toth Issues Draft BWC Protocol, Reactions in Geneva Mixed." *Arms Control Today* 31 (4): 28–29. 2001. https://www.armscontrol.org/act/2001-05/press-releases/toth-issues-draft-bwc-protocol-reactions-geneva-mixed.

15 For example, in 2005, Iran stated that "any viable approach to strengthening the BTWC lies in the mandate and the work of the Ad Hoc Group, established by the 1994 Special Conference". See Iran. "Statement by the Islamic Republic of Iran." Meeting of States Parties, December 5–9, Geneva. 2005. https://web.archive.org/web/20060506120138/http://www.opbw.org/new_process/msp2005/statements/iran_E.pdf. pg, 1.

16 Jenkins, Bonnie. "Remarks to United Nations First Committee (5 Minutes)." UNFC General Debate Speech. October 6, 2021.

17 Jenkins, Bonnie. "Statement by Under Secretary of State Bonnie Jenkins to the 2021 Biological Weapons Convention Meeting of States Parties." November 22, 2021. https://geneva.usmission.gov/2021/11/22/remarks-to-the-2021-biological-weapons-convention-meeting-of-states-parties/.

18 Bencini, Leonardo, Henk Cor van der Kwast, and Gustavo Zlauvinen. "Reflections on Review Conferences: The Nuclear Non-Proliferation Treaty, the Biological Weapons Convention, and the Chemical Weapons Convention." *UNIDIR*, Geneva. 2023. https://docs.un.org/en/A/C.1/78/PV.14.

19 *Ibid*

20 Guthrie, Richard.. "The Second Day: The General Debate and Points of Order." RevCon Report 3, Wednesday, November 30, 2022. https://www.cbw-events.org.uk/RC22-combined.pdf. pg 6.

21 UN. *Final Document of the Ninth Review Conference*. BWC/CONF.IX/9. Geneva: United Nations. 2022. https://unodaweb-meetings.unoda.org/public/2022-12/2022-1221%20BWC_CONF_IX_9%20adv%20vers.pdf. pg 9.

22 See In Den Bosch, Robert, and Alonso Ruiz. "Statement to the Working Group on

the Strengthening of the Biological Weapons Convention, Third Session." December 7, 2023. https://unodaweb-meetings.unoda.org/public/2023-12/2023-1207%20proc %20report_DRAFT.pdf.

23 UN. "A Common Basis to Consider Verification." BWC/WG/5/WP.6/Rev.2, France December 4, 2024. https://documents.un.org/doc/undoc/gen/g24/222/92/pdf/g2422292.pdf. pg 2-4

24 UN "Considerations for Compliance and Verification of the Biological and Toxin Weapons Convention." BWC/WG/5/WP.7, Germany. November 29, 2024. https://documents.un.org/doc/undoc/gen/g24/219/58/pdf/g2421958.pdf. pg 3.

25 UN. "Food for Thought on Compliance and Verification." BWC/WG/5/WP.11, December 2, 2024. https://documents.un.org/doc/undoc/gen/g24/220/82/pdf/g2422082.pdf. pg 2.

26 UN. "Conceptual and Methodological Aspects of a Possible Mechanism of Verification of the Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction." BWC/WG/3/WP.5, Russian Federation. November 29, 2023. https://documents.un.org/doc/undoc/gen/g23/245/69/pdf/g2324569.pdf. pg 2-3.

27 UN. Outcome of Discussions by the Friend of the Chair on Measures to Promote Compliance. BWC/AD HOC GROUP/L.53/Add.2, July 26, 1999. Fifteenth Session, Geneva. https://docs-library.unoda.org/Biological_Weapons_Convention_-_Ad_Hoc_Group_Fifteenth_session_(1999)/BWC_AHG_L.53_Add.02.pdf. pg 1.

28 Suseanu, Ionut. *IAEA Safeguards System*. Third Session of the Working Group on Strengthening the Biological Weapons Convention, December 4–8, 2023. Office of Legal Affairs. https://docs-library.unoda.org/Biological_Weapons_Convention_-Working_Group_on_the_strengthening_of_the_ConventionThird_session_(2023)/WG_WBC_IAEA_presentation_as_delivered_6December.pdf. pg 2.

29 Ghionis, Alexander, Alexander Kelle, and María Garzón Maceda. "Preparing for Success at the Fifth Review Conference of the Chemical Weapons Convention: A Guide to the Issues." UNIDIR, Geneva. February 6, 2023. https://doi.org/10.37559/WMD/23/CWC/01.

30 UN. "Food for Thought on Compliance and Verification." BWC/WG/5/WP.11, Switzerland. December 2, 2024. https://docs.un.org/en/BWC/WG/5/WP.11. pg 3.

31 UN. "Possible Structure/Functions of a BWC Implementation Organization." BWC/WG/5/WP.1/Rev.1, United States of America. November 12, 2024. https://documents.un.org/doc/undoc/gen/g24/207/05/pdf/g2420705.pdf#:~:text=O ne%20approach%20for%20the%20Working,review%20of%20annual%20information%20submissions.&text=specifically%20tailored%20to%20the%20unique,concerns%20re garding%20activities%20at%20facilities. pg 3.

32 Revill, James. "Verifying the BWC: A Primer." UNIDIR, Geneva, Switzerland. 2023. https://doi.org/10.37559/WMD/23/Bio.verification.primer1.

33 UN. Working Group on the Strengthening of the Biological Weapons Convention, Third Session. December 7, 2023. https://conf.unog.ch/digitalrecordings/en/clients/61.0619/meetings/C44180D9-C317-4EF8-9BD9-CF361FD6746E/15h21/en.

34 The EU cautioned of the impact of "Rapid progress in biotechnology will significantly change the risk landscape" EU. "Position of the European Union and Its Member States on Compliance and Verification." BWC/WG/5/WP.13, December 16, 2024. https://docs.un.org/en/BWC/WG/5/WP.13

35 UN. "Considerations for Compliance and Verification of the Biological and Toxin Weapons Convention." BWC/WG/5/WP.7, Germany. November 29, 2024. https://documents.un.org/doc/undoc/gen/g24/219/58/pdf/g2421958.pdf. pg 5.

36 UN. *Draft Recommendation of the Working Group on the Strengthening of the Biological Weapons Convention Proposing a Special Conference in 2025.* BWC/WG/5/CRP.1, December 8, 2024. https://docs-library.unoda.org/Biological_Weapons_ Convention _-Working_Group_on_the_ strengthening_of_ the_ConventionFifth_session_(2024)/2024-1208_draft_Chairs_CRP1_0.pdf. pg 1.

37 Bencini, Leonardo. "Closing Statement to the Working Group on the Strengthening of the Biological Weapons Convention (BWC) – 5th Session." December 13, 2024.

38 Guthrie, Richard. "Fifth Session Closure – A Rare Speech and Concerns for the Future." *BWPP Report*, December 16, 2024. https://cbw-events.org.uk/BWC24-16.pdf.

39 In Den Bosch, Robert, and Alonso Ruiz. "Statement to the Working Group on the Strengthening of the Biological Weapons Convention, Third Session." December 7, 2023.

SECTION IV

SCIENCE, SAFETY AND SECURITY

9

The Biological Weapons Convention at 50: Emerging Technological Challenges, Historical Lessons, and India's Strategic Imperative

Dr. Mrinmayee Bhushan

9.1. Introduction: Between Aspiration and Fragility

The year 2025 marks the fiftieth anniversary of the Biological Weapons Convention (BWC)—the first multilateral disarmament treaty banning an entire class of weapons of mass destruction. Opened for signature in 1972 and entering into force in 1975, the BWC was a product of Cold War diplomacy, intended to draw a moral and legal boundary against the militarization of biology. Yet, as the world enters a new phase of geopolitical turbulence and technological acceleration, the BWC's symbolic legacy risks being overshadowed by its institutional stagnation.

The BWC was designed in an era when the threat of biological warfare was primarily defined by state-level industrial bioweapons programs, such as those of the United States, the Soviet Union, and the United Kingdom. It was not built to address the challenges posed by digitally encoded biology, open-source genome databases, or AI-driven pathogen design—each of which can now enable small groups or individuals to synthesize dangerous pathogens de novo using commercially available platforms.[1] As these scientific frontiers

advance, the boundaries between peaceful research and hostile applications have become increasingly porous, further compounded by the absence of a verification protocol or compliance mechanism within the BWC framework.

In contrast to the top-down structure of intergovernmental treaties, scientific communities have historically exhibited a remarkable capacity for anticipatory governance. One of the most significant milestones in this regard was the Asilomar Conference on Recombinant DNA in 1975. Convened by leading molecular biologists—including Paul Berg, Maxine Singer, and others—Asilomar reflected a profound ethical reckoning within the scientific community at the dawn of recombinant DNA technology. Recognizing the unpredictable risks of gene manipulation, the conference produced a voluntary moratorium on certain classes of high-risk experiments and led to the development of biosafety level (BSL) laboratory practices, which remain foundational today.[2]

The Asilomar precedent demonstrated that scientific restraint and normative self-regulation could emerge even in the absence of state intervention. However, the durability of such self-regulation has since been tested by the democratization of synthetic biology, the rise of techno-nationalism, and the strategic exploitation of biotechnology by state and non-state actors. In this context, the lack of an institutional scientific advisory board within the BWC ecosystem—unlike the Chemical Weapons Convention's Scientific Advisory Board[3] represents a critical structural gap. Moreover, attempts to establish verification protocols, particularly during the Fifth Review Conference in 2001, collapsed due to resistance from major powers, primarily the United States, citing concerns over industrial espionage and proprietary research exposure.[4]

Today, as geopolitical rivalries intensify, the BWC risks becoming a skeleton framework: normatively aspirational but strategically hollow. The contemporary challenge is not simply the weaponization of pathogens by rogue regimes, but the convergent threat landscape—where AI, cyber tools, gene editing, and platform biotechnologies coalesce into unprecedented security risks. The US-China techno-scientific competition, the global diffusion of CRISPR and DNA synthesis platforms, and the loss of trust in multilateral health governance post-COVID-19 have all contributed to a climate where strategic ambiguity and plausible deniability thrive.

As this chapter will argue, the BWC must now be assessed not merely by

its text or longevity but by its strategic utility in the current and emerging threat landscape. This includes examining its institutional limitations, revisiting parallel histories of scientific foresight and restraint, and particularly from Indian perspective, addressing the urgent need for national and regional biodefence architectures that go beyond normative reliance on a multilateral framework that no longer commands universal confidence.

9.2. The BWC's Evolution: Diplomatic Milestones Amid Scientific Disruption

When the Biological Weapons Convention (BWC) was opened for signature in 1972 and entered into force in 1975, it stood as a bold commitment by the international community to ban one of the most insidious forms of warfare. Coming on the heels of the renunciation of the U.S. offensive biological weapons program by President Richard Nixon in 1969, the treaty's entry into force represented a rare moment of Cold War convergence on ethical grounds. It prohibited the development, production, and stockpiling of microbial or other biological agents "of types and in quantities that have no justification for prophylactic, protective, or other peaceful purposes".

However, the treaty was born with structural compromises. Most notably, it lacked any provisions for verification, inspection, or enforcement. Unlike the Chemical Weapons Convention (CWC), which established a verification regime and an implementation body (the Organisation for the Prohibition of Chemical Weapons, OPCW), the BWC relies on voluntary confidence-building measures (CBMs), ad hoc meetings, and politically negotiated review conferences. Its institutional base remains a small Implementation Support Unit (ISU) within the United Nations Office for Disarmament Affairs (UNODA), with limited capacity or mandate.

9.2.1. Asilomar 1975 and the Unanswered Questions of the BWC

The Asilomar Conference of 1975 has long stood as a defining moment of ethical reckoning within the scientific community. Yet, in the sweep of its legacy—the voluntary moratorium, the dramatic pause in progress, and the spirit of self-regulation—one question remains curiously unresolved: why did the global diplomatic machinery negotiating the Biological Weapons Convention (BWC), which entered into force that same year, not incorporate the very threats the scientists at Asilomar were urgently confronting?

Only two years before Asilomar, concerns about laboratory safety and the public implications of recombinant DNA research had begun surfacing in the scientific literature. Paul Berg and Norton Zinder, deeply aware of the unintended consequences of manipulating the building blocks of life, sounded an early alarm. By early 1973, nearly a hundred scientists convened at the Asilomar Conference Center to discuss the biohazards inherent in this revolutionary domain of genetic engineering. What began as a scientific colloquy quickly spilled into the public domain—legislators threatened regulatory clampdowns, activist groups decried potential ecological and ethical catastrophes, and even some within the scientific community began calling for outright bans. The specter of a repeat of the atomic era, with its legacy of Hiroshima, napalm, and Agent Orange, loomed heavily over the proceedings. The age of scientific innocence was undeniably over.

By 1974, the scientific community had done something unprecedented: it chose restraint over ambition. At Berg's urging, researchers worldwide halted high-risk experiments. The so-called Berg Letter, co-signed by a pantheon of biotechnology pioneers, issued a clarion call for caution. It warned against experimentation that might unwittingly create antibiotic-resistant, toxic, or cancer-inducing organisms. Notably, these warnings also extended to fears about how recombinant DNA might be weaponized[5]—yet that dimension remained largely unspoken in official diplomatic corridors. However, it was intriguing to note that this intensely debated matter till 1977, quickly faded away and were replaced by soothing reassurances.[6]

This context makes the silence about the impact of breakthrough dual use technological developments within the BWC negotiations all the more puzzling. The Convention was negotiated in an era of mounting scientific awareness about the risks of genetic manipulation, and yet its final text remained rooted in the vocabulary of state-led biological warfare from an earlier age—focused on pathogens and toxins, but not on the emerging means of creating new ones. The potential for recombinant DNA to serve as a platform for novel bioweapons, or for synthetic life to be misused for malevolent purposes, was conspicuously absent from the treaty's scope.

The BWC was, in essence, a Cold War artifact—negotiated in the shadow of offensive bio-warfare programs, a string of allegations of covert deployment of bio-weapons for sabotaging human, animal and crop health as an economic

warfare strategy (Operation Mongoose[7] in Cuba,[8] Korean war and International Scientific Commission reports[9]); and with a focus on disarmament between major powers. It failed to anticipate the democratization of biotechnology and the coming age of dual-use dilemmas. While scientists in California were pausing in humility, diplomats in Geneva were concluding a treaty that would soon appear outdated in the face of biological innovations it did not foresee.

This disjuncture between Asilomar and the BWC underscores a critical lesson: the governance of emerging technologies cannot afford to be isolated within disciplinary or institutional silos. The "Spirit of Asilomar 2025" aspires to correct this by integrating ethics, public engagement, scientific foresight, and policy coordination into one coherent framework. It seeks to renew the normative firewall against biological weapons—not just through prohibition but through proactive, anticipatory governance of high-risk research.

As we reflect fifty years later, it becomes evident that while Asilomar seeded a culture of scientific responsibility, the BWC missed a vital opportunity to enshrine that spirit within international law. The convergence of science and diplomacy remains an unfinished project—one that the next generation must now complete.

9.2.2. Challenges and Gaps in the BWC Framework

While the Biological Weapons Convention (BWC) has been instrumental in establishing norms against the development and use of biological weapons, its effectiveness has been constrained by several challenges. These gaps have become more pronounced in the face of rapid technological advancements and evolving security threats. This section examines the limitations in the BWC framework, focusing on structural, operational, and technological dimensions.

I. *Structural Limitations of the Biological Weapons Convention*

The BWC, although foundational, remains the weakest pillar among the three disarmament treaties (BWC, CWC, NPT). Since its inception in 1972, it has lacked an institutional framework to enforce compliance, no scientific advisory board to guide its application in light of emerging technologies, and most critically, no verification protocol akin to the Organisation for the Prohibition of Chemical Weapons (OPCW) under the CWC.

Efforts to establish a verification regime, particularly during the Review Conference of 2001, collapsed under geopolitical pressure—primarily due to objections from the U.S. and other Western states citing risks to proprietary research and national security.[10] Since then, Confidence Building Measures (CBMs) have been voluntary and sporadically reported, rendering them ineffective as a deterrent.

One of the most significant weaknesses of the BWC is the absence of a formal verification regime to ensure compliance with its provisions. Unlike the Chemical Weapons Convention (CWC) and the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), the BWC relies primarily on trust and voluntary transparency measures.

II. *Insufficient Adaptation to Technological Change*

In an age where emerging biotechnologies blur the lines between offensive and defensive research, this skeletal framework offers little assurance against proliferation. Particularly problematic is the BWC's inability to address the proliferation of convergent threats: bio-cyber weapons, gene drives, AI-engineered pathogens, and weaponization of neurobiology.[11]

The pace of scientific and technological advancement often outstrips the BWC's ability to adapt, leaving significant gaps in biosecurity governance.

- **Monitoring Emerging Technologies**: There is no formal mechanism for tracking developments in fields like synthetic biology, quantum computing, or AI, despite their profound implications for the Convention.
- **Ethical and Regulatory Challenges**: Efforts to embed biosecurity in scientific research are fragmented and lack universal standards, leaving gaps in oversight for dual-use technologies.
- **Challenges of Convergence**: The overlap between biotechnology and other fields (e.g., robotics, cybernetics, and nanotechnology) creates new avenues for bioweapons development that the BWC has yet to address comprehensively.

III. *Ineffective Confidence-Building Measures (CBMs)*

CBMs, introduced in 1986, were designed to promote transparency

among States Parties by encouraging voluntary declarations of biological research activities and facilities. However, their impact has been limited. Due to Low Participation Rates, Lack of Enforcement and Transparency Challenges. Some states are hesitant to disclose sensitive information, citing national security or proprietary concerns.[12]

Across the decades, efforts to strengthen the BWC have encountered significant resistance. The Third Review Conference in 1991 introduced CBMs to enhance transparency, but participation has been inconsistent and non-binding. The Fifth Review Conference in 2001—widely expected to deliver a verification protocol—collapsed following the unilateral withdrawal of the United States, citing risks to national security and proprietary research. This occurred just weeks after the 9/11 attacks and the anthrax letters incident, both of which reshaped the U.S. biosecurity landscape, leading to domestic initiatives but weakening international consensus.

Subsequent review conferences—held every five years—have produced aspirational declarations but no substantive legal or institutional progress. The Eighth Review Conference in 2016 was marked by political gridlock, with states failing to agree on even minimal language for future work. Meanwhile, the global bio-innovation landscape has moved forward at breakneck speed. DNA synthesis companies now routinely handle customer orders for genetic material, and several cloud-based platforms offer AI-generated designs for synthetic pathogens and toxin expression. This decentralized, privatized, and accelerated biotechnological environment poses risks that the BWC is not equipped to manage.

A further asymmetry has emerged between scientific capacity and normative oversight. The BWC does not have a standing Scientific Advisory Board, leaving it unable to meaningfully assess or respond to developments in fields such as synthetic biology, gene editing, systems biology, or human performance enhancement technologies. These capabilities—once the domain of military laboratories—are now commercially available, open-source, and often untethered from regulatory scrutiny, even in advanced industrial nations. The net result is a treaty architecture that, while morally resonant, is increasingly

detached from operational realities.

This divergence is not lost on geopolitical actors. Several major powers have expressed concern over the opacity of dual-use research being conducted by their rivals. The post-COVID environment, in particular, has witnessed an erosion of trust in global health institutions and increased strategic ambiguity surrounding the intersection of biodefense and biological warfare R&D. Public speculation—fueled by political statements, declassified intelligence documents, and partisan media coverage—has also reignited debates about U.S. research grants via USAID and NIH, dual-use funding structures, and the lack of international oversight mechanisms.

In this climate, the BWC risks being further sidelined—not by irrelevance, but by inadequacy. It was designed for a world of state-centric warfare and centralized R&D; it now finds itself in a world of bio-economies, decentralized innovation, and strategic disinformation. Unless it adapts—or unless nations build parallel bio-defense and deterrence architectures to complement it—its 50th anniversary could also be its geopolitical tipping point.

9.3. Strategic Disintegration and the Case for National Bio-Defence Architectures

9.3.1. Current Relevance of Biotechnology and Emerging Technologies

The 21st century has witnessed a surge in technological innovation, with biotechnology at the forefront. Alongside breakthroughs like synthetic biology and CRISPR gene editing, other emerging technologies such as quantum computing, cybernetics, robotics and advanced engineering disciplines are converging with biotechnology to transform the global threat landscape. This section explores these advancements, limitations of the Biological Weapons Convention (BWC) to regulate dual use developments, and need for comprehensive preparedness at national level.

I. *Breakthrough Technologies and their Implications*

- **Synthetic Biology:** Synthetic biology has expanded the capacity to design and engineer biological systems from the ground up.

Researchers can now create entirely new organisms or modify existing ones to enhance traits such as virulence or resistance to treatment. These capabilities raise concerns about the de novo synthesis of pathogens, which could bypass traditional oversight mechanisms.[13]

- **CRISPR and Gene Drives:** CRISPR technology enables precise genome editing, while gene drives allow for the intentional spread of genetic modifications through populations. Though these tools hold great promise for eradicating diseases and pests, they could also be weaponized to target specific populations or disrupt ecosystems.[14]
- **Neuro-technology and cognitive weapons:** The threat of another arms race looms large, driven by geopolitical rivalries and disruptive technological advancements. The blurring lines between biological, chemical, and neurological warfare introduce new-age neuro-warfare threats that can manipulate cognition, behavior, and decision-making processes. The weaponization of biochemistry is no longer limited to state actors; it is increasingly being exploited by non-state actors, rogue entities, and transnational networks that challenge traditional deterrence and response frameworks.[15]
- **Artificial Intelligence (AI):** AI, with its ability to swiftly bridge the knowledge gaps, accelerates bioinformatics research by enabling rapid analysis of genetic data, predicting the effects of genetic modifications, and even designing new biological agents. AI-driven tools can streamline vaccine and therapeutic development but could also facilitate the creation of designer pathogens and toxins.[16]
- **Nanotechnology:** Advances in nanotechnology have enabled the development of nanoscale delivery systems for drugs, vaccines, and genetic material. While these technologies offer groundbreaking medical applications, they also pose risks if adapted to deliver biological agents in targeted or aerosolized forms; and for developing race-specific weapons or the defensive strategies.[17]
- **Additive Manufacturing (3D Bio-printing):** Bio-printers can create living tissues, including organoids and synthetic tissues, potentially revolutionizing medicine. However, this technology could also be

misused to recreate pathogenic tissues or enhance biological agents.[18]

- **Quantum Technology:** Quantum computing offers immense potential for solving complex biological problems, such as protein folding or drug discovery. However, its ability to process vast amounts of genetic and biological data could also aid in the rapid design and simulation of harmful biological agents.[19]
- **Data security, Cybernetics and Advanced Medical Devices:** The integration of biological systems with cybernetic devices—such as neural interfaces or wearable sensors—blurs the line between biology and technology. Cyber-attacks threaten data security of public health infrastructure, industrial intellectual property and critical manufacturing operations. The cybernetics has revolutionized the historical aerial deployment of bio-weapons in the form of miniature drones and drone swarms. Medical devices with remote access such as pace-makers or insulin pumps can be potentially compromised by hacking.[20]
- **Chemical and Robotics Engineering in Medical Devices:** Advanced engineering technologies have led to innovations in robotics, such as surgical robots, and chemical processes for drug synthesis and delivery. These technologies can be exploited for developing sophisticated mechanisms to disseminate biological agents, complicating detection and response efforts.

9.3.2. Convergence of Disciplines

The convergence of biotechnology with other fields—such as Chemical, AI, quantum computing, nanotechnology, and cybernetics—has amplified the complexity of the biosecurity landscape. These interdisciplinary innovations:

- Enable greater precision in the design and delivery of biological agents.
- Accelerate the pace of technological development, often outstripping regulatory frameworks.
- Increase accessibility to advanced tools, lowering barriers for non-state actors and individuals with malicious intent.

For example, combining AI with synthetic biology allows for predictive modeling of gene-editing outcomes, while quantum computing could dramatically shorten the time needed to simulate complex biological processes.

Similarly, robotic systems integrated with nanotechnology can create automated, scalable platforms for pathogen production or delivery.

The rapid interplay of these fields necessitates a more integrated approach to biosecurity, as traditional mechanisms may not be sufficient to address the multifaceted risks posed by such convergence.

9.3.3. Efforts to Regulate Dual-Use Technologies

The growing recognition of dual-use risks has prompted national and international efforts to establish regulatory frameworks, particularly for Gain of Function research. However, progress remains uneven and fragmented, with significant challenges in achieving global consensus.

I. *National Frameworks*

Many countries have introduced national advisory boards, export controls and research oversight measures for dual-use technologies. For instance, the U.S. Select Agent Program regulates access to pathogens and toxins, while the European Union enforces dual-use export controls under its Common Foreign and Security Policy.

II. *International Norms and Agreements*

- **BWC Confidence-Building Measures (CBMs):** These voluntary measures encourage transparency in dual-use research but lack enforceability and consistent reporting.
- **United Nations Security Council Resolution 1540 (2004):** This resolution requires states to prevent non-state actors from acquiring weapons of mass destruction, including biological agents, though its implementation varies widely.

III. *Science and Technology Reviews*

The BWC Review Conferences have increasingly focused on addressing emerging technologies. The Eighth and Ninth Review Conferences emphasized strengthening international cooperation to monitor dual-use research and promote ethical guidelines for scientific conduct.[21]

IV. *Ethical Guidelines and Codes of Conduct*

Efforts to embed biosecurity into the life sciences have included the development of ethical codes for researchers, particularly those

working with synthetic biology and gene editing. The International Gene Synthesis Consortium, for example, has established screening protocols for synthetic DNA orders.[22]

V. *Other International Regimes*

International regimes like the Wassenaar Agreement, Missile Technology Control Regime (MTCR), the Nuclear Suppliers Group (NSG), the Australia Group, and the Chemical Weapons Convention (CWC) also play a role in regulating dual-use technologies relevant to BWC.

The integration of new and converging technologies presents both opportunities and challenges for the BWC. Efforts to regulate these technologies must strike a delicate balance between fostering scientific progress and mitigating risks. However, fragmented governance and differing national priorities hinder the development of a cohesive global framework. Addressing these challenges will require enhanced international cooperation and the alignment of scientific, legal, and policy initiatives.

9.3.4. Paradigm Shifts in Global Geopolitics

The past five years have witnessed a systemic erosion of multilateralism—not just in arms control but across global health and security frameworks. The U.S. withdrawal from the WHO, the dismantling of USAID platform, and the rise of geopolitical antagonisms, particularly between the United States and China, have destabilized long-standing norms around biological non-proliferation. As the Biological Weapons Convention (BWC) approaches its sixth decade, its institutional fragility—marked by the absence of a verification regime, enforcement mechanism, or scientific advisory board—has become starkly apparent. While BWC member states continue to reaffirm its moral salience, the technological, political, and strategic terrain has outpaced its structural capacity.

Simultaneously, the politicization of bioscience—fueled by competing narratives around the origins of COVID-19, declassified intelligence documents on covert operations, and arms race dynamics—has blurred the lines between biodefense and bio-warfare. These events include Operation Mongoose files declassified by the U.S. National Archives in 2025 reaffirm

Cold War-era bio-warfare planning against Cuba, and virus hunting program PREDICT funded by USAID which failed to predict Covid-19, eventually contributed to the dismantling of USAID. These revelations have triggered widespread international concern about asymmetric compliance and covert proliferation under the cover of health diplomacy.

I. *US-China Bio-Tech Arms Race*

The U.S.-China rivalry has now extended decisively into the domains of synthetic biology, AI, quantum computing, and biodefence infrastructure. Both nations have adopted dual-use development strategies, wherein innovations in life sciences serve civilian and military goals simultaneously. China's Military-Civil Fusion policy encourages PLA-linked institutions to invest in gene-editing, vaccine development, bio-surveillance platforms and cognitive weapons. In contrast, the collaboration of the U.S. and China has continued significant investments through USAID, Eco Health Alliance and NIH on Gain of Function Research as evidenced during the Covid-19 origin investigations and their alliance for virus surveillance via the USAID's PREDICT program.[23]

These techno-nationalist agendas raise the threat of an uncontrolled bio-tech arms race, with vast implications for global security. The 2017 synthesis of an extinct horsepox virus using mail-order DNA, published in *PLOS ONE*, demonstrated the practical feasibility of de novo pathogen creation using publicly available genomes—underscoring the vulnerabilities created by synthetic biology.

This convergence of bioinformatics, gene synthesis, and computational design could eventually make the synthesis of viruses like variola major (smallpox) possible, thus bypassing existing controls over live virus stockpiles held by the U.S., UK and Russia as the BWC repository countries.

While the bioweapons arms race has roots in 20th-century geopolitical conflicts, the advent of convergent emerging technologies has accelerated the stakes in modern-day warfare. In particular, the arms race between the U.S. and China now encompasses the development of neuro-weapons, designed to affect human cognition, perception, and decision-making processes.[24]

II. *Global Realignments in 2025*

During his first term, Trump's decision to withdraw the U.S. from the World Health Organization (WHO) at the height of the COVID-19 pandemic sent shockwaves through the international community. Scrutiny of USAID's role in controversial disease surveillance, capacity-building projects across the Global South and viral research—particularly under the PREDICT program[25]—intensified after reports emerged of indirect funding channels linked to Wuhan-based labs, reviving concerns about dual-use research of concern (DURC) and potential violations of the Biological Weapons Convention (BWC).[26] Although direct links remain speculative, media and political commentary have flagged USAID and NIH's potential role in gain-of-function research, challenging the transparency of biological research pipelines.

These developments have widened mistrust in multilateral oversight systems and accelerated the move toward unilateral biodefence postures, weakening the BWC's global relevance.

III. *Declassified Files and Cold War Echoes: Operation Mongoose and Historical Precedents*

The recent declassification of the JFK assassination files, particularly those related to Operation Mongoose,[27] underscores the longstanding history of covert biological operations. Operation Mongoose (1961–63) authorized by the Kennedy administration aimed to destabilize Cuba through a range of covert tactics, including biological sabotage, psychological warfare, and potential use of disease agents. The lesser known World War II history of US-UK collusion in keeping the secret[28] of heinous bio-chemical war crimes of Japanese Imperial Army against the Chinese, Russian civilians and POWs in lieu of valuable scientific and human clinical trial data[29] generated by the Japanese Unit 731. Motivated by the arms race with the Soviet Union, The United States not just acquired the knowhow, and protected the architect of Unit 731 Shiro Ishii and his fellow war criminals but also ensured that they were 'taken care of' financially by the then US government.[30]

These historical precedents challenge assumptions that the U.S. or its

allies have always upheld biological norms. In today's context, with the proliferation of dual-use technologies and AI-designed pathogens, the same logic of *plausible deniability* and *covert action* could be repurposed by other actors—both state and non-state. Given the absence of real-time verification mechanisms in the BWC, such activities could proceed without meaningful accountability.

In a recent interview, the Director of National Intelligence of US Tulsi Gabbard delivered a scathing indictment of the U.S. administration's role in the funding of Gain-of-Function (GoF) research,[31] particularly highlighting the controversial involvement of the Wuhan Institute of Virology (WIV)—a potential origin site of the COVID-19 pandemic. Gabbard questioned the opaque financial pathways that channeled U.S. taxpayer funds through the Eco Health Alliance, under the oversight of former NIH Head, Dr. Anthony Fauci, to conduct high-risk virological GOF experiments in China. Her remarks echoed mounting public and congressional outrage over the lack of accountability, especially in light of reports suggesting Fauci may have received preemptive legal indemnity shielding him from prosecution. The new U.S. administration has signaled a crackdown on these legacy arrangements, suggesting possible criminal investigations and institutional reforms.

These revelations, surfacing during the 50th anniversary of the Biological Weapons Convention (BWC), cast a long shadow over global biosecurity norms. These efforts to bring about transparency, while exposing the loopholes in dual-use research oversight, also erode the moral authority of key BWC signatories, especially the United States, to demand compliance from others. This crisis of credibility may hinder efforts to strengthen BWC enforcement mechanisms, particularly at a time when the convention is under pressure from emerging biotechnologies and geopolitical rivalries.

This situation calls into question the effectiveness of existing arms control regimes and demonstrates how historical patterns of covert bio-warfare and plausible deniability have contemporary relevance in the grey zones of modern conflict.

IV. *Conclusion: The BWC at a Tipping Point*

The BWC, though noble in its intent, is facing existential stress. The dissolution of multilateral cooperation, advances in dual-use biology, and the re-emergence of geopolitical rivalries threaten to disintegrate this fragile edifice. Unless reformed with urgency, the BWC risks becoming a symbolic gesture rather than a substantive guardrail.

In this geopolitical moment—defined by fractured global governance and emerging bio-threats—India must step beyond normative frameworks and proactively build a resilient, verifiable, and credible deterrence architecture. A robust national bio-defence strategy is not only vital for safeguarding public health and national security, but also for ensuring India's relevance and leadership in global non-proliferation diplomacy.

9.3.5. India's Vulnerability: Historical Experience and Strategic Oversight

India's own historical experience with biological warfare—both as a target of experimentation and as a case study in institutional apathy—adds a sharp dimension to this discourse. Declassified documents from the Cold War era, have provided credible evidence that between the 1950s and the early 1970s, the United States conducted vector-based bio-warfare experiments over Indian territory without the knowledge of Indian Government.[32]

These experiments, often carried out without informed consent or even basic notification to the Indian public or the Indian government, included a variety of experiments in simulated warfare conditions in India. While cloaked in scientific language and conducted by philanthropic organizations and NGOs, these operations were part of Project Pacific,[33] broader U.S. Department of Defense programs intended to test biological dissemination in tropical climates—India being treated as a proxy for Southeast Asia and the Pacific theater.

India's institutional response at the time was shaped by Cold War dependencies and an underdeveloped security bureaucracy. However, internal audits of government performance did not go silent. The Public Accounts Committee (PAC) Reports of 1974-75 and 1975-76 contained scathing observations on India's lack of preparedness, absence of inter-ministerial

coordination, and failure to develop a bio-defence doctrine in light of repeated violations of territorial integrity through foreign experiments.

Specifically, PAC Report No.167 (1974-75)[34] raised alarm over:

> *"The committee find that the Genetic Control of Mosquito Unit Project, the Bird Migration and arbovirus studies at the Bombay Natural History Society, the Ultra Low Volume Spray experiment for Malaria Control at Jodhpur, the Pantnagar Microbial Pesticides Project and some of the research projects undertaken in West Bengal and Narangwal in collaboration with the Johns Hopkins University establish beyond a doubt a definite pattern. This is that agencies of foreign governments, in some cases explicitly military agencies of those governments have been conducting basic research through Indian scientist and Indian scientific organizations. Even in case where such research is carried out in collaboration with philanthropic civilian organizations from abroad, the committee find that some of these 'civilian' organizations also have active liaison and communication at several levels with military agencies."*

The Committee also raised concerns:

> *"What causes surprise to the Committee, and this ought to be a matter of grave public concern also, is the lack of security consciousness in the Indian agencies involved in these projects and the casual attitude and indifference towards foreign supported research in India."*

Similarly, the PAC Report No. 200 (1975-76) noted[35]:

> *"Government should decide that all proposals for scientific investigations proposed to be undertaken in these defined areas with the help of or in any association with foreign organisations or with foreign monies from any source should be sent by the Ministry, Agency, Laboratory or private institution concerned to a nodal point within the government for a comprehensive review and clearance.* ***This nodal point should be a high power committee of scientists headed by the Scientific Adviser to the Ministry of Defence but can include. and perhaps ought to include. other high security agencies of Government****. The Committee desire that once this mechanism has been set up, it should also review all existing projects of the types mentioned in the preceding paragraph."*

> *"As already pointed out in paragraph 7.1.86 of the 167th Report (Fifth Lok Sabha), the scrutiny of the 'sensitive and security aspects' of research projects should not be viewed in a narrow formal sense, involving only military installations or military information, but more comprehensively, and with a special eye on their inter-connected connotations."*

These observations—nearly fifty years old—remain tragically relevant today. Despite India's emergence as a biotechnological and pharmaceutical powerhouse, its national security architecture continues to treat biological threats as subordinate to conventional or nuclear concerns, with no institutional focus for coordinated biodefence planning. The Ministry of Health, Department of Biotechnology, DRDO, and armed forces all operate in silos, while critical decisions are often reactive, rather than anticipatory. The Niti Aayog's Pandemic Preparedness Plans[36] or recommendations in the legal framework and disease surveillance framework by the 22nd Law Commission report[37] made in response to COVID-19, have addressed most deficiencies. However, these reports barely discuss the possible deliberate weaponization of advanced biotechnology to threaten human, animal and food security as threats to national security.

9.3.6. A Strategic Imperative Beyond the BWC

Given these historical vulnerabilities and current institutional gaps, India must now pivot from its doctrinal dependence on the BWC. Treaty-based deterrence has limited value in a world where verification is non-existent, enforcement is voluntary, and compliance is politicized. India should not wait for the BWC to evolve; rather, it must construct a parallel, sovereign biodefence strategy—much like it has done in the nuclear, cyber and space domains.

India's path forward should be informed by its past—where foreign interests weaponized its territory for experimentation—and its present, where the strength of BWC is further eroded and multilateralism is under stress. Only through institutional foresight, strategic alignment, and scientific integration can India credibly deter and defeat the next generation of biological threats.

9.4. Toward a Comprehensive Preparedness Strategy: From Normative Commitments to Strategic Capability

With the growing fragility of global biological disarmament frameworks and

the acceleration of dual-use technological convergence, India cannot afford to outsource its biosecurity to multilateral instruments alone. Instead, it must cultivate internal strategic depth—blending constitutional mandates, scientific innovation, national security priorities, and economic ambition into a coherent bio-defence architecture. This strategy must not only deter hostile actors but also build international investor confidence, protect public health, and future-proof the nation's ambitions in the bio-economy and convergent technologies.

9.4.1. India's Strategic Reluctance: A Call for a National Bio-Defence Strategy

Despite its prominence in pharmaceuticals and vaccine manufacturing, India lacks a national biodefence architecture. Unlike the U.S. (with its National Biodefense Strategy),[38] the U.K. Biosecurity Strategy,[39] or even South Korea,[40] India does not have a dedicated agency or roadmap for bio-threat mitigation. National preparedness is currently dispersed across ministries—with the Ministry of Health leading outbreak responses, and the Department of Biotechnology and DRDO working on bio-research, but with little inter-ministerial synergy.

The lack of awareness regarding the scale and depth of these threats in the Indian stakeholders is evident in recent Delhi High Court proceedings regarding of 2023 Parliament breach case. It was indicated that 'If use of smoke canister is a terrorist act, every Holi & IPL match will also attract UAPA' despite the argument of the prosecution, opposing Azad's bail plea, arguing that the accused wanted to bring back the 'haunted memories' of what had happened in the old Parliament (on the anniversary of the 2001 Parliament attack) to the 'majestic new Parliament building'.[41] Another example of a 'routine' public health incidence which attracted attention of the experts was the neurotoxin poisoning of citizens of Badhal, in the border district of Rajouri in J&K.[42] Incidents that appear 'benign' or 'routine' may in fact serve as beta tests for impending terrorist attacks or threats to national security.

Indian policy discourse continues to place disproportionate faith in the BWC, assuming it provides sufficient protection. However, with BWC mechanisms increasingly incapable of addressing contemporary threats, this reliance is misplaced.

It is imperative that Indian experts and strategic advisors initiate a paradigm shift:

I. *Drafting a National Bio-Defence Strategy*

- Setting up an inter-ministerial National Bio-Chemical Defence Agency under the National Security Council Secretariat (NSCS).
- Launching a bio-threat surveillance and attribution program, powered by AI and microbial forensics.
- Comprehensive strategy for capacity-building across all the stakeholders.
- Engaging regional actors through BIMSTEC and IORA to shape a South-South biosecurity dialogue.

II. *The Preparedness Cycle: A Five-Stage Framework*

Drawing inspiration from the U.S. B-PLAT (Biodefense Policy Landscape Analysis Tool) and WHO's global frameworks for emergency preparedness, India's strategy must integrate the following five pillars:

- **Prevention** – Strong bio-surveillance infrastructure, dual-use research oversight, import/export regulation of sensitive biological materials, and biosafety training across institutions.
- **Preparedness** – National stockpiles of PPE and therapeutics, civilian-military joint simulations, genomic sentinel networks, and pre-approved response protocols.
- **Response** – Inter-agency task forces, unified command-and-control for bio-incidents, rapid diagnostics deployment, and health system surge capacities, and battlefield pathogen containment protocols
- **Risk Awareness and Communication** – Multilingual risk communication campaigns, real-time public alert systems, and data-sharing platforms across public and private health providers.
- **Recovery and Resilience** – Legal indemnity frameworks, post-incident audits, adaptive policy feedback loops, and economic recovery assistance for affected sectors.

To operationalize this cycle, India must establish a National Bio-Chemical Defence Agency (NBCDA) under the National Security Council Secretariat

(NSCS)—with cross-ministerial authority spanning health, home, defence, agriculture, science, industry, and intelligence. This agency would integrate strategic foresight with tactical coordination.

9.4.2. Mapping the Strategic and Economic Imperative: The Bio-economy and CETs

India's aspirations to become a global bio-economy leader—articulated in its Bio-economy 3.0 (BioE3) Policy[43]—cannot be realized without an equally ambitious biosecurity infrastructure. The policy envisions scaling India's bio-economy from $80 billion in 2021 to $300 billion by 2030, driven by innovation in biopharma, agri-biotech, bioenergy, genomics, and synthetic biology.[44] However, this vision inherently sits at the frontier of convergent emerging technologies (CETs)—including AI-biology interfaces, neuro-synaptic tools, nano-biotechnology, and programmable cell systems—all of which carry immense dual-use potential.

Global investors and domestic industry stakeholders increasingly recognize the risks posed by unregulated CET environments. In a post-pandemic world where public trust, compliance regimes, and traceability systems matter as much as innovation, biosecurity is no longer a compliance checkbox—it is a strategic enabler. Nations that build guardrails for safe innovation will attract Foreign Direct Investment (FDI), global R&D partnerships, and technology transfers. Those that fail to do so will see de-risking and capital flight, particularly in high-trust sectors like bio-manufacturing, Bio-AI hubs and gene editing.

India's future in the Global South Bio-economy Leadership space hinges on its ability to offer:

- A **robust national bio-security governance framework**, including real-time certification, threat modeling, and incident reporting;
- **A comprehensive protocol for surveillance of a variety of biological threats (not limited to infectious diseases)**;
- **A robust legal framework to address all new-age biological deliberate threats to national security;**
- A centralized **National Bio-chemical Defence Agency** with scientific, legal, and ethical representation to protect the Bio-economy from economic warfare;

- And biosecurity frameworks and **confidence-building mechanisms** for global partners.

Only through such measures can India strengthen its comprehensive deterrence to new-age threats of biological origin.

In conclusion, while global frameworks offer valuable blueprints, India must craft a context-specific comprehensive preparedness strategy that reflects its geopolitical realities, socio-economic diversity, and legacy of frugal innovation. Rather than relying on massive standalone allocations for biodefence, India can strategically leverage existing public health, disaster management, and national security budgets to build a resilient, integrated, and sustainable response system. By doing so, India not only addresses its niche threat landscape effectively but also sets a precedent for cost-effective preparedness models that other developing nations can emulate.

9.5. Conclusion: Sovereignty Through Preparedness

For over five decades, the Biological Weapons Convention (BWC) has been a foundational pillar of global disarmament and non-proliferation, setting essential norms against the development, production, and use of biological weapons. Yet, in today's world—shaped by accelerating technological advancements and shifting geopolitical fault lines—the BWC faces growing challenges to its relevance and enforcement. To remain effective, the Convention must evolve to address the dual-use dilemmas posed by emerging technologies and bolster its mechanisms for preventing misuse.

I. *Balancing Innovation and Security*

A central theme throughout this discussion is the urgent need to strike a balance between the promise of scientific innovation and the risks it may entail. Tools like CRISPR, synthetic biology, and artificial intelligence offer revolutionary potential across medicine, agriculture, and sustainability. Harnessing these tools for peaceful purposes will be key to ensuring their benefits are realized. However, this demands robust governance frameworks—ones that anticipate dual-use risks, foster transparency, enable international cooperation, and promote equitable access. Trust-building among States Parties will be crucial in averting a biological arms race and ensuring that innovation is steered towards the global good.

II. *The Year of significance for India*

The year 2025 marks a pivotal milestone—not only as the Golden Jubilee of the Biological Weapons Convention and the historic Asilomar Conference, but also as a critical year for India's national security in the context of biological threats. In the mid-1970s, while global deliberations were underway on the BWC and the potential weaponization of scientific advancements like recombinant DNA and converging emerging technologies, the Indian Parliament was rocked by revelations of bio-warfare experiments conducted within the country by foreign entities and NGOs.

In this evolving landscape, the BWC—despite its symbolic value—can no longer serve as the cornerstone of India's biological security strategy. India today is situated at the crossroads of three transformative revolutions: the unraveling of legacy disarmament regimes, the convergence of disruptive technologies reshaping biological threats, and an economic pivot powered by biotech innovation. In such a moment, strategic adequacy demands more than passive compliance. India must transition from being a rule-follower to a rule-shaper—designing its own biodefence doctrine, institutional infrastructure, and dual-use governance mechanisms. This is not only vital for India's own security but also for amplifying the voice of the Global South in shaping future biosecurity norms.

The grey-zone nature of biological threats—marked by covert operations, delayed or disguised impacts, and the challenge of direct attribution—demands urgent and proactive action. These characteristics make timely and effective responses nearly impossible without a robust, anticipatory strategy. India's national security apparatus, public health institutions, policymakers, and scientific community must converge to build a resilient biosecurity framework grounded in a comprehensive understanding of both the threat to the bio-economy and the evolving modalities of new-age bio-chemical warfare.

While India's nuclear doctrine provides for a nuclear response in the event of a major bio-chemical attack, translating this declaratory policy into credible deterrence requires a comprehensive preparedness strategy that addresses both conventional and emerging threats. In this rapidly

evolving landscape, India must adopt an adaptive and forward-looking approach that favour prevention and resilience over reaction and remediation.

Like its nuclear doctrine, India's biosecurity approach must be deterrence-driven, institutionally robust, and globally respected. Only through such a strategy can India protect its population, safeguard its growing bio-economy, and offer a credible leadership model for the developing world.

What the Non-Aligned Movement achieved for nuclear geopolitics in the last century, India's leadership in bio-defence and ethical converging emerging technologies (CET) can do for this one. The moment for decisive action is not after the next biological crisis—but now.

NOTES

1 "*Since HPXV may be extinct and the only specimen of HPXV that has been identified is unavailable for investigation, we explored whether HPXV could be obtained by largescale gene synthesis. Ten large (10–30 kb) fragments of DNA were synthesized based on the HPXV sequence along with two 157 ntVACV terminal sequences, and were recombined into alive synthetic chimeric HPXV (scHPXV) incells infected with Shope fibroma virus (SFV).*" Ryan S. Noyce, Seth Lederman, David H. Evans, *Construction of an infectious horsepox virus vaccine from chemically synthesized DNA fragments*. *PLOS ONE*, Volume 13 Number 1. January 19, 2018. 10.1371/journal.pone.0188453. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0188453

2 Paul Berg, David Baltimore, Sydney Brenner, Richard O. Roblin III, Maxine F. Singer, *Summary statement of the Asilomar conference on recombinant DNA molecules*.Proc. Natl. Acad. Sci. USA. June 1975.Volume 72 Number 6, pg. 1981–1984. https://www.pnas.org/doi/abs/10.1073/pnas.72.6.1981

3 Scientific Advisory Board *Keeping pace with scientific and technological change*. Organisation for the Prohibition of Chemical Weapons. May 7, 2025. https://www.opcw.org/about/subsidiary-bodies/scientific-advisory-board

4 John R. Walker, *Reflections on the 2001 BWC Protocol and the verification challenge*. The Nonproliferation Review, Volume 27 Number 4-6, pg. 507–515, September 1, 2020. https://doi.org/10.1080/10736700.2020.1865635

5 "*Earlier questions about lab safety quickly evolved into unease among scientists and the science press about how recombinant DN/A might be deployed, including in biological weapons*."
Ben Seal, *An Absolute Good? : Paul Berg, controversy, and the engineering of life*. Science History Institute. February 6 , 2025. https://www.sciencehistory.org/stories/magazine/an-absolute-good/

6 Susan Wright, *Molecular Biology or Molecular Politics? The Production of Scientific Consensus on the Hazards of Recombinant DNA Technology.* Soc. Stud. Sci. November 1986. Volume 16 Number 4 pg. 593–620. https://pubmed.ncbi.nlm.nih.gov/11650809/

7 NSC, Memorandum for the Record, Minutes of Meeting of the Special Group (Augmented) on Operation MONGOOSE. National Security Archive. September 6, 1962 https://nsarchive.gwu.edu/sites/default/files/documents/6434721/National-Security-Archive-Doc-15B-NSC-Memorandum.pdf

8 *Kennedy and Cuba: Operation Mongoose*. National Security Archive. October 3, 2019 https://nsarchive.gwu.edu/briefing-book/cuba/2019-10-03/kennedy-cuba-operation-mongoose

9 Report of the International Scientific Commission for the Investigation of the Facts Concerning Bacterial Warfare in Korea and China. The National Archives. 1952. https://discovery.nationalarchives.gov.uk/details/r/2c89ee98-ef76-4fcf-8d9f-9a9fdc53ab8f

10 John R. Walker, *Reflections on the 2001 BWC Protocol and the verification challenge*. Nonproliferation Review. September 1, 2020. Volume 27 Number 4-6, pg. 507–515. https://www.tandfonline.com/doi/full/10.1080/10736700.2020.1865635

11 Mark Wheelis and Malcolm Dando, *Neurobiology: A case study of the imminent militarization of biology*. International Review of the Red Cross. September 2005. Volume 87 Number 859, pg. 553–571. https://international-review.icrc.org/sites/default/files/irrc_859_8.pdf

12 Iris Hunger & The Sunshine Project, *Confidence-building needs transparency: A summary of data submitted under the Bioweapons Convention's confidence building measures*. The Carl Friedrich von Weizsäcker Centre for Science and Peace Research. September 2005. http://www.biological-arms-control.org/publications/hunger_CBM.pdf

13 "*SynBio is a rapidly developing and diffusing technology. The wide availability of the protocols, procedures, and techniques necessary to produce and modify living organisms combined with an exponential increase in the availability of genetic data is leading to a revolution in science affecting the threat landscape that can be rivaled only by the development of the atomic bomb. As the technology improves, the level of education and skills necessary to engineer biological agents decreases. Whereas only state actors historically had the resources to develop and employ biological weapons, SynBio is changing the threat paradigm. The economic and social impact of COVID-19 has highlighted the broad and lasting effects that can result from the spread of a novel biological agent. This collective experience has increased the chance that terrorist organizations will attempt to use biological agents to asymmetrically attack the United States and its allies. This possibility should be anticipated and planned for at all levels of government*."
J. Kenneth Wickiser, Kevin J. O'Donovan, Michael Washington, Stephen Hummel, F. John Burpo, *Engineered Pathogens and Unnatural Biological Weapons: The Future Threat of Synthetic Biology.* Combating Terrorism Center at West Point. August 2020. Volume 13 Number 8 https://ctc.westpoint.edu/engineered-pathogens-and-unnatural-biological-weapons-the-future-threat-of-synthetic-biology/

14 *"A particularly sentinel feature of novel gene editor techniques such as CRISPR/Cas is their fairly broad and facile accessibility. Unlike other weaponizable elements (eg, materials in the nuclear realm, or scheduled chemicals on lists of toxins), CRISPR/Cas tools are comparatively inexpensive and available to a wide variety of actors. Customizable kits are commercially available, and companies (eg, AddGene) make sequences accessible to any user. Security concerns arise from the notion that state actors could reengineer traditional bioweaponry agents with new gene editing tools, including those that affect the nervous system. A wider group of actors wishing to take advantage of editing technology to create bioagents could be included in the risk space for neuroagents."*

"The ability to accurately target specific genes in the brain could enable both specific and generalized modulation of key aspects of physiological function, cognition, and behavior. Novel gene-editing technologies and techniques will allow further elucidation of functional genetic and epigenetic mechanisms that can be used to develop potential neurotherapeutics and enable creation of new, or alteration of existing, biosynthetic pathways that are involved in neurological functions. But as we and others have noted, there is frequent and relatively easy "spillover" from the medical silo to dual- and direct-use arenas of weapon development and production."

Diane DiEuliis, James Giordano *Why Gene Editors Like CRISPR/Cas May Be a Game-Changer for Neuroweapons*. Health Security. June 1, 2017 Volume 15 Number 3 pg. 296–302. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5510677/

15 "*It is unwise—and inapt—to overestimate (or underestimate) the capability of neuro S/T, and it is equally foolish to misjudge the power conferred by this science or the tendency for certain groups to misdirect and misuse these technologies and the power they yield. Granted, there is robust political—and thus national security—power that can be gained and leveraged through neuro S/T. Although contributory to new dimensions of military capability, such power is not limited to war-fighting capacity. The changing political "power shift from the West towards the East … [as] consequence of the latest … financial crises"… and the growing prominence of non-Western nations in neuro S/T research and production afford a number of heretofore ineffectual nations a greater economic presence upon the world stage. Taken together with the relative accessibility of neuro S/T to nonstate actors, this creates new scenarios of socioeconomic and political dependencies, and rebalances power equations of global politics, influence, and defense needs and capabilities*."

James Giordano, *Neurotechnology in National Security and Defense: Practical Considerations, Neuroethical Concerns*. Routledge & CRC Press. ISBN 9781032922454. October 14, 2024. https://www.routledge.com/Neurotechnology-in-National-Security-and-Defense-Practical-Considerations-Neuroethical-Concerns/Giordano/p/book/9781032922454

16 Christopher A. Mouton, Caleb Lucas, Ella Guest, *The Operational Risks of AI in Large-Scale Biological Attacks: A Red-Team Approach. Research and Development* (RAND). Oct 16, 2023. https://www.rand.org/pubs/research_reports/RRA2977-1.html

17 Muhammad Hamdan Khan, *Bioweapons Targeting Specific Ethnicities: A Threat and Nanotechnology's Promise* For Defence – OpEd. Eurasia Review. March 27, 2023. https://www.eurasiareview.com/27032023-bioweapons-targeting-specific-

ethnicities-a-threat-and-nanotechnologys-promise-for-defence-oped/

18 *"3D printing could develop gas centrifuges out of carbon fibre for uranium enrichment or to produce explosives for radiological dispersal devices. It could also be used to make laboratory equipment for the development of bio-weapons or to bio-print tissue samples to assess their effectiveness. It could aid the creation of miniaturised fluidic reaction ware devices for synthesising chemical agents and producing WMD means of delivery, especially drones capable of dispersing chemical agents and pathogens."*
Nicolò Miotto, *3D printing and WMD terrorism: a threat in the making? European Leadership Network*. January 10, 2024. https://europeanleadershipnetwork.org/commentary/3d-printing-and-wmd-terrorism-a-threat-in-the-making/

19 "*Quantum genetics could pose a great danger to humanity, allowing scientists to manipulate the human genome at very deep levels. This could lead to genetic mutations that could be dangerous to human health and survival. Furthermore, this technology could also be used to create biological weapons that could be used to attack entire populations. Finally, quantum genetics could also be used to create artificial organisms that could be stronger and smarter than humans and thus threaten the survival of humanity*."
Jeremy Lamri, *The Promises of Quantum Genetics. Medium Future of Work & Society —Towards the quaternary economy.* December 27, 2022. https://medium.com/future-of-work-society-towards-the-quaternary/the-promises-of-quantum-genetics-9d62920f28b6

20 "*Cyber-Biosecurity, an emerging threat landscape at the intersection of cybersecurity, cyber-physical security and biosecurity has a potential to disrupt economic, social and political wellbeing of the nation and has tremendous national security implications. All forms of cyber-attacks impact the manufacturing industries, governments, health infrastructure, patients and Bio-economy at large. Rapidly evolving Cyber-Biosecurity threat landscape has potential to disrupt the rapid growth of Indian Bio-economy by compromising data security and intellectual property, disrupting manufacturing operations and supply chains resulting in destabilising investor confidence in Indian BioEconomy*."
Mrinmayee Bhushan, *Cyber-Biosecurity: An Emerging National Security Frontier*. Journal of Defence Studies. Manohar Parrikar Institute for Defence Studies and Analyses. April 20, 2023. Volume 17 Number 2 https://www.idsa.in/publisher/journal-of-defence-studies/cyber-biosecurity-an-emerging-national-security-frontier

21 Jez Littlewood, *Potential outcomes of the Ninth BWC Review Conference*. United Nations Institute for Disarmament Research, March 21, 2022 https://unidir.org/wp-content/uploads/2023/05/UNIDIR_Potential_Outcomes_9th_BWC_RevCon.pdf

22 International Gene Synthesis Consortium, *Harmonized screening protocol; gene sequence and customer screening to promote biosecurity*. Georgetown University. July 12, 2011. https://repository.library.georgetown.edu/handle/10822/515010

23 Emily Kopp, State Department, *USAID endorsed novel virus project with China despite national security risks*. U.S. Right to Know. December 19, 2024. https://usrtk.org/risky-research/state-usaid-endorsed-virus-project-with-china-despite-national-security-risks/

24 Armin Krishnan, *Military Neuroscience and the Coming Age of Neurowarfare*. Taylor and Francis Group. October 4, 2016. doi:10.4324/9781315595429. https://www.taylorfrancis.com/books/mono/10.4324/9781315595429/military-neuroscience-coming-age-neurowarfare-armin-krishnan

25 *Predict: Advancing Global Health Security at the Frontiers of Disease Emergence.* United States Agency for International Development. https://ohi.vetmed.ucdavis.edu/sites/g/files/dgvnsk5251/files/inline-files/PREDICT%20LEGACY%20-%20FINAL%20FOR%20WEB_0.pdf

26 Emily Kopp, *Elon Musk's Claim Linking USAID to Bioweapons isn't as Far-Fetched as the Deep State wants you to Think*. The Daily Caller. February 5, 2025 https://dailycaller.com/2025/02/05/elon-musks-linking-usaid-bioweapons-covid-wuhan/?utm_content=bufferaf832&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer

27 *Kennedy and Cuba: Operation Mongoose*. National Security Archive. October 3, 2019. https://nsarchive.gwu.edu/briefing-book/cuba/2019-10-03/kennedy-cuba-operation-mongoose

28 William King & Jeanne Guillemin, *The price of alliance: Anglo-American intelligence cooperation and Imperial Japan's criminal biological warfare programme, 1944–1947.* Intelligence and National Security. Taylor and Francis Online. October 21, 2018. Volume 34 Number 2, pg. 263–277. https://www.tandfonline.com/doi/full/10.1080/02684527.2018.1534646?scroll=top&needAccess=true

29 "The experiments were as horrific as any conducted by the Nazis, yet the Camp Detrick specialists dispassionately concluded in their summary of the report of B W Investigations of 12 December 1947 that the potential benefits of the research for the Western biological warfare programme far outweighed the demands of justice. If the Japanese were to be questioned by the Russians, then they rather than the Americans would obtain the benefits of wartime research. Their concluding recommendation read as follows: *Evidence gathered in this investigation has greatly supplemented and amplified previous aspects of this field. It represents data which have been acquired by Japanese scientists at the expenditure of many millions of dollars and years of work. Information has accrued with respect to human susceptibility to these diseases as indicated by specific infectious doses of bacteria. Such information could not be obtained in our own laboratories because of scruples attached to human experimentation. These data were acquired with a total outlay of $250,000 to date, a mere pittance by comparison with the actual cost of the studies.... It is hoped that individuals who voluntarily contributed this information will be spared embarrassment because of it, and that every effort be made to prevent this information falling into other hands.*

Jeremy Paxman, Robert Harris, *A Higher Form of Killing*. Random House. ISBN 9780307430403. December 18, 2007

30 Stephen Endicott, Edward Hagerman, *The United States and Biological Warfare: Secrets from the Early Cold War and Korea*. Indiana University Press. ISBN 13: 9780253334725. November 22, 1998.

31 "The administration last month launched a web page making the case that the pandemic originated in a Chinese lab and accusing former NIH official Anthony Fauci of covering it up. In her interview with Kelly, Gabbard pointed to NIH

grants that went to gain-of-function research to make a case that such research led to the pandemic. 'In the case of the Wuhan lab, as well as many other bio labs around the world, was actually U.S. funded, and leads to this dangerous kind of research that in many examples has resulted in either a pandemic or some other major health crisis,"' Gabbard said. Kennedy argued that a lab leak following U.S.-funded research caused the pandemic in his 2023 book, 'The Wuhan Cover-Up: And the Terrifying Bioweapons Arms Race.'

Erin Schumaker, Tulsi Gabbard is out to prove Covid came from a lab. POLITICO. January 5, 2025 https://www.politico.com/news/2025/05/01/gabbard-00322598.

32 "*The Bombay Natural History Society's (BNHS) bird banding project, funded over the years by the US Army, the Smithsonian Institution, and the World Health Organization played a role in this endeavor. In exchange for the WHO funding for the bird banding project, Dr. Ali agreed to work related to collecting ticks and blood samples from monkeys for another project called the Kyasanur Forest Disease Virus (KFDV) project, being conducted by the Rockefeller Foundation in India. The Migratory Animals Pathological Survey (MAPS), a front organization of the US Army Medical Research Laboratory, and the Pacific Ocean Biological Survey (POBS), were also involved in this KFDV project of WHO.*"

Dr. Mrinmayee Bhushan , Lt. Gen. Vinod Khandare, *Silent Weapons Deadly Secrets-Unveiling the Bioweapons Arms Race.* Pathak Publishers and Distributors. ISBN 13: 9789391952945. January 1, 2024

33 "*Much of what the Smithsonian researchers did was standard procedure. But against the background of the military's interest, their reports read like the passages out of* ***The Andromeda Strain****. Bird samples were taken within 20 minutes of capture, placed in glass vials, frozen, then shipped to Fort Detrick*." "*Among the dozens of contracts with the military, the Smithsonian has conducted a study of dolphins with a Navy grant, an Air Force study of the Demilitarized Zone in Korea, focusing on '****diseases of man transmitted by animal vectors****' and 1966-68 Army study on mosquitoes as vectors of disease in South Asia.*"

Ted Gup, The Smithsonian Secret: *Why an innocent bird study went straight to biological warfare experts at Fort Detrick.* Washington Post. 12 May 1985. Pg 8. https://www.cia.gov/readingroom/docs/CIA-RDP90-00965R000302600001-3.pdf

34 Public Accounts Committee (1974-75) Fifth Lok Sabha, 167th report, and 200th report*, "Foreign participation or collaboration in reserve projects in India",* New Delhi: the Lok Sabha Secretariat https://web.archive.org/web/20241208202728/https://eparlib.nic.in/bitstream/123456789/4081/1/pac_5_167_1975.pdf

35 Public Accounts Committee (1975-76) Fifth Lok Sabha, 200th report, *"Foreign participation or collaboration in reserve projects in India"*, New Delhi: the Lok Sabha Secretariat https://eparlib.nic.in/bitstream/123456789/4132/1/pac_5_200_1976.pdf

36 Report of the Expert Group—*Future Pandemic preparedness and emergency response-A Framework for Action.* NITI Aayog. August 2024. https://www.niti.gov.in/sites/default/files/2024-09/Report-of-the-Exper-Group—Future-Pandemic-preparedness-and-emergency-response_0.pdf

37 The 22nd Law Commission, *A Comprehensive Review of the Epidemic Diseases Act, 1897. Report no 286*. Government of India, Law Commission of India. February 2024. https://cdnbbsr.s3waas.gov.in/s3ca0daec69b5adc880fb464895726dbdf/uploads/2024/02/20240212724768593.pdf

38 National Biodefense Strategy, *National Biodefense Strategy and Implementation Plan: For Countering biological Threats, Enhancing Pandemic Preparedness, and Achieving Global Health Security.* October 2022. https://bidenwhitehouse.archives.gov/wp-content/uploads/2022/10/National-Biodefense-Strategy-and-Implementation-Plan-Final.pdf

39 UK Biological Security Strategy. Report CP858. HM Government. June 2023 https://assets.publishing.service.gov.uk/media/64c0ded51e10bf000e17ceba/UK_Biological_Security_Strategy.pdf

40 Hyun Jung (Henry) Kim, *Biosecurity Strategy I: The Necessity of Introducing a Korean - Nucleic Acid Synthesis Screening System.* INSS Strategic Report Volume 1 Number 1. Institute For National Security Strategy. 2025. https://www.inss.re.kr/common/viewer.do?atchFileId=F20250321170917691&fileSn=0

41 "*The Delhi High Court has raised serious concerns over the application of the Unlawful Activities (Prevention) Act (UAPA) in the 2023 Parliament security breach case*." Vivek G., Using Smoke Canister Not Necessarily a 'Terrorist Act': Delhi High Court Questions UAPA Charge in Parliament Breach Case. Court Book. April 25,2025 https://courtbook.in/posts/using-smoke-canister-not-necessarily-a-terrorist-act-delhi-high-court-questions-uapa-charge-in-parliament-breach-case

42 "*The series of deaths, concentrated within three interconnected families, were initially attributed to potential viral or bacterial outbreak. However, toxicology reports ruled out infectious diseases and instead pointed to neurotoxic exposure. Symptoms observed in victims included severe neurological damage, with some patients experiencing seizures, loss of consciousness, and respiratory failure. In response, authorities imposed medical restrictions in the village, quarantining over 230 people who had been in contact with the deceased. Several patients exhibiting similar symptoms were transferred to hospitals in Jammu and Chandigarh for further treatment. The Jammu and Kashmir government formed an 11-member Special Investigation Team (SIT) to probe the incident. Toxicology results from a Lucknow-based forensic lab confirmed the presence of neurotoxins, but officials have yet to determine the exact source—whether it stems from contaminated food, water, environmental factors, or man-made factors*." Nasir Hussain, *Rajouri Deaths: Specific Neurotoxin Source Still an Unresolved Puzzle.* Kashmir Times. March 8, 2025. https://kashmirtimes.com/in-focus/specific-neurotoxin-source-still-an-unresolved-puzzle

43 BioE3 Policy (Biotechnology for Economy, Environment and Employment): Fostering High Performance Biomanufacturing. Department of Biotechnology, Ministry of Science and Technology, Government of India. August 2024. https://bmi.dbtindia.gov.in/pdf/folder.pdf

44 Narayanan Suresh, Srinivas Rao Chandan, Mr G S Krishnan, *India BioEconomy Report 2024*. Biotechnology Industry Research Assistance Council. 2024. https://www.birac.nic.in/webcontent/IBER_2024.pdf

10

Securing the Life Sciences: The Role of Biosafety and Biosecurity in the Biological Weapons Convention

Dr. Ketan Thorat and Dr. Suryesh Kumar Namdeo

10.1. Introduction

Historically, biology was a science centred on observation and understanding. However, ground-breaking discoveries such as the identification of DNA's structure in 1953, recombinant DNA technology in the 1970s, CRISPR-Cas9 gene editing in 2012, and mirror life in 2024 transformed it into a powerful engineering discipline.[1,2,3] These advances revolutionised medicine, agriculture, and industry by enabling precise genetic manipulation and the creation of novel biological systems. However, they also introduced significant risks, including the potential misuse of these technologies for developing biological weapons. This shift underscores the need to prioritise global biosafety and biosecurity measures and strengthen frameworks like the Biological Weapons Convention (BWC) to mitigate the dual-use risks associated with these transformative tools.[4]

The interplay between scientific advancement and global security has become increasingly critical in life sciences. While biotechnology offers unprecedented opportunities for innovation, it also poses risks that demand robust biosafety and biosecurity practices. These measures are essential to ensure

biological research does not inadvertently or intentionally harm humanity, aligning with the BWC's goal of preventing the proliferation and misuse of biological weapons.

Biosafety focuses on preventing accidental exposure to or release of harmful biological agents through policies and practices that protect researchers, the environment, and the public. It also provides frameworks for managing risks associated with biological research. High-containment facilities, like those working with Ebola, Hantavirus, and Marburg virus exemplify the importance of rigorous safety protocols in mitigating risks. In contrast, biosecurity addresses the growing concern that advances in biotechnology could be exploited for nefarious purposes, such as the development of biological weapons or bioterrorism. Effective biosecurity measures are indispensable for maintaining control over sensitive biological materials. For example, the 2001 anthrax attacks in the United States underscored the need for stringent biosecurity practices, as they revealed vulnerabilities in the storage, transfer, and oversight of dangerous biological agents.[5] Similarly, concerns about the dual-use nature of life sciences research—where scientific advancements can be repurposed for harmful applications—highlight the necessity of robust biosecurity frameworks.

Both biosafety and biosecurity align seamlessly with the objectives of the BWC, which was adopted in 1975 to prohibit the development, production, and stockpiling of biological and toxin weapons.[6] While the BWC provides a foundational legal framework, the practical implementation of biosafety and biosecurity measures complements the treaty by reducing the risks of accidental or deliberate misuse of biological materials.

The importance of integrating biosafety and biosecurity into the BWC framework has been underscored by real-world incidents. Historical events such as the Sverdlovsk anthrax outbreak in 1979 demonstrated the catastrophic consequences of biosafety failures in laboratories.[7] More recently, the COVID-19 pandemic has brought global attention to the vulnerabilities in managing emerging pathogens, emphasizing the critical role of biosafety and biosecurity in preventing future pandemics. The pandemic has also led to renewed discussions on enhancing global cooperation and capacity-building in biosafety and biosecurity, particularly in low-resource settings.

Emerging technologies, such as synthetic biology, gene editing, and mirror

life, further underscore the need for robust biosafety and biosecurity measures. These technologies have the potential to revolutionise medicine and agriculture but also pose new risks if misused. For example, the ease of access to CRISPR-Cas9 gene-editing tools raises concerns about the potential for creating harmful biological agents. Similarly, the growth of Do-It-Yourself (DIY) biology and cloud laboratories, which offer remote access to sophisticated research tools, presents challenges for monitoring and regulating biological research conducted outside traditional institutional settings.[8]

This chapter discusses the conceptual understanding and case studies of biosafety and biosecurity. It also explores the evolution of these concepts within the BWC framework, analysing their roles in risk mitigation, the challenges of implementation, and their relevance in addressing emerging threats. By examining past BWC meetings and recent global developments, it provides recommendations and a pathway for strengthening biosafety and biosecurity measures to align with the evolving realities of the BWC.

10.2. Biosafety vs Biosecurity

10.2.1. Biosafety: Mitigating Accidental Harm

Biosafety encompasses a range of strategies and practices aimed at minimizing unintentional exposure to or release of potentially hazardous biological materials. According to the World Health Organization (WHO), biosafety involves employing containment principles, technologies, and procedures to prevent biological risks to laboratory workers, the surrounding community, and the environment.[9] This includes proper handling, storage, and disposal of biological agents and toxins to mitigate potential hazards.

These measures are supported by globally recognised standards such as the WHO Biosafety Manual and the System of Biosafety Levels (BSLs), which classify laboratories based on the level of containment required for specific pathogens.[10] For instance:

- **BSL-3 Facilities:** Laboratories in this category are equipped to safely manage agents that pose severe health risks through aerosol transmission, such as tuberculosis bacteria and SARS-CoV-2. These facilities incorporate features like controlled ventilation systems to maintain directional airflow, sealed environments to prevent pathogen escape and specialized entry points with multiple barriers. Staff

working in these labs undergo rigorous training and wear protective equipment, including respirators, to ensure maximum safety during high-risk procedures.

- **BSL-4 Facilities:** The highest level of containment is reserved for labs handling the most dangerous pathogens, such as the Ebola virus or Marburg virus, which have no readily available treatments or vaccines. These laboratories are designed with robust safety features, including air-locked entry, HEPA-filtered exhaust systems, and decontamination zones. Personnel are required to wear pressurised suits with independent air supplies and follow strict protocols for movement and activity within the lab. Facilities like the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) implement comprehensive safety audits and fail-safe mechanisms to maintain high containment standards.

In addition to facilitating safe research, BSL-3 and BSL-4 facilities are instrumental in addressing public health emergencies involving emerging pathogens. For example, during the COVID-19 pandemic, high-containment laboratories around the globe played a critical role in studying the SARS-CoV-2 virus, enabling the rapid development of vaccines and therapeutic strategies. Similarly, these labs have been at the forefront of research into other high-risk pathogens, including MERS, avian influenza, and Nipah virus, providing vital data for outbreak preparedness and response.

10.2.2. Biosecurity: Preventing Unauthorized Access and Misuse

Biosecurity complements biosafety and is defined by WHO as "Principles, technologies and practices that are implemented for the protection, control and accountability of biological materials and/or the equipment, skills and data related to their handling. Biosecurity aims to prevent their unauthorized access, loss, theft, misuse, diversion or release."[9] It includes measures to safeguard sensitive information, laboratory equipment, and biological materials from unauthorized access or malicious intent. As advances in biotechnology have made it easier to manipulate and produce pathogens, the potential for their misuse by state or non-state actors has grown. Biosecurity measures, such as physical security, personnel reliability programs, export controls, and inventory controls are crucial in mitigating these risks.

The emergence of cloud laboratories—platforms that allow scientists to conduct experiments remotely—presents both opportunities and challenges. While these labs democratize access to advanced research tools, they also necessitate robust cybersecurity and oversight mechanisms to prevent unauthorized use.[10] For example, ensuring secure access to genetic data and experimental processes in cloud labs is critical to mitigating biosecurity risks. Similarly, the discovery of genetically engineered bacteria in illicit settings underscores the ongoing threat posed by the unauthorized manipulation of biological agents.

10.3. Case Studies in Biosafety

10.3.1. The 1979 Sverdlovsk Anthrax Outbreak

This incident, resulting from the accidental release of anthrax spores at a Soviet military facility, underscored the catastrophic consequences of biosafety breaches.[7] The outbreak led to nearly 100 fatalities and highlighted the critical need for rigorous containment protocols, regular equipment maintenance, and transparent reporting of incidents.

10.3.2. Laboratory-Acquired SARS Infections (2003)

Multiple SARS infections linked to laboratory accidents in Singapore and Taiwan demonstrated vulnerabilities in biosafety practices even in advanced research facilities.[11] These cases emphasised the need for comprehensive personnel training and adherence to international biosafety guidelines to prevent similar occurrences in the future.

10.3.3. Contamination of Influenza Virus Stocks (2014)

The accidental contamination of influenza virus strains during laboratory research underscored gaps in quality control and risk assessment processes.[12] This incident led to heightened scrutiny of biosafety practices and reinforced the importance of regular audits and compliance monitoring.

10.4. Case Studies in Biosecurity

10.4.1. The 2001 Anthrax Attacks

The deliberate dissemination of anthrax spores through the U.S. postal system highlighted vulnerabilities in biosecurity measures, including inventory control and personnel reliability programs.[13] This event catalysed significant reforms, such as the implementation of stricter access controls and enhanced tracking of dangerous pathogens.

10.4.2. Cybersecurity Threats to Cloud Laboratories

The rise of cloud-based laboratories has introduced novel biosecurity challenges. For instance, unauthorised access to cloud lab systems could enable the misuse of sensitive genetic data or experimental protocols[10]. Strengthening cybersecurity measures, such as encryption and multi-factor authentication, is critical to addressing these risks.

10.4.3. Illicit Use of Synthetic Biology

The discovery of synthetic DNA sequences designed to produce harmful pathogens in unauthorized settings highlights the ongoing threat posed by the misuse of emerging biotechnologies. This case underscores the need for international collaboration to monitor and regulate synthetic biology research.

10.4.4. Artificial Intelligence and Biosecurity

AI is rapidly transforming life sciences, offering powerful tools for disease modelling, vaccine design, and genomic research. However, its dual-use potential poses significant biosecurity concerns.[14] For example:

- **AI in Pathogen Design:** AI-powered platforms can predict genetic modifications that enhance a pathogen's virulence or resistance to treatment. While these tools have legitimate research applications, their misuse could lead to the creation of novel biological weapons.
- **Automated Data Analysis:** AI systems capable of analysing large datasets, such as genomic sequences, could be exploited to identify vulnerabilities in human or animal populations, facilitating the development of targeted bioweapons.
- **Real-World Threats Amplified by AI:** Recent developments in AI,

such as generative models capable of predicting protein structures and interactions, have significant implications for biosecurity. For example, the misuse of AI to design toxin-like molecules was demonstrated in a controlled experiment where an AI system was repurposed to suggest potential bioweapon candidates. Such examples underscore the urgent need for regulatory oversight and the integration of AI ethics into biosecurity policies.

- **Mitigation Strategies:** To address these risks, AI must be integrated into biosecurity frameworks as a preventive measure. This includes developing AI-based threat detection systems that monitor global data for signs of unauthorised research, as well as ensuring that AI systems used in biology are governed by ethical standards and robust security protocols.

10.5. Emerging Pathogens and their Impact on Biosafety and Biosecurity

The emergence of global health threats such as SARS, H1N1, and COVID-19 has significantly influenced the biosafety and biosecurity landscape. These events have underscored the interconnectedness of global health security and the BWC's objectives. For example:

- **SARS (2003):** The outbreak demonstrated the critical importance of early detection and containment, as well as the need for strict biosafety measures to prevent laboratory-acquired infections.
- **H1N1 Influenza (2009):** This pandemic highlighted the necessity of global coordination in vaccine distribution, surveillance, and managing research involving high-risk pathogens.
- **Ebola Virus (2014–2016):** The epidemic in West Africa exposed gaps in international response mechanisms and underscored the importance of safe handling protocols for high-risk pathogens during outbreaks.
- **Zika Virus (2015–2016):** The spread of Zika, with its severe effects on maternal and foetal health, emphasised the need for effective vector control and biosafety practices in research on mosquito-borne diseases.
- **MERS (2012–present):** The ongoing threat of MERS-CoV highlights the role of zoonotic surveillance and preparedness against emerging coronaviruses.

- **Avian Influenza (H5N1, H7N9):** Recurring outbreaks emphasised the importance of biosecurity in agriculture and vigilance against zoonotic transmission to prevent global health crises.
- **Mpox (Resurgence since 2022):** The re-emergence of Mpox reinforced the importance of public health awareness and laboratory biosafety to manage zoonotic disease outbreaks.
- **COVID-19 (2019–2023):** The global pandemic underscored the urgent need for comprehensive biosafety and biosecurity frameworks to manage high-containment laboratories and strengthen pandemic preparedness.

These examples emphasise the critical need for international cooperation, stringent biosafety practices, and biosecurity measures to address the challenges posed by emerging pathogens and to achieve BWC's objectives. By learning from past incidents and addressing emerging challenges, the international community can strengthen the integration of these principles into the treaty framework, ensuring a safer and more secure future. Robust frameworks not only mitigate the risk of pandemics but also align with the BWC's mission of preventing the misuse of biological agents.

10.6. The Role of Biosafety and Biosecurity in the BWC Framework

Biosafety and biosecurity are integral to the operationalization of the Biological Weapons Convention (BWC). Together, they form a critical foundation for ensuring that biological research and advancements do not inadvertently or intentionally contribute to the development or use of biological weapons. Biosafety and biosecurity are mutually reinforcing and align directly with the BWC's core objective: to prevent the proliferation and use of biological weapons. By ensuring that biological research is conducted safely and securely, these measures reduce the likelihood of both accidental and intentional misuse of biological agents. This synergy is reflected in several aspects of the BWC framework:

10.6.1. Confidence-Building Measures (CBMs)

CBMs, introduced in 1987, require BWC member states to report on their biosafety and biosecurity practices, among other activities. These measures

foster transparency and trust that are essential for strengthening international cooperation under the BWC. However, challenges remain, as inconsistent submission rates and varying quality of reports limit their effectiveness.

10.6.2. Capacity-Building Initiatives

The BWC promotes capacity-building in biosafety and biosecurity, particularly in low-resource settings. Initiatives such as the Article X Assistance and Cooperation Database facilitate training and resource-sharing among member states, helping to strengthen global preparedness against biological threats.

10.6.3. Science and Technology Monitoring

The BWC's discussions on emerging technologies, including synthetic biology and artificial intelligence, emphasise the importance of integrating biosafety and biosecurity considerations into the oversight of scientific advancements. By proactively addressing potential risks, the BWC can adapt to the evolving landscape of biological research.

The integration of biosafety and biosecurity into the BWC has evolved significantly since the treaty's adoption in 1975. While the foundational years of the BWC focused on establishing a legal framework and Confidence-Building Measures (CBMs), subsequent decades have demonstrated the importance of operationalizing biosafety and biosecurity principles to address both historical and emerging biological threats.

It is no surprise that there have been numerous discussions on biosafety and biosecurity in the official BWC meetings, including the Review Conferences, Meetings of State Parties (MSPs) and Meetings of Experts (MXs). These discussions have led to the incorporation of biosafety and biosecurity elements into the CBMs, National Contact Points (NCPs) responsibilities, and the Article X Assistance and Cooperation Database. Biosafety and biosecurity also feature prominently in the agenda of the ongoing Working Group on Strengthening the BWC as part of the topics including Compliance & Verification, Confidence-Building & Transparency, and Science & Technology Review Mechanism.[15] Several Working Papers during the Review Conferences, MSPs, MXs and Working Group meetings highlight the importance of biosafety and biosecurity for the BWC. These Working Papers form the basis for deliberation during the official BWC meetings as State

Parties and State Groups (Eastern European Group, Non-Aligned Movement and Other States, and Western Group) put forward their proposals through Working Papers.

For instance, Switzerland submitted a Working Paper titled 'Managing Biosafety and Biosecurity Risks: The Importance of Codes of Conduct and a BTWC Science and Technology Advisory Process' at the MSP in 2021.[16] Similarly, Canada, Germany, Mexico and the US submitted a Working Paper titled 'Reinforcing Laboratory Biosafety and Biosecurity Internationally' at the Ninth Review Conference in 2022.[17] Further, China and Pakistan submitted a Working Paper on the Tianjin Biosecurity Guidelines for Codes of Conduct for Scientists that mainstreamed these guidelines in the official BWC meetings.[18] These Working Papers have played a crucial role in sensitising and informing diplomats about the foundational importance of biosafety and biosecurity in the BWC. Also, close consultation with scientists in preparing these documents brings elements of neutrality and universality in what often are very charged political deliberations at the BWC.

Another major avenue for biosafety and biosecurity in BWC is the Article X Assistance and Cooperation Database, which lists several offers and requests for capacity building and training by the State Parties.[19] Enhanced international cooperation on biosafety and biosecurity through this mechanism could strengthen the BWC if there is more active interest from the State Parties. Further, various side events on biosafety and biosecurity are organised during the BWC meetings by organisations such as the International Federation of Biosafety Associations (IFBA), American Biological Safety Association (ABSA International), iGEM Foundation, and the Nuclear Threat Initiative (NTI:Bio) in addition to the relevant side events by the State Parties. These side events provide a crucial avenue for broader discussion on biosafety and biosecurity from scientific and technical perspectives and help facilitate knowledge exchange between scientific and diplomatic communities.

10.6.4. Biosafety and Biosecurity in Confidence Building Measures

Confidence-Building Measures (CBMs) are a crucial instrument in strengthening the BWC in the absence of compliance and verification mechanisms. During its initial years, the BWC focused on building consensus among member states regarding the importance of transparency and cooperation. CBMs, introduced in the treaty's early review conferences, laid

the groundwork for member states to share information on biosafety and biosecurity practices, laboratory facilities, and outbreaks of infectious diseases. These measures, while voluntary, were instrumental in fostering trust and collaboration among signatories. For example, the early exchanges of information on containment practices in high-security laboratories provided valuable insights for developing international biosafety standards.

They have been expanded and modified several times and currently consist of six measures, which are Forms A to G (without D).[20] These CBM Forms are submitted to the BWC Implementation Support Unit (ISU) every year and the State Parties have the option to keep them restricted to only the other State Parties or make them publicly available. All the CBMs submitted so far are compiled in the eCBM platform managed by the BWC ISU.[21] The BWC CBM Forms are listed below:

Table 10.1: Confidence Building Measures (CBMs) for the BWC

CBM A	Part 1: Exchange of data on research centres and laboratories;Part 2: Exchange of information on national biological defence research and development programmes.
CBM B	Exchange of information on outbreaks of infectious diseases and similar occurrences caused by toxins.
CBM C	Encouragement of publication of results and promotion of use of knowledge.
CBM E	Declaration of legislation, regulations and other measures.
CBM F	Declaration of past activities in offensive and/or defensive biological research and development programmes.
CBM G	Declaration of vaccine production facilities.

As it is clear from Table 10.1, the CBM Forms contain crucial information regarding biosafety, biosecurity and available countermeasures to address biothreats. If the prescribed information is comprehensively, regularly and proactively shared by all State Parties, the existing CBMs could provide excellent overviews of the evolving biosafety and biosecurity scenarios at the national, regional and global levels. However, most of the CBMs are not publicly available which could have allowed for further research, biothreats modelling, and foresight strategies to be prepared to reduce and mitigate biological risks. Further, CBMs are instruments to be voluntarily shared by State Parties and a very significant number of them choose not to submit them. In fact, out of 187 state parties, only 109 State Parties submitted the CBMs in 2024, which

is the highest number so far.[22] Several reasons including the lack of resources and low prioritisation could explain the low rate for submission. CBMs are shared with ISU by the designated National Contact Points (NCPs) of the State Parties, who are also responsible for compiling all the required information for the CBMs. These NCPs are not always trained or empowered enough to compile the required CBM information from different government agencies, labs and industries, which affects the quality and regularity of CBM reporting exercises.

There are several emerging biosafety and biosecurity challenges which are not covered under the existing CBMs. These include the potential biological risks with the developments in Do-It-Yourself (DIY) biology and the convergence of technologies such as Artificial Intelligence and Neurotechnology with synthetic biology. The ease of access to knowledge, equipment and other resources has resulted in the enormous growth of DIY biology.[23] DIY, while democratising biological research and development, also leads to increased biological risks as they are notoriously difficult to monitor and regulate.[24] Similarly, there has been enormous growth in the number of AI-based tools for biological research in recent years, which could reduce the knowledge and resource threshold for malicious actors to develop biological weapons.[25] New or updated CBMs will need to be created that can account for biosafety and biosecurity challenges.

In summary, Biosafety and biosecurity are indispensable components of the BWC framework, providing practical mechanisms to mitigate the risks associated with biological research and technological advancements. By addressing both accidental and intentional threats, these measures contribute significantly to the treaty's mission of preventing biological weapons proliferation. As the field of life sciences continues to evolve, it is imperative to strengthen the integration of biosafety and biosecurity into the BWC's structures and processes, ensuring that the treaty remains effective in safeguarding global security.

10.7. Recommendations and Way Forward

Given the foundational importance of biosafety and biosecurity for the BWC, it becomes crucial that steps are taken to strengthen them. One of the major challenges is the lack of capacity in the Global South. Here, popularisation and effective utilisation of the Article X Assistance and Cooperation mechanism

by State Parties could help plug the existing resource gap. It is also crucial to update the CBMs to incorporate measures for emerging biological risks due to advancements in DIY biology, synthetic biology and AI-biology interface. Additionally, complementarities for strengthening biosafety and biosecurity should be explored with initiatives such as the Global Partnership Against Weapons of Mass Destruction,[26] WHO's project on ensuring responsible use of life science research,[27] and the Global Health Security Agenda.[28] Similarly, relevant international organisations should explore joint projects or joint task forces for addressing common biosafety and biosecurity challenges. An international oversight body for biological risks should be created to monitor and assess the evolving threats and prepare strategies to counter them.

Further, establishment of an internationally recognised mechanism should be deliberated at the BWC or WHO for monitoring and certifying high containment (BSL-3 and BSL-4) labs for their existing biosafety and biosecurity measures. Here, global standards and best practices will have to be developed and disseminated progressing from existing instruments like the ISO Standard 350001:2019 for biorisk management in laboratories, WHO Global Guidance Framework for the Responsible Use of Life Sciences, and the Tianjin Biosecurity Guidelines for the Code of Conduct of Scientists. Here, a commendable recent effort is the coming together of several scientists and AI model developers to prepare a community statement titled 'Community Values, Guiding Principles, and Commitments for the Responsible Development of AI for Protein Design'. The community efforts should be complemented by active governance innovation involving the establishment of science and technology advisory bodies, risk-based monitoring and regulatory systems, and international exchange of technical expertise. Foresight and forecasting-based approaches should be explored to understand and prepare for possible future biothreats. Lastly, science diplomacy and international collaboration should be promoted as they can play pivotal roles in addressing the inherently cross-border nature of biological risks.

As BWC completes fifty years, it is an opportune time to re-evaluate the strengths and limitations, and hits and misses of the treaty. Here, we find the incorporation of biosafety and biosecurity measures through the CBMs and Article X cooperation mechanism as significant steps for the success of the Convention. Given the long history of biological threats, mentioned case studies and emerging challenges, it remains critical that biosafety and biosecurity

maintain the core importance for the success of the Convention for the next fifty years. However, this would require serious concerted efforts from all stakeholders, including the State Parties, scientists, biosafety professionals, civil society, academia and industry. A sustained investment in biosafety and biosecurity is necessary to help ensure a world better prepared for biological risks of the future.

Acknowledgements

KT acknowledges the United Nations Office of Disarmament Affairs (UNODA) Youth for Biosecurity Fellowship and 'India Biosecurity Fellowship' by the Mahatma Gandhi Medical Advanced Research Institute, Sri Balaji Vidyapeeth (SBV; Deemed to be University) in collaboration with Gryphon Scientific LLC USA for insights and support. SKN acknowledges Mercatus Center, George Mason University and the Department of Science and Technology, Government of India for the funding support.

NOTES

1 James D. Watson and Francis H. Crick, *Molecular Structure Of Nucleic Acids : 'A Structure for Deoxyribose Nucleic Acid'*. Nature. Volume 171 Number 4356. April 25, 1953. pg. 737–738. https://doi.org/10.1038/171737a0

2 Jennifer A. Doudna and Emmanuelle Charpentier, *'The New Frontier of Genome Engineering with CRISPR-Cas9'*. Science. Volume 346, Number 6213. November 28, 2014, pg. 1258096. DOI: 10.1126/science.1258096

3 Katarzyna P. Adamala et al., *'Confronting Risks of Mirror Life'*. Science. Volume 386, Number 6728. December 12, 2024. pg. 1351–1353. DOI: 10.1126/science.ads9158.

4 Brian Rappert and Caitriona McLeish (eds), *A Web of Prevention: Biological Weapons, Life Sciences and the Governance of Research.* Routledge: Taylor & Francis. September 12, 2014. ISBN 9781138012189

5 U.S. Department of Health and Human Services, *'Biosecurity History S3: Science Safety Security'*. Administration for Strategic Preparedness and Responses History of Biosecurity and Biorisk Management., Accessed on February 1, 2025.

6 '*Biological Weapons Convention: Overview*'. United Nations Office for Disarmament Affairs. https://www.un.org/disarmament/biological-weapons. Accessed on February 1, 2025.

7 Matthew Meselson, Jeanne Guillemin, Martin Hugh-Jones, Alexander Langmuir, Irina Popova, Anatoli Shelokov and Olga Yampolskaya, '*The Sverdlovsk Anthrax Outbreak of 1979'*. Science. Volume 266, Number 5188. November 18, 1994. pp. 1202–08. DOI: 10.1126/science.7973702

8 Lalitha S. Sundaram, '*Biosafety in DIY-Bio Laboratories: From Hype to Policy—*

Discussions About Regulating DIY Biology Tend to Ignore the Extent of Self-Regulation and Oversight of DIY Laboratories'. EMBO Reports. European Molecular Biology Organization *Press*. Volume 22, Number 4. March 24, 2021. https://www.embopress.org/doi/full/10.15252/embr.202152506

9 World Health Organization. *Laboratory Biosafety Manual*, 4th edition. Geneva: World Health Organization. December 21, 2020. ISBN: 978-92-9-49001131-1 https://www.who.int/publications/i/item/9789240011311.

10 Ying-Chiang Jeffrey Lee and Barbara Del Castello, *'Robust Biosecurity Measures Should Be Standardized at Scientific Cloud Labs*'. Research and Development Corporation. November 8, 2024. https://www.rand.org/pubs/commentary/2024/11/robust-biosecurity-measures-should-be-standardized.html . Accessed on February 3, 2025.

11 Poh Lian Lim, Asok Kurup, Gowri Gopalakrishna, Kwai Peng Chan, Christopher W. Wong, Lee Ching Ng et al., *'Laboratory-Acquired Severe Acute Respiratory Syndrome'*, The New England Journal of Medicine. Volume 350, Number 17. April 22, 2004. pg. 1740–1745. https://www.nejm.org/doi/full/10.1056/NEJMoa032565. DOI: 10.1056/NEJMoa032565.

12 Donald G. McNeil Jr., *'CDC Closes Anthrax and Flu Labs After Accidents'. The New York Times*. 11 July 2014. https://www.nytimes.com/2014/07/12/science/cdc-closes-anthrax-and-flu-labs-after-accidents.html, Accessed on February 3, 2025.

13 James M. Hughes and Julie Louise Gerberding, *'Anthrax Bioterrorism: Lessons Learned and Future Directions'. Emerging Infectious Diseases*. Volume 8, Number 10. October 2002. pg. 1013–14. DOI: 10.3201/eid0810.020466

14 Jaspreet Pannu, Sarah Gebauer, Greg McKelvey Jr., Anita Cicero, and Tom Inglesby, '*AI Could Pose Pandemic-Scale Biosecurity Risks: Here's How to Make It Safer'*. Nature. Vol. 635, No. 8040. November 21, 2024. pg. 808–811. doi: https://doi.org/10.1038/d41586-024-03815-2

15 Biological Weapons Convention: Working Group on the Strengthening of the Convention, Fifth Session. United Nations Office for Disarmament Affairs. 2024. https://meetings.unoda.org/bwc-/biological-weapons-convention-working-group-on-the-strengthening-of-the-convention-fifth-session-2024 . Accessed on February 3, 2025

16 Meeting of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, Managing Biosafety and Biosecurity Risks: The Importance of Codes of Conduct and a BTWC Science and Technology Advisory Process. Biological Weapons Convention: Working Paper 10. August 23, 2021. https://docs.un.org/en/BWC/MSP/2020/MX.2/WP.10. Accessed on February 3, 2025

17 Ninth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, Reinforcing Laboratory Biosafety and Biosecurity Internationally. Biological Weapons Convention: Working Paper 29. November 24, 2022. https://bwcimplementation.org/sites/default/files/resource/MX_Reinforcing%20Laboratory%20Biosafety%20and%20Biosecurity%20Internationally_EN.pdf.

Accessed on February 3, 2025

18 Ninth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, *Advocating Responsible Biological Research: the Tianjin Biosecurity Guidelines for Codes of Conduct for Scientists*. Biological Weapons Convention: Working Paper 61. December 13, 2022. https://documents.un.org/doc/undoc/gen/g22/611/29/pdf/g2261129.pdf. Accessed on February 3, 2025.

19 Offers. *Biological Weapon Convention Article X: Assistance and Cooperation Database*. List available at https://bwc-articlex.unog.ch/offers. Accessed on February 3, 2025.

20 *Confidence-Building Measures (CBMs) under the Biological Weapons Convention*, https://web.archive.org/web/20241123040503/https://bwc1972.org/home/the-biological-weapons-convention/about-the-bwc/text-of-the-biological-weapons-convention-2/cbms/.

21 United Nations Office for Disarmament Affairs. Electronic CBM Platform (eCBM). Geneva: Implementation Support Unit, Biological Weapons Convention. https://bwc-cbm.un.org/. Accessed on February 3, 2025.

22 Confidence-Building Measures (CBMs) Statistics under the Biological Weapons Convention. United Nations BWC Confidence Building Measures. https://bwc-cbm.un.org/statistics. Accessed on February 3, 2025.

23 Thomas Landrain , Morgan Meyer , Ariel Martin Perez and Remi Sussan , *'Do-it-Yourself Biology: Challenges and Promises for an Open Science and Technology Movement*'. Systems and Synthetic Biology. Volume 7, Number 3. September 2013, Epub Aug 2, 2013. pg. 115–126. DOI: 10.1007/s11693-013-9116-4.

24 Lalitha S. Sundaram, *'Biosafety in DIY-Bio Laboratories: From Hype to Policy*'. EMBO Reports. European Molecular Biology Organization Press. April 7, 2021. Volume 22, Number 4. Article e52506. https://doi.org/10.15252/embr.202152506.

25 James Revill, Clarissa Rios, and Louison Mazeaud, *'What Will Be the Impact of AI on the Bioweapons Treaty?'*. The Bulletin of the Atomic Scientists. November 16, 2024. https://thebulletin.org/2024/11/what-will-be-the-impact-of-ai-on-the-bioweapons-treaty/. Accessed on February 3, 2025.

26 Biological Security. Global Partnership against the spread of weapons material of mass destruction, G7, 2025 Kananaskis. https://www.gpwmd.com/bswg. Accessed on February 3, 2025

27 *Ensuring Responsible Use of Life Sciences Research*. World Health Organization. https://www.who.int/activities/ensuring-responsible-use-of-life-sciences-research. Accessed on February 3, 2025

28 Global Health Security Agenda. https://globalhealthsecurityagenda.org/. Accessed on February 3, 2025.

11

Public Health in Reverse: WHO's Role at the Boundary of the BWC

Dr. Kai Ilchmann

11.1. Public Health in Reverse

This chapter looks at the role of the World Health Organization (WHO) in the Biological Weapons Convention (BWC), or better, its relationship with responses to and prohibition of biological weapons – spanning, in broad terms, disease surveillance and outbreak detection, laboratory capabilities, risk assessment and preparedness, research governance and ethics, capacity building, emergency coordination, information sharing, cross-sectoral collaboration, technical guidance, standard-setting, and public health interventions across the prevention-detection-response space.

What is the role of WHO in the BWC? What is its mandate in respect to various aspects that pertain to biological weapons and in the wider global public health security? The respective mandates overlap in many aspects. What are the boundaries?

Persistent calls for WHO to assume various roles in the combat against the deliberate use of poison and disease as weapons requires an examination of the role WHO had, has, and may play in regard to biological weapons, the challenges, potential pitfalls, and opportunities.

The relationship between WHO and the BWC illustrates a broader

challenge in global governance: how to coordinate specialized organisations with specific and distinct mandates to address complex threats that cross traditional boundaries between health, security, development, and other domains – especially in the absence of a dedicated BWC institution.

11.2. Blunting the Worst Effects: WHO's Role at the Boundary

Eighty years ago, Dag Hammarskjöld, the second Secretary-General of the United Nations, said: "the United Nations was not created to bring us to heaven, but in order to save us from hell"[1]—a pragmatic vision of its bounded institutional reality. This observation also holds for the relationship between the WHO and biological weapons. WHO's role is not the eradication of biological weapons, but, and largely only by extension of its mandate, blunting their worst effects.

WHO's effectiveness hinges on its political neutrality and credibility, particularly in building capacities, ensuring access to critical regions, carrying out its humanitarian role and providing life-saving information, and as a necessity for staff safety. Perceived bias already endangers WHO operations and undermines its recommendations. In an operating environment increasingly fraught with mis- and disinformation and geopolitical tensions, WHO's independence is critical to avoid being seen as captured by interests or as an arm of any particular power.

WHO is frequently cast in roles that exceed its mandate—expected to fill gaps left by the absence of other dedicated organisations. These expectations, while understandable in a fragmented governance landscape, risk distorting WHO's actual capabilities and weakening the very attributes that make it effective—neutrality, global reach, access, and technical authority.

This chapter traces WHO's historical role to its future options in relation to the BWC as the treaty marks its 50th anniversary—a time in which the UN and WHO, humanitarian work, and the entire normative international framework are under intense strain and under mounting stress.

The complex relationship between WHO and biological weapons control evolved through decades of institutional experience that continues to inform its contemporary role

11.3. A Historical Connection with Biological Weapons

The involvement of WHO with aspects of BW predates the BWC by two decades and goes back to the early days of the organisation. In the 1950s, preparations were made at the Division of Communicable Diseases of the WHO in case the organisation were to be asked to investigate allegations of US use of germ warfare in the Korean War. The organisation was not asked to investigate, but "WHO thereafter remained sensitive to the risk of germ warfare".[2] Martin Kaplan, who was leading these preparations at WHO, characterised BW as "public health in reverse".[3] Kaplan's advice and initiative would remain instrumental in guiding and shaping WHO's work on BW for several decades. The notion of BW as a reversal of public health efforts, the antithesis of health work, presents a core tension between the weaponisation of the same expertise that advances health in direct opposition to WHO's mission and mandate.

In January 1969, the UN Secretary-General requested the WHO Director-General to assist the UN Group of Consultant Experts on Chemical and Bacteriological (Biological) Weapons in preparing a report on various aspects of the problem of chemical, bacteriological, and other biological weapons.[4] WHO was asked to provide relevant health-related information for the report, which was intended for the Eighteen-Nation Committee on Disarmament, the Security Council, and the General Assembly.[5]

WHO had previously engaged in discussions on chemical and biological weapons (CBW). In 1967, the World Health Assembly, the principal decision making body of WHO, urged member states to take action against the threats posed by CBW,[6] ostensibly prompted by the use of chemical weapons in the Vietnam war.[7]

To support the 1969 UN report, WHO appointed consultants and coordinated with the UN Disarmament Affairs Division, the Food and Agriculture Organization (FAO), the Stockholm International Peace Research Institute (SIPRI), and the Pugwash Organization.[8] In May 1969, WHO submitted an interim report to the UN Secretary-General, contributing key health-related findings that were incorporated into the final UN report on chemical and biological weapons.[9] This report was released to the public on 2 July 1969 and transmitted to the Eighteen-Nation Committee on Disarmament for further discussion leading to the conclusion of the BWC in 1972.[10]

Cognizant of the importance of the subject the World Health Assembly adopted a resolution[11] to expand on the interim report which was written in a short period of time between January 1969 and May 1969. This resulted in the 1970 report "Health aspects of chemical and biological weapons,"[12] a guidance document to provide more technical detail for medical and public health authorities on public health, medical, and related scientific aspects of chemical and biological warfare than contained in the interim report.

Throughout this process, WHO's role was technical and advisory, providing scientific and public health expertise rather than engaging in treaty negotiations. Its contributions, first as input to the 1969 UN report, ensured that medical, public health, and technical considerations informed the BWC discussions.

Three decades after the 1970 report, after the end of the Cold War and in the wake of new bioterrorism fears, WHO undertook a major revision of its BW guidance.[13] In 2004, it published "Public Health Response to Biological and Chemical Weapons: WHO Guidance"[14]—essentially a second edition of the 1970 report, updated for 21st-century threats and responses. These two documents (1970 and 2004), together with the UN Secretary-General's 1969 report that presaged the BWC stand as *de facto* international reference works on the public health dimensions of chemical and biological weapons.[15] In these documents WHO consistently frames deliberate outbreaks as a health challenge to be managed, not a crime to be adjudicated.

11.4. Post-Cold War Updates and Expanding Role in Biosecurity

In 2002, following the anthrax laced letters distributed in the US, the Fifty-fifth World Health Assembly adopted a resolution, reaffirming WHO's view "that one of the most effective methods of preparing for deliberately caused disease is to strengthen public health surveillance and response activities for naturally or accidentally occurring diseases" underlining that the focus is "on the possible public health consequences of an incident ... regardless of whether it is characterized as a natural occurrence, accidental release or a deliberate act".[16] It further urges Member States to have national disease-surveillance plans aligned with regional and global disease-surveillance mechanisms, collaborate in rapid analysis and sharing of surveillance data of international humanitarian concern, collaborate and provide mutual support to enhance

relevant diagnostic and response activities, and "to treat any deliberate use ... as a global public health threat".[17]

By the early 2000s, there was broad consensus: the intentional spread of disease must be met with the same urgency and solidarity as naturally occurring disease outbreaks.

Throughout, a defining feature of WHO's role is apparent: the Organization contributed to biological weapons control, albeit *indirectly*, through its public health mandate, rather than by taking on any direct functions of non- or counter-proliferation, arms control, or disarmament. WHO provided expert advice, assessments, strengthened disease surveillance networks, and built national capacities for outbreak response, advised on to dual-use research, and developed guidelines for laboratory safety and research conduct—activities that inherently help counter BW. As the stalwart of global public health WHO's role in matters around biological weapons is indispensable.

From the 1950s preparations to respond to Korean War allegations, the 1969 UN report contribution, the 1970 and 2004 guidance documents, and affirmations in official statements represent WHO's approach to maintaining clear institutional boundaries. Its role in supporting the BWC remains complementary, framing deliberate disease outbreaks as public health challenges.

11.5. First and Second Diagnosis: Institutional Boundaries

There is a critical distinction between two fundamentally different tasks during an unusual disease outbreak. Coupland and Loye call this the first and second diagnosis.[18]

The first 'diagnosis' is purely medical and epidemiological: identifying the causative agent of the outbreak—be it a naturally occurring pathogen like a haemorrhagic fever, or something more unusual like inhalational anthrax in an urban setting—and treating those affected. This is squarely within WHO's mandate. In any outbreak, WHO's primary role is to assist with detecting the disease, confirming what pathogen is involved, helping local and international health authorities provide guidance and support in the treating of casualties, and contain its spread. Whether an outbreak is accidental, natural, or deliberate does not change the necessity of this first diagnosis.[19]

The second diagnosis involves establishing the cause and goes beyond public health into the realm of attribution and enforcement. It asks: *Was the outbreak deliberately caused, and if so, how and by whom?* Answering that question entails forensic investigations of samples, intelligence analysis, and ultimately a political/legal determination of responsibility.

There a delicate issue arises, Coupland and Loye contend, that "[t]hose responsible for the public health response and the first 'diagnosis' are likely to be in possession of the information that pertains to the second 'diagnosis.' Who has a right to this information? Who will co-ordinate the information? Who will make the judgment call that it was or was not an intentional act? To whom is this judgment communicated—and how?"[20]

This is where the role, if any, of WHO in relation to the BWC becomes tricky. The 2004 WHO guidance document discusses cooperation between public health authorities and other government bodies, including law enforcement and that to reduce the risk of a deliberate event would "require an unprecedented degree of cooperation among the public health and law-enforcement agencies of governments, utilities, commercial and other private sector organizations, and the public".[21] The finer points of the nature and character of the cooperation between public health authorities and other government bodies, including law enforcement, are primarily concerns for national health authorities and not necessarily WHO. These functions are outside of WHO's mandate and expertise.

This distinction was formalized in the 2011 Memorandum of Understanding between WHO and the United Nations, which outlines the modalities for cooperation in investigating alleged biological weapons use. [22] According to the MoU, WHO may provide technical support in assessing the public health aspects of an alleged use but remains strictly limited to health-specific support. It does not conduct forensic investigations, determine responsibility, or certify laboratories for verification purposes.

The tension between these two diagnoses has been tested repeatedly – from investigations into chemical weapons use in Syria to questions surrounding the origins of COVID-19. In each instance, WHO's effectiveness has depended on maintaining its primary focus on the first diagnosis, even as political pressures push for involvement in the second. WHO's ability to operate effectively as a trusted, neutral broker during crises, particularly in highly

sensitive situations, demands clearly defined boundaries. When WHO's neutrality becomes compromised, its ability to access affected populations diminishes, its technical recommendations face increased scepticism, and staff safety may be jeopardized—directly undermining its core public health functions. The organization can only deliver its critical services by remaining apolitical – functioning strictly as a public health authority rather than as an enforcement mechanism for arms control. Realistically, any engagement in contested spaces, especially regarding allegations of biological weapons use, will inevitably draw WHO into political controversies. The temptation to expect more from WHO than it can reasonably be expected to deliver, to allow its mission to creep, risks weakening both the organisation's response capabilities and its overall stability, especially in an increasingly fragmented and antagonistic geopolitical landscape.

11.6. Distinct Roles, Shared Goals: Parallel and Indispensable

Many aspects of WHO's work naturally aligns with the aims of the Biological Weapons Convention (BWC), either directly or in many cases indirectly. From capacity building and preparedness measures to laboratory biosafety and global disease surveillance, and WHO's core function to strengthen health systems worldwide. Much of this work also has the effect of reducing opportunities for deliberate misuse of pathogens, by promoting safer practices, by raising awareness of misuse potential, and by strengthening global public health in general, especially in low and medium income countries.[23] With a focus on capacity building, emergency response and assistance, resource mobilisation, technical guidance, normative frameworks, and international collaboration—rather than arms control or verification—WHO is firmly anchored in its public health mandate, yet it plays a crucial role in the broader "web of prevention"[24] from the perspective of the BWC.

The International Health Regulations (2005)[25] is an important instrument in this respect, illustrating how global health governance can help mitigate risks associated with disease, whether arising from natural, accidental, or deliberate causes. Under the legally binding IHR, states must develop core capacities for surveillance, detection, assessment, and reporting of public health risks. They must notify WHO of potential Public Health Emergencies of International Concern (PHEIC).[26] The IHR do not address attribution or intent but require rapid identification and reporting of unusual outbreaks.

WHO's surveillance and response focused work are critically important for comprehensive and coordinated global public health security efforts, applicable regardless of origin—deliberate, accidental, or natural.[27]

WHO's laboratory biosafety standards, guidance on responsible science, and efforts to anticipate emerging technologies all play a role in addressing dual-use risks. The Laboratory Biosafety Manual[28] and the Global Guidance Framework for the Responsible Use of Life Sciences[29] are prime examples. Much more than the documents themselves, it is the global programmatic engagement behind these guidelines and manuals—their implementation, or in WHO speak, their 'socialisation'—that encourage safe and secure pathogen management, risk awareness, and ethical awareness and conduct in scientific research, bolstering a preventive culture without an overt security rationale.

WHO's partnerships across the UN system and beyond further reinforce the web of prevention. By co-leading the One Health Quadripartite (with FAO, WOAH, and UNEP),[30] WHO bridges health, agriculture, and environment to address a wide array of threats at the human-animal-environment interface. In addition, initiatives such as the Global Health Security Agenda (GHSA)[31] and the Global Health Security Initiative (GHSI)[32] —where WHO provides technical input—focus on strengthening national and regional preparedness for all hazards. Together, these, and a raft of other engagements, reflect a public health–first approach that, in theory, creates barriers to potential biological weapon development or use.

Efforts such as those outlined above are often fragmented, overlapping, and poorly coordinated. In 2020, United Nations BioRisk Working Group (UN-BRWG) was established, co-led by the UN Office for Disarmament Affairs and WHO, primarily as a stocktaking exercise to clarify what the UN system is actually doing regarding biological risks and to map existing capacities, identify gaps, and facilitate improved coordination across UN entities.

WHO's normative, technical, coordinative, and collaborative endeavours, carried out under its global health mandate, weave critical strands into the broader web of prevention. WHO shapes the terrain on which BW threats are deterred—through technical norms, ethical guidelines, and anticipatory governance. By supporting responsible science, ethics, and norms; developing and setting standards, coordinating diverse stakeholders to tackle emerging risks; providing technical expertise; building critical capacities and responses;

and by convening expert groups and advisory committees, WHO activities align with and support the BWC in various ways.

Public, media, and even institutional demands often conflate WHO's role in the first diagnosis with an assumed responsibility for the second. Clarifying and restating this boundary is not only essential for operational effectiveness, but for managing expectations.

It would be a mistake to conceptualise the relationship and interactions between WHO and the BWC solely in terms of their abstract institutional mandates, without considering organisational inertia, political interests, structural path dependencies, lock-ins, and the agency of individual actors.

11.7. Systemic Friction: Institutional Silos and Political Pressures

Preventing the re-emergence of biological weapons and effective implementation of the prohibitions contained in the Biological Weapons Convention is a complex challenge of touching many different areas. Confronting disease challenges—whether deliberate, accidental, or naturally occurring—cuts across multiple domains, including health, security, development, humanitarian response, and science. As outlined above there are efforts to coordinate efforts across the UN system. The relationship between WHO and the BWC is located within a complex institutional framework that significantly shapes their interaction. WHO's structure as a member state-governed organisation creates an inherent tension between technical imperatives and geopolitical realities.

WHO's internal structure is complex: regional offices, HQ divisions, and vertical programs, where departmental silos separate technical from governance and policy work, complicating work on cross cutting issues like biological weapons that span multiple domains, including emergency response, laboratory standards, emerging technology, and normative and ethical frameworks. Expanding mandates and demands are met with chronic underfunding, and a resulting heavy reliance on voluntary and donor contributions which are often earmarked for specific work or programmes. This creates asymmetries and avails the opportunity to set agendas by funding particular topics and prioritising specific work streams, shaping how, for instance, biological threats are understood, which responses or countermeasures receive priority, and whose security concerns merit attention.

These internal constraints intersect with external challenges in a contested geopolitical landscape. WHO operates in an increasingly fragmented and, at times, outright hostile geopolitical landscape. Its work is increasingly confronted by mis- and disinformation, scientific and technical work is politicised and faces unprecedented scrutiny. Controversies surrounding investigations, from chemical weapons use in Syria to questions about COVID-19 origins, demonstrate how rapidly WHO's technical authority and trust can be undermined when its technical work intersects with security concerns or affects political agenda.

11.8. Mandate and Mission: WHO's Position in the BWC Context

WHO's practical and normative work in global health plays a significant role in the context of the BWC. Through promoting scientific best practices, establishing standards, coordinating responses to emerging threats, and bringing together expert advisors, WHO reinforces the critical importance of strong health systems and frameworks as essential safeguards against biological threats, including deliberate misuse.

As the BWC marks its 50th anniversary, the relationship between WHO and efforts to prevent the "reversal of public health" stands at a critical juncture.

WHO's greatest value to the biological weapons control regime lies paradoxically in its institutional distinctiveness—in its commitment to addressing biological threats through a public health lens rather than a security framework. This approach maintains the organisation's operational access and credibility in politically sensitive contexts, preserves its ability to coordinate international health responses across geopolitical divides, and protects its capacity to perform its primary functions effectively.

In calls to strengthen the BWC's implementation framework it is often suggested that WHO's involvement could be instrumental in addressing gaps related to the prohibition of biological weapons.

Despite frequent calls and demands for greater involvement, WHO's role in relation to biological threats must remain anchored in its public health mandate, separate from direct engagement with security or enforcement activities. Maintaining neutrality is critical for WHO to perform its primary functions effectively. If WHO were to become involved in security or

attribution processes, it could compromise the organization's access, operational safety, and credibility—essential factors enabling effective disease surveillance and response in sensitive and politically complex settings. By strengthening global public health capacities, including disease surveillance, preparedness, and healthcare infrastructure, WHO directly contributes to reducing vulnerabilities related to biological weapons. In this way, WHO's role remains clearly defined and firmly within its mandate: to reinforce global health resilience rather than participate directly in biosecurity enforcement or arms control measures.

NOTES

1 Dag Hammarskjöld, Address by Secretary-General Dag Hammarskjöld at University of California Convocation, Berkeley, California, Thursday, May 13, 1954, at 10:00 a.m. (Pacific Coast Time). United Nations Digital Library. Press Release SG/382. 13 May 1954. https://digitallibrary.un.org/record/1291161?ln=en&v=pdf. The full speech still resonates today, with many challenges.

2 Harvard Sussex Program. Martin Kaplan (Obituary). The CBW Conventions Bulletin no. 66. December 2004. pg. 5.

3 Ibid. Kaplan's characterisation of biological weapons as "public health in reverse", his long and influential engagement with aspects of BW and instrumental roles in WHO make this phrase a poignant hook for this chapter. The phrase is ascribed to him in the cited obituary. Another early source, likely drawing on Martin Kaplans words: "BW has been aptly described as public health in reverse." Effects of biological warfare agents for use in readiness planning. United States. Department of Health, Education, and Welfare. Pamphlet. July 1959

4 WHO. *Health Aspects of Chemical and Biological Weapons – report of a WHO group of consultants*. WHO: Geneva. 1970.

5 The request was made in UN Resolution 2454 A (XXIII) adopted in December 1968.

6 World Health Assembly. *Chemical and Bacteriological (Biological) Weapons and the Effects of Their Possible Use*. Resolution WHA20.54. May 25, 1967.

7 This engagement aligned with broader UN disarmament discussions, which had been ongoing since 1966, when the UN General Assembly initiated an intergovernmental debate on strengthening the 1925 Geneva Protocol in response to extensive use of chemical weapons by the US in Vietnam, Laos, and Cambodia. The momentum towards a dedicated prohibition of biological weapons accelerated in August 1968, when the UK proposed the conclusion of a new convention prohibiting microbiological warfare at the Eighteen-Nation Disarmament Committee meeting in Geneva. This proposal marked the first explicit push for a Biological Weapons Convention (BWC), emerging from broader discussions on CBW disarmament. A year later, immediately after the UN Secretary-General

published his final report on CBW, the UK tabled the first draft of what would become the BWC, formally separating biological weapons from the broader CBW disarmament debate.

8 J.P. Robinson, *The Impact of Pugwash on the Debates of Chemical and Biological Weapons. Scientific Cooperation, State Conflict: The Roles of Scientists in Mitigating International Discord*. Annals of the New York Academy of Sciences. Volume 866. December 1998.

9 United Nations. *Chemical and bacteriological (biological) weapons and the effects of their possible use: report of the Secretary-General*. New York: United Nations. 1969. https://digitallibrary.un.org/record/577282?ln=en&v=pdf.

10 Though initially supported only by the Western Group, the push for a separate BWC gained broader acceptance in March 1971, when the USSR unexpectedly agreed to the proposal and introduced its own draft. The Soviet draft mirrored the UK proposal but omitted prohibitions on BW research and use, as well as provisions for investigating allegations of BW use. The USA, aiming to secure an agreement before President Nixon's 1972 visit to Moscow, chose not to challenge these divergences. By August 1972, the USA and USSR tabled identical drafts, paving the way for the rapid conclusion of the BWC.

11 World Health Assembly Resolution WHA 22.59, adopted July 1969.

12 World Health Organisation. *Health aspects of chemical and biological weapons: report of a WHO group of consultants.* Geneva: World Health Organization. 1970.

13 There are certainly other influences: Iraq's use of chemical weapons in the 1980s, the 1995 Tokyo subway sarin attack, as well as the 2001 anthrax letters in the United States. All raised urgency and illustrated "why it is necessary to prepare" for deliberate incidents. Ibid.

14 WHO. *Public health response to biological and chemical weapons: WHO guidance*. Geneva: World Health Organization. 2004

15 It is notable that all of them were authored and/or edited by the same person, Julian Perry Robinson.

16 World Health Assembly. *Global Public Health Response to Natural Occurrence, Accidental Release or Deliberate Use of Biological and Chemical Agents or Radionuclear Material That Affect Health.* Resolution WHA55.16. May 18, 2002.

17 World Health Organization. *Public Health Response to Biological and Chemical Weapons: WHO Guidance*. Geneva: World Health Organization. 2004.

18 Robin Coupland and Dominique Loye have articulated this distinction and their implications variously. For a comprehensive treatment see: Robin Coupland & Dominique Loye, *International assistance for victims of use of nuclear, radiological, biological and chemical weapons: time for a reality check?.* International Review of the Red Cross. Volume 91, Number 874. June 2009. pg. 329-40. https://international-review.icrc.org/sites/default/files/irrc-874. doi:10.1017/S181638310 9990105.

19 The need for cooperation and assistance in an outbreak event cannot await determination of its origin or nature of the event. Under the BWC, States Parties recognise that assistance measures (Article VII) should be available regardless of the origin of the disease outbreak. For an in-depth discussion see*: Operationalising Article*

VII of the Biological Weapons Convention. Edited by: Jean Pascal Zanders. United Nations: Geneva. 2022. in particular the chapter by Bob Mathews: RJ Mathews. *The importance of international cooperation activities (Article X) in the effective operationalisation of assistance and protection measures (Article VII).* pg.19. https://www.the-trench.org/wp-content/uploads/2018/07/202204-BTWC-ISU-Article-VII-Operationalisation.pdf

20 Robin Coupland & Dominique Loye*, International assistance for victims of use of nuclear, radiological, biological and chemical weapons: time for a reality check?* International Review of the Red Cross. Volume 91, Number 874. June 2009. pg. 335. https://international-review.icrc.org/sites/default/files/irrc-874. doi:10.1017/S1816383109990105.

21 World Health Organization, *Public health response to biological and chemical weapons: WHO guidance*. Geneva: World Health Organization, 2004. pg. 317.

22 World Health Organization & United Nations. (2011*). Memorandum of Understanding between the World Health Organization and the United Nations concerning WHO's support to the Secretary-General's mechanism for investigation of the alleged use of chemical, biological or toxin weapons*. Signed by Dr. Margaret Chan (WHO Director-General) and Mr. Sergio Duarte (UN High Representative for Disarmament Affairs). 31 January 2011.

23 Although the focus here is on WHO's role in the context of the BWC, it should be remembered that WHO is first and foremost the global health authority, engaged in an array of activities – from routine immunizations, disease surveillance, and maternal health to addressing the rise of non-communicable diseases and health systems strengthening. Much of its critical work has little to do with the control or prevention of CBRN hazards and is instead geared toward ensuring the broadest possible coverage of healthcare services and equitable health outcomes worldwide.

24 The "web of prevention" set out by McLeish and Rappert describes the interconnecting and overlapping legal, regulatory, ethical, and educational frameworks, measures, customs, and practices (treaties, national legislation, professional codes of conduct, export controls, institutional oversight, etc.) that collectively discourage, detect, and deter the malicious development or use of biological weapons. Brian Rappert, Caitriona McLeish (eds.), A Web of Prevention: Biological Weapons, Life Sciences and the Governance of Research. Earthscan, 2007. Routledge, ePub. May 16, 2012. ISBN 9781138012189. https://doi.org/10.4324/9781849770354

25 International Health Regulations (ý2005)ý, 3rd edition. World Health Organization. (ý2016)ý. https://iris.who.int/handle/10665/246107. ISBN 9789241580496. WHO Member States are currently engaged in a formal process to update the IHR following recent global health emergencies, most notably the COVID-19 pandemic. Key drivers are the need for clearer reporting obligations, stronger core public health capacities, and more transparent mechanisms for data sharing and collaboration. These discussions run parallel to deliberations over a proposed pandemic treaty ("accord") that would complement IHR.

26 The WHO Director-General makes the final PHEIC determination. The

Regulations rely on states acting in good faith, without strong enforcement mechanisms. Resource constraints limit many countries' ability to meet IHR requirements. Sovereignty concerns and fear of repercussions often delay reporting, undermining rapid detection goals.

27 Two important examples are the Global Outbreak Alert and Response Network (GOARN), an operational network and coordinating hub for surge support, expert deployment, and technical assistance; and the WHO Hub for Pandemic and Epidemic Intelligence to improve surveillance, risk detection, and data integration.

28 Laboratory biosafety manual, 4th edition. World Health Organization. (ý2020)ý. https://iris.who.int/handle/10665/337956. ISBN 9789240011311.

29 *Global guidance framework for the responsible use of the life sciences: Mitigating biorisks and governing dual-use research*. World Health Organization. (ý2022)ý. https://iris.who.int/handle/10665/362313 . ISBN 9789240056107.

30 One Health Initiative. World Health Organisation. https://www.who.int/teams/one-health-initiative/quadripartite-secretariat-for-one-health. Accessed in February 2024.

31 The Global Health Security Agenda (GHSA) is a collaborative, multisectoral network to enhance global health security and accelerate implementation of the International Health Regulations (IHR) (2005). https://globalhealthsecurity agen da.org

32 The Global Health Security Initiative (GHSI) is an informal network of countries and organisations to undertake concerted global action to strengthen public health preparedness and response to chemical, biological, radiological, and nuclear (CBRN) threats, as well as pandemic influenza and exchange information and coordinate practices within the health sector to that end. https://ghsi.ca/about/

SECTION V

CHALLENGES

12

Past and Current Challenges to the 1975 Biological and Toxin Weapons Convention

Dr. Tatyana Novossiolova

12.1. Introduction

Regardless of their origins, disease outbreaks can have significant negative impacts on societies. The recent global experience with the COVID-19 pandemic is instructive. The scale and magnitude of the disruption caused by the virus were unprecedented and its negative effects were felt across multiple spheres of social activities including employment, access to healthcare and social assistance, education, access to justice and administrative services, and transport and travel. Diseases that affect animals or plants can be equally devastating. Agriculture is a key sector of the national economies of most states around the world with stockbreeding and farming being tightly coupled with food security and international trade.

The use of disease and poisons as weapons has a long trail in the history of mankind. Up until the second half of the twentieth century biological warfare tactics featured in the military planning of many industrialised states. Whereas the 1925 Geneva Protocol prohibits the deployment of bacteriological methods of warfare during an armed conflict, development and testing of biological weapons and their means of delivery intensified after the Second World War

with more countries joining the toxic arms race. Against this backdrop, the US unilateral renunciation of biowarfare in 1969 was a pivotal moment for biological disarmament which prompted other major states at the time including the Soviet Union to take a decisive stance on the issue. Three years later, the Biological and Toxin Weapons Convention (BTWC) was opened for signature with three states – the UK, USA, and USSR – taking up the role of treaty guarantors.

The BTWC introduced a blanket prohibition on the development, stockpiling, acquisition, retention, and transfer of biological and toxin weapons and their means of delivery. It is the first international agreement that outlaws an entire class of weapons of mass destruction (WMD). Its historical and political significance notwithstanding, the Convention does not envisage formal verification procedures for compliance but relies solely on the commitment of states parties to abide by its provisions and undertake appropriate steps and measures domestically to implement its provisions. This chapter examines the main challenges that the international community faces with regard to the integrity of the BTWC. It focuses on the issue of accountability in case of violations and how emerging security concerns and geopolitical dynamics can impact on the long-term resilience of the international norm against biological and toxin weapons. The analysis uses a comparative case study approach to elucidate key trends and outline possible approaches and tools that stakeholders can leverage to guarantee that the letter and spirit of the BTWC remain relevant in future.

12.2. State-sponsored Bioweapon Programmes after 1975: Non-compliance and Accountability

The BTWC entered into force in 1975. It requires all states parties to discontinue any existing offensive biological programmes, destroy all bioweapon stockpiles, and ensure that any activities involving biological agents and toxins within the territory under their jurisdiction are intended for peaceful, prophylactic, and protective purposes. States parties further undertake not to transfer biological weapons or their means of delivery and related equipment to other states, or assist anyone to develop or otherwise acquire offensive biological capability. The Convention lacks a system for verifying compliance and the process of addressing states parties' complaints of possible breaches

passes through the UN Security Council. These two features of the BTWC have direct implications for establishing accountability in case of violation.

First, clandestine efforts to procure or maintain offensive biological programmes can go unnoticed for an extended period of time. Ensuring covertness, however, is not a straightforward process which, for its own part, can hinder research and development activities.[1] And second, responding to violations of the Convention largely remains hostage to the politics that pervades the UN Security Council and which manifests itself in the veto power vested in the five permanent member states. To unpack the issue of accountability, the remainder of this section focuses on three case studies which briefly discuss examples of state-mandated bioweapon programmes after 1975 and the response of the international community when these violations were uncovered.

12.2.1. The Bioweapon Programme of Apartheid-era South Africa

Racial segregation was at the heart of the Apartheid governing regime in South Africa between 1948 and 1994. The South African bioweapon programme code-named *Project Coast* commenced in 1981 and historical evidence indicates that it was intended to serve both foreign and domestic policy objectives.[2] At the time of the establishment of the programme, South Africa had already ratified the BTWC. The primary goal of *Project Coast* was to develop offensive and defensive chemical and biological capabilities for the military and domestic security forces.

To conceal the offensive activities, chemical and biological weapon (CBW) facilities were set up as front companies, so that no immediate links between these facilities and the military could be detected. The front companies also had access to international markets and could easily procure materials and equipment that military units could not. The *de facto* chief of *Project Coast* was a military doctor, Dr Wouter Basson who served as a project officer and secretary of the Coordinating Management Committee (CMC), the body overseeing the CBW programme. Whilst not solely responsible for the programme, Dr Basson played a significant part in ensuring its smooth operation and occasionally took orders from the intelligence, the special forces, and security police forces that were never reported to the military command.

The scientists recruited to work within *Project Coast* were well-paid and

enjoyed considerable freedom to pursue research of their own choosing. Many of those employed by the front companies were not aware of the role that these companies played in CBW development but suspected the involvement of the military, as work was carried out under utmost conditions of secrecy. The majority of scientists involved in the programme overtly or tacitly supported the racist ideology of the Apartheid regime and genuinely perceived their work as a patriotic duty. CBW research and development activities focused on the weaponisation of the causative agents of anthrax and botulism, as well as the study of toxins for use in covert operations. Attention was given to the potential of developing non-lethal CB weapons for birth control and suppression of dissent.

With the start of political liberalisation in South Africa in the early 1990s and amidst growing diplomatic pressure to end the Apartheid regime, *Project Coast* was gradually shut down. The country held its first democratic elections in 1994 and the military formally terminated the programme shortly thereafter. The newly elected Government of the National Unity set up a court-like body —the Truth and Reconciliation Commission (TRC)—to tackle the legacy of the Apartheid regime in 1995.[3]

Evidence about the operation of *Project Coast* emerged by chance following the arrest of Dr Basson on suspicion of drug dealing in 1998. The police seized documents about the CBW programme at the home of one of Basson's associates and these documents were made available both to the TRC and the Attorney-General's office.[4] The TRC subsequently held a public hearing which required scientists and project administrators including company managers and military personnel to account openly and fully to the public for the development and daily activities of the chemical and biological offensive programme.[5] This public hearing was the first of its kind in the world and to date, remains an important precedent for promoting transparency regarding national CBW-related efforts.

Besides his involvement in the public hearing, Dr Basson went on a separate criminal trial facing multiple charges, including charges regarding his involvement in *Project Coast*. He was eventually acquitted in 2002 but in 2013, the Health Professions Council of South Africa (HPCSA) found him guilty of breaches of ethics and unprofessional conduct.[6] Whereas Dr Basson still practises in private medical clinics in the country, his status as a health

professional and his overall career remain deeply controversial.[7] He is colloquially referred to as 'Dr. Death'.

12.2.2. The Iraqi Biological Weapon Programme and UNSCOM

Iraq signed the BTWC in 1972 but did not ratify it until 1991. Suspicion that the government of Saddam Hussein was pursuing offensive biological capability grew during the 1980s amidst Iraq's use of chemical weapons. During the Iraq-Iran war, both countries relied on chemical warfare tactics despite having ratified the 1925 Geneva Protocol. The absence of a firm international reaction emboldened the Saddam regime as evident in the subsequent attacks with tabun and mustard gas against the local Kurdish minority.[8]

Much of what is known about the Iraqi biological warfare programme was only uncovered during the work of the UN Special Commission (UNSCOM) that was established in 1991 by the UN Security Council following the Gulf War. This commission was tasked with ensuring Iraq's disarmament and the elimination of any non-conventional weapons and ballistic missiles. Under the provisions of UN Security Council Resolution 687, Iraq was required to accept the destruction and removal of "all chemical and biological weapons and all stocks of agents and all related subsystems and components and all research, development, support, and manufacturing facilities".[9] UNSCOM was charged with overseeing this process and conducting long-term monitoring to prevent the Iraqi government from rebuilding its offensive capabilities. The results of UNSCOM inspections revealed that Iraq sought to weaponise anthrax bacterium, botulinum toxin, aflatoxin, camel pox virus, gas gangrene bacteria, and bubonic plague bacterium, and to acquire appropriate delivery systems such as munitions, artillery shells, bombs, and warheads. Throughout the 1990s, concerns remained that the government might have hidden quantities of freeze-dried organisms and retained sufficient capacity to resurrect its offensive activities relatively quickly.[10]

At the time of its establishment, the UNSCOM was the most intrusive disarmament and arms control verification regime ever designed.[11] Its strategy for ongoing monitoring included, *inter alia,* unannounced on-site inspections, and aerial and camera surveillance. Economic sanctions and restrictions on the transfer of materials, goods, and equipment that could be applied for military purposes were imposed. All sales of dual-use items to Iraq had to be

reported to the UNSCOM.[12] In 1999, the UN Security Council established the United Nations Monitoring, Verification and Inspection Commission (UNMOVIC) which replaced UNSCOM assuming most of its mandate and responsibilities.[13] Both UNSCOM and UNMOVIC faced challenges with securing Iraq's full commitment to openness and transparency. Incomplete declarations, missing data, and reluctance at times to support the full and effective implementation of the UN Security Council resolutions bred suspicion and uncertainty. Nevertheless, the 2003 US invasion of Iraq did not result in uncovering unreported or hidden WMD capability. Despite the political hurdles that pervaded the work of the UNSCOM and later, of UNMOVIC, both of these internationally mandated verification mechanisms were instrumental for maintaining diplomatic pressure over the Iraqi government for an extended period and thus contributed to reducing the threat of illicit WMD procurement and proliferation.[14]

12.2.3. The Soviet Bioweapon Programme

The origins of the Soviet bioweapons programme can be traced back to the late 1920s.[15] The Vaccine-Serum Laboratory under the auspices of the Military-Sanitary Directorate of the Red Army provided the backbone for the development of offensive and defensive capabilities and by the early 1940s this laboratory was expanded and officially transformed into the Scientific Research Institute of Epidemiology and Hygiene in Kirov. Other research centres under the direction of the military were created in Sverdlovsk (today Yekaterinburg) and Zagorsk (today Sergiev Posad). An open-air testing site was established on Vozrozhdenie ('Resurrection') Island in the Aral Sea in 1935.

The 'modern' Soviet bioweapons programme commenced in the early 1970s around the time when the BTWC was negotiated.[16] Besides the military research facilities under the auspices of the Ministry of Defence, an enormous research complex, *Biopreparat*, was established as a branch of the Main Directorate of Biotechnology Industry. *Biopreparat* essentially served as a dual-use agency: whereas it was formally tasked with the development of vaccines and pharmaceuticals, in practice it offered a comfortable disguise for the conduct of military-related work. A significant number of institutes and laboratories of the Ministry of Health, the Academy of Medical Sciences, and the USSR Academy of Sciences participated in bioweapon development.

The programme ran under utmost conditions of secrecy.[17] A multi-layer narrative (*legenda*) was used to ensure that only a handful of individuals at the highest level of authority (e.g. senior government officials and military command) were aware of the *real* purpose of *Biopreparat* and the network of civilian scientific facilities involved in the bioweapon effort. Alongside the offensive work, code-named *Ferment*, a defensive biological programme, *Problem 5*, was established. Besides anti-personnel bioweapons, the programme focused on the development of offensive capability targeting crops and livestock. Related projects were consolidated under the code-name *Ekologiya* ('Ecology') and ran by the Main Directorate for Scientific-Research and Experimental-Production Establishments of the Ministry of Agriculture.[18] At its peak, the Soviet biological weapons effort encompassed tens of thousands of scientists spread across facilities nation-wide.

Suspicions that the USSR retained its offensive biological capability grew in the early 1980s. In 1979 a deadly anthrax outbreak in the city of Sverdlovsk attracted international attention. According to the official Soviet position, affected local people consumed infected meat. In reality, the outbreak occurred as a result of a malfunction at one of the bioweapon production facilities located near the neighbourhood where most of the victims lived.[19] Accounts by senior Soviet officials who defected to the West in the late 1980s made it possible to start piecing together the structure and *modus operandi* of the bioweapon programme. Shortly after the collapse of the Soviet Union and under increasing diplomatic pressure, the then Russian President, Boris Yeltsin formally admitted to the existence of the programme and issued a decree announcing its termination. President Yeltsin also issued a decree that granted pensions to the families of the victims of the Sverdlovsk anthrax outbreak. This decree, however, avoided any mention of the real cause of the outbreak and the involvement of the military.[20]

Evidence of the Soviet non-compliance with the BTWC triggered an international response. A Trilateral Agreement between Russia, UK, and the USA—the three depository states of the BTWC—was concluded in 1992. This agreement was cooperative in nature and envisaged a package of activities designed to enhance transparency and resolve ambiguities regarding the Soviet offensive programme. The agreement contained a part ascertaining that "Russia had ceased offensive research, dismantled weapon production lines, closed test facilities and dissolved the department in the Ministry for Defence that

was responsible for the offensive programme".[21] Much of the agreement was never implemented even though a number of reciprocal visits to pre-selected biological sites in the participating countries did take place. These visits were in the form of no-notice inspections and encompassed non-military facilities only.

Whereas the Trilateral process enabled the dismantling of some equipment and the conversion of a number of former weapon facilities to civilian use, its overall impact on guaranteeing Russia's full biological disarmament remained questionable. The Russian military biological facilities were never subject to an international oversight and the military command were never investigated for illicit biological activities. None of the senior government officials involved in the offensive programme was ever investigated or faced charges, either. The reciprocal visits secured Russia's participation in the Trilateral process but they also allowed Moscow to shift the focus away from its own wrong-doing, ultimately reducing the political costs and reputational damage usually associated with a breach of international law. Domestically, the Russian leadership made hardly any attempt to promote public awareness of the bioweapon programme and over time, effectively managed to frame it as a 'myth'.

12.3. Biological Weapon Proliferation Risks in the 21st Century

Georgi Markov, a Bulgarian defector working with the BBC Service in London died as a result of ricin poisoning in 1978. The weapon used in his murder was an unusual one: a poison-tipped umbrella capable of firing tiny metal pellets containing a deadly substance. This umbrella was most probably supplied to the Bulgarian state security service by the Soviet KGB. Bulgaria, a Warsaw Pact member at the time, was the USSR's closest ally within the Socialist bloc. To date, the investigation of Markov's death remains a cold case. In 1989, a stack of modified umbrellas was found at the Bulgarian interior ministry. However, many of the files related to the killing were destroyed and the deputy interior minister committed a suicide before facing a trial.[22]

The murder case of Georgi Markov is not an isolated one. At the time of his poisoning, the Bulgarian state security service tried to eliminate in a similar manner Vladimir Kostov, a senior intelligence officer who defected to France. But Markov's case is also similar to several more recent incidents that have occurred over the past two decades. In 2006, Aleksandr Litvinenko suffered a

polonium-210 poisoning and died after spending nearly a month in a critical condition in a hospital. A public enquiry conducted in the UK where Litvinenko resided at the time of the attack found that the assassination was carried out by two Russian nationals. In 2021, the European Court of Human Rights (ECtHR) held that the two individuals responsible for Litvinenko's death—Andrey Lugovoy and Dmitriy Kovtun—acted as agents of the Russian state.[23] The case is ground-breaking and sets an important precedent for holding a government accountable for orchestrating targeted assassinations involving chemical, biological, and radioactive materials (CBR).

Investigating a CBR-enabled targeted assassination is far from a straightforward task. Poisoning symptoms do not always show immediately and can resemble a natural health condition. But the correct identification of the toxic agent is only half of the story. Attribution can be particularly challenging, since investigators are expected not only to build a credible and well-grounded case but also to communicate it in a convincing manner. The latter entails the process of managing a hostile information environment with malign actors spreading misleading and manipulative content to sow confusion and distrust, and ultimately blur the distinction between facts and fiction. The investigation of the poisoning of Sergei Skripal and his daughter with "Novichok" in 2018 highlights many of the challenges that law enforcement personnel, technical experts, and the diplomatic community have to grapple with.

The use of the chemical warfare nerve agent "Novichok" against the Skripals was first confirmed by the British authorities following an examination of victims' samples. The UK requested technical assistance from the Organisation for the Prohibition of Chemical Weapons (OPCW), the international watchdog which oversees compliance with the Chemical Weapons Convention (CWC). The samples were studied at an OPCW-accredited laboratory which confirmed the initial results that the toxic agent involved was indeed "Novichok", a nerve agent many times more potent than sarin.[24] Additional evidence collected at the incident scene indicated two Russian security service operatives as the perpetrators of this attack. The Russian government refuted the accusations questioning the transparency and credibility of the investigation process and alleged—without providing any evidence—that the poisoning was organised by Western intelligence services.[25] Russian verbal attacks against Western government officials and media outlets were

accompanied with cyber-attacks against the OPCW's Wi-Fi network, in order to compromise data related to the investigation.[26]

Attempts to manipulate the discourse on non-proliferation and disarmament issues are concerning, particularly because this subject matter can relatively easily be exploited to influence public perceptions. WMD-related topics are technical and using oversimplified interpretations of the facts can trigger mass panic and shift public opinion in a specific direction. For years now, the Russian state media and government officials have accused the USA and its allies of conducting illicit biological activities. These accusations reached their peak during the Russian invasion of Ukraine in 2022 but Moscow had repeatedly employed similar rhetoric regarding the work of biomedical laboratories in other countries, as well—notably, Georgia.[27] False allegations in the area of biological disarmament undermine the integrity of scientific collaboration which is key to ensuring health security and enhancing national preparedness for detection and response to disease outbreaks. As the COVID-19 pandemic has vividly demonstrated, no state in the world is ready and capable of dealing with biological risks entirely on its own and international cooperation is essential for strengthening local and national prevention, diagnostic and treatment capacities.

12.4. Conclusion: the International Prohibition of Biological Weapons in the Next 50 years

Whereas the BTWC remains a weak international regime in terms of formal mechanisms and procedures for monitoring compliance, the international norm against biological weapons is strong and robust. No state openly prides itself as possessing such weapons and states that evidently have tried to develop offensive capability have gone to extremes to conceal this effort and deny related accusations as much as possible. As its history demonstrates, the Convention is resilient and violations do not undermine its relevance and value. On the contrary, in recent years, the number of states parties has increased and currently stands at 188 with additional 4 signatory states.

BTWC lacks a verification system but the process of verification is a political just as much as it is a technical matter. The example of South Africa demonstrates that it is possible to promote transparency and accountability regarding bioweapon development in the absence of an explicit international pressure. At the same time, the experience of UNSCOM and UNMOVIC

shows that an intrusive externally imposed disarmament regime can yield important results provided that appropriate political support and adequate resources are available. By contrast, the experience of the Trilateral Agreement illustrates that systemic reluctance at the domestic level to confront institutional and infrastructural legacies of bioweapon development undermines verification efforts, breeds ambiguity, and deepens suspicion.

Tending the international norm against biological weapons is a shared responsibility. An internationally mandated verification system is not a 'silver bullet'; on the contrary, the full and effective implementation of the BTWC requires an integrated and multi-layered web of preventive policies and measures.[28] Countering the misuse of life sciences requires inclusive dialogue, international cooperation, and meaningful interaction among stakeholders in government, academia, and industry. The life science community plays a fundamental role in promoting responsible research and innovation practices and a professional ethos that cherishes openness, trust, and rigour.[29] Empowering stakeholders including by fostering awareness and understanding of emerging security concerns and encouraging the use of risk mitigation tools and approaches helps to disrupt malign life science activities.

NOTES

1 Sonia Ben Ouagrham-Gormley, "The Challenges of Expertise and Organization for Weapons Development", Barriers to Bioweapons, New York, Cornell University Press, 2014, https://doi.org/10.1017/S1537592715002133

2 The description of *Project Coast,* including its structure and operation is based on Chandre Gould and Peter Folb, "*The South African Chemical and Biological Program: An Overview",* The Nonproliferation Review, Vol. 7 Issue 3, 2000, Pg. 10-23, https://doi.org/10.1080/10736700008436822.

3 See Truth and Reconciliation Commission, "*Truth and Reconciliation Commission website*", Department: Justice and Constitutional Development of South Africa, 2025, https://www.justice.gov.za/trc/ , accessed on 26 April 2025.

4 See Chandré Gould and Peter Folb, "*Project Coast: Apartheid's Chemical and Biological Warfare Programme*", United Nations Institute for Disarmament Research (UNIDIR), 20 December 2002, https://unidir.org/publication/project-coast-apartheids-chemical-and-biological-warfare-programme/, accessed on 26 April 2025.

5 Chandre Gould and Peter Folb, "*The South African Chemical and Biological Program: An Overview*", The Non-proliferation Review, Vol. 7 Issue 3, 2000, 10-23, https://doi.org/10.1080/10736700008436822.

6 See "*South Africa's 'Dr Death' Basson Found Guilty of Misconduct*", BBC News, 18 December 2013, https://www.bbc.com/news/world-africa-25432367, accessed on

26 April 2025

7 See, for example, "*South Africa 'Dr Death' Row: Clinics Defend Basson's Right to Practise*", BBC News, 20 January 2021, https://www.bbc.com/news/world-africa-55733217, accessed on 26 April 2025

8 See Gunilla Flodén et al, "*Iraq: the UNSCOM Experience*", SIPRI, October 1998, https://www.sipri.org/publications/1998/sipri-fact-sheets/iraq-unscom-experience, accessed on 27 April 2025

9 See United Nations Security Council (UNSC), "*Resolution 687(1991)*", United Nations Monitoring, Verification and Inspection Commission (UNMOVIC), 8 April 1991, https://www.un.org/depts/unmovic/documents/687.pdf, accessed on 27 April 2025

10 Gunilla Flodén et al, "*Iraq: the UNSCOM Experience"*, SIPRI, October 1998, https://www.sipri.org/publications/1998/sipri-fact-sheets/iraq-unscom-experience, accessed on 27 April 2025

11 Gunilla Flodén et al, "*Iraq: the UNSCOM Experience"*, SIPRI, October 1998, https://www.sipri.org/publications/1998/sipri-fact-sheets/iraq-unscom-experience, accessed on 27 April 2025

12 United Nations Security Council (UNSC), "*Resolution 1051(1996)*", United Nations Monitoring, Verification and Inspection Commission (UNMOVIC), 27 March 1996, https://www.un.org/depts/unmovic/documents/1051.PDF, accessed on 27 April 2025

13 United Nations Security Council (UNSC), "*Resolution 1284(1999)*", United Nations Monitoring, Verification and Inspection Commission (UNMOVIC), 17 December 1999, https://www.un.org/depts/unmovic/documents/1284.pdf, accessed on 27 April 2025

14 See "*The Case of Iraq's "Missing" Weapons*", Arms Control Today, Arms Control Association,1 June 2003, https://www.armscontrol.org/act/2003-06/issue-briefs/case-iraqs-missing-weapons, accessed on 27 April 2025; see also "*Morell 'Wanted to Apologize' to Powell about WMD Evidence*", CBS News, 11 May 2015, https://www.cbsnews.com/news/michael-morell-apologizes-colin-powell-about-cia-pre-iraq-war-wmd-evidence/, accessed on 29 April 2025

15 Anthony Rimmington, "*Invisible Weapons of Mass Destruction: The Soviet Union's BW Programme and Its Implications for Contemporary Arms Control*", The Journal of Slavic Military Studies, vol.13 Issue 3, September 2000, Pg. 1-46, 10.1080/13518040008430448

16 See Milton Leitenberg and Raymond Zilinskas, "*The Soviet Biological Weapons Program: A History*", Harvard University Press, Cambridge, Massachusetts, USA, 20 July 2012, 9780674047709

17 See Sonia Ben Ouagrham-Gormley, "*Growth of the Anti-Plague System during the Soviet Period*", Critical Reviews in Microbiology, vol. 32 Issue 1, 2006, Pg. 33-46, 10.1080/1040841050049683; Raymond Zilinskas, "*The Anti-Plague System and the Soviet Biological Warfare Programme*", Critical Reviews in Microbiology, vol.32 issue 1, 2006, Pg. 47-66, 10.1080/10408410500496896

18 Anthony Rimmington, "*Invisible Weapons of Mass Destruction: The Soviet Union's*

BW Programme and Its Implications for Contemporary Arms Control", The Journal of Slavic Military Studies, vol.13 Issue 3, September 2000, Pg. 1-46, 10.1080/13518040008430448.; Ken Alibek with Stephen Handelman, "*Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Programme in the Word – Told from the Inside by the Man Who Ran It*", London: Arrow, 2000, 0099414643

19 Matthew Meselson et al. "*The Sverdlovsk Anthrax Outbreak of 1979*", Science, vol. 266 issue 5188, 18 November 1994, 1202-1208, 10.1126/science.7973702

20 See Jeanne Guillemin, "*Anthrax: The Investigation of a Deadly Outbreak*", University of California Press, 2001, 9780520229174

21 On the Trilateral Agreement, see David C. Kelly, "*The Trilateral Agreement: Lessons for Biological Weapons Verification*", Verification Yearbook, Verification Research, Training and Information Centre (VERTIC), 2002, Pg. 93-109, accessed on 28 April 2025

22 See Lajos Rozsa and Kathryn Nixdorff, "*Biological Weapons in Non-Soviet Warsaw Pact Countries*", Deadly Cultures: Biological Weapons since 1945, Harvard University Press, Cambridge MA, 2006, Pg.157-168, 10.4159/9780674045132-008.

23 See "*Carter v. Russia, (application no. 20914/07)*", European Court of Human Rights, Strasbourg, 21 September 2021, https://hudoc.echr.coe.int/fre?i=001-211972

24 See "*Incident in Salisbury*", Organisation for the Prohibition of Chemical Weapons, 2018, https://www.opcw.org/media-centre/featured-topics/incident-salisbury, accessed on 29 April 2025

25 See Gordon Ramsay and Sam Robertshaw, "*Weaponising News: RT, Sputnik, and Targeted Disinformation*", Kings College London, 2019, https://www.kcl.ac.uk/policy-institute/research-analysis/weaponising-news, accessed on 29 April 2025

26 "*How the Dutch Foiled Russian 'Cyber-Attack' on OPCW*", BBC, 4 October 2018, https://www.bbc.com/news/world-europe-45747472, accessed on 29 April 2025

27 Francesco Femia and Caitlin Werrell, "*The Deeply Dangerous Spread of Russian Disinformation on Biological Weapons*", Council on Strategic Risks, 11 March 2022, https://councilonstrategicrisks.org/2022/03/11/the-deeply-dangerous-spread-of-russian-disinformation-on-biological-weapons/, accessed on 29 April 2025

28 Tatyana Novossiolova et al. "*The Vital Importance of a Web of Prevention for Effective Biosafety and Biosecurity in the Twenty-First Century*", One Health Outlook, vol. 3 issue 17, 20 September 2021, 10.1186/s42522-021-00049-4

29 Tatyana Novossiolova, "*Role of the Life Science Community in Strengthening the Web of Prevention for Biosafety and Biosecurity*", Essentials of Biological Security: A Global Perspective, March 2024, Pg. 107-120, 10.1002/9781394189045.ch9

13

Bioterrorism and the Biological Weapons Convention: A Review of Five Decades of Evolving Treaty Framework

Mr. Animesh Roul

13.1. Introduction

The adoption of the Biological Weapons Convention (BWC) in 1972 was a watershed moment, marking a historic step in global arms control, representing the first multilateral disarmament treaty that banned an entire class of weapons of mass destruction (WMD). As of now (May 2025), the BWC has 189 state parties, including Palestine and the Holy See, along with four signatory states, Egypt, Haiti, Somalia, and Syria, that have yet to ratify the treaty. Additionally, five states, Chad, Djibouti, Eritrea and Israel, have neither signed nor ratified the BWC.[1] Primarily focused on state-level actors, the BWC prohibited the development, production, and stockpiling of biological and toxin weapons. However, in its formative years, the treaty and the global security community paid scant attention to the potential threat posed by Non-State Actors (NSAs: e.g., terrorist groups, criminal syndicates, religious cults, deranged bio-scientists) and the threat of bioterrorism. This initial neglect or oversight was shaped by the dominant security paradigms of the prevalent Cold War and subsequent periods. Then, the primary concern remained focused on the massive bioweapon arsenals of major powers, particularly the United States

and the former Soviet Union/Russia. At the same time, the global priority was primarily focused on nuclear weapons proliferation, along with conventional threats that dominated the post-World War II era arms control conversations.

The absence of bioterrorism discourse in early BWC negotiations also reflected a limited understanding of the dual-use nature of biological research. Although the potential misuse of biological science was acknowledged, mechanisms to prevent non-state actors from accessing dangerous pathogens or related knowledge were not prioritised. The treaty's emphasis remained firmly on state-level obligations and inter-state verification challenges.

The chapter aims to provide a comprehensive review of the Biological Weapons Convention (BWC) from the perspective of how the treaty has evolved in response to the growing threat of bioterrorism. While the BWC was initially conceived in 1972 as a disarmament treaty prohibiting biological weapons among state actors, the past five decades have witnessed the rise of non-state threats, including terrorist organisations and rogue actors, leveraging advances in life sciences to pursue biological weapons for mass violence. The paper argues that despite growing global recognition of bioterrorism, institutional adaptation within the BWC has remained inconsistent, constrained by verification gaps, political divisions, and resource limitations. Finally, the paper attempts to situate bioterrorism prevention at the heart of the BWC's reform agenda and argues for a reinvigorated multilateral commitment to biosecurity governance in an age of technological uncertainty.

13.2. Evolution of Bioterrorism Discourse in the BWC Framework

A series of critical security events, scientific advancements, and evolving perceptions of threat in the 1990s have shaped the evolution of bioterrorism (or bio-crime) discourse within the BWC framework. The journey from marginal acknowledgement to a relatively important issue reflects the dynamic nature of biological security in an era marked by both scientific progress and security uncertainties. During the initial decades post-adoption in the 1970s, discussions within BWC frameworks were largely state-centric, with limited engagement on the threats posed by non-state actors. This was partly due to the inherent difficulties in detecting and attributing biological attacks and the overarching Cold War security framework that dominated global arms control

discussions. Additionally, the lack of concrete incidents involving bioterrorism events meant the issue did not command immediate international attention.[2]

Even though the global concern about biological weapons remains on state-backed programmes, primarily due to contemporary geopolitical dynamics, bioterrorism and non-state actors' threats have found a place in BWC discussions. The initial strategic oversight began to erode in the post-Cold War period, especially following at least four major developments. First, the dissolution of the Soviet Union and the discovery of its extensive and clandestine bioweapons program (Biopreparat) raised concerns about the potential for proliferation to rogue states and non-state actors.[3] Second, the 1995 Tokyo subway Aum Shinrikyo sarin nerve gas attack and its clandestine efforts to develop and use bioweapons to kill or maim Japanese people starkly demonstrated the lethal ambitions of terrorist organisations and the plausibility of mass-casualty attacks using weapons of mass destruction.[4] Third, the global terrorist group Al Qaeda's leader, Osama bin Laden, declared in 1998 that acquiring WMD was a religious duty, increasing the WMD threat emanating from terrorist groups.[5] This declaration from a transnational jihadist leader was later backed by many Islamic clerics and ideologues who have accepted the use of biological and chemical weapons as a legitimate act of war for mass killings of non-believers, for example in 2003, Saudi Islamist cleric Nasir bin Hamd al-Fahd brought out a treatise on the legal status of using weapons for mass killings, especially against non-believers.[6] Fourth, the perceived threat of bioterrorism intensified after the 2001 anthrax letter attacks in the United States, which revealed critical vulnerabilities in public health infrastructure and highlighted the fact that even small-scale bioterror incidents could trigger widespread panic and disruption. These events prompted a major shift in global security discussions, forcing the BWC community to confront the challenge posed by bioterrorism more explicitly.[7]

Subsequent developments, including the adoption of UNSCR 1540 emphasised the urgency to prevent non-state actors from acquiring Weapons of Mass Destruction (WMDs), including biological weapons. The UNSC 1540, which was adopted unanimously under Chapter VII of the UN Charter, obligated all states to enforce domestic controls and take measures to stop non-state actors from developing, acquiring, or using nuclear, chemical, or biological weapons and their delivery systems.[8] This resolution complemented the BWC's objectives by mandating that all states establish and enforce domestic

controls to prevent the proliferation of terrorists. Yet, despite growing awareness, the integration of bioterrorism concerns into the BWC's operational framework has remained uneven. The absence of a dedicated verification mechanism and the treaty's reliance on voluntary Confidence-Building Measures (CBMs) have hampered comprehensive risk assessment and mitigation strategies. Again, the rapid advancement of life sciences and the proliferation of dual-use technologies present complex regulatory challenges.

13.3. BWC Deliberations on Bioterrorism

The central part of the evolution of bioterrorism discourse within the BWC framework has been shaped by deliberations and outcomes of its Review Conferences, Intersessional Meetings, Meetings of Experts, Meetings of State Parties, etc. These platforms have served as critical milestones for reflecting upon and refining strategies to address the threat of bioterrorism.

During the initial Review Conferences (1980-1996), discussions on bioterrorism or non-state actor threat concerns remained peripheral, mainly as discussed earlier in the paper, due to limited awareness, technological constraints, and geopolitical priorities. At the time, the focus was primarily on state-centric threats and the strategic dynamics of the Cold War, which overshadowed concerns about non-state actors and emerging bioterrorism risks. Additionally, the technical complexities associated with developing and deploying biological weapons made the prospect of bioterrorism seem less immediate. During that time, the discourse largely centred around state compliance and broader disarmament frameworks, with limited engagement on the specific threats posed by terrorist groups. Despite global incidents highlighting terrorism risks, bioterrorism was not substantively addressed in these early deliberations. However, the Fourth Review Conference (1996) marked the initial stirrings of concern over biological threats from non-state actors, influenced partly by the events of the 1995 Aum Shinrikyo sarin attack.[9]

At the Fourth BWC Review Conference, States Parties reaffirmed the critical role of Article IV (of the BWC), emphasising the obligation of each State to enact national implementation measures to prohibit and prevent the misuse of biological agents and toxins. While originally focused on state-level compliance, the discussion extended explicitly to preventing bioterrorism and criminal misuse of biological materials, thereby integrating non-state actor threats into the scope of BWC obligations. The Conference stressed that

domestic legislation, such as penal laws, physical security protocols for laboratories, and biosecurity education in scientific and military institutions, should be adopted or reviewed to 'close legal and regulatory gaps' that could be exploited by terrorists. More importantly, member states were urged to apply these legal measures extraterritorially, where possible, to their nationals operating abroad, acknowledging the transnational nature of bioterrorism. By calling for greater transparency through information-sharing with the UN and through confidence-building measures (CBMs), the Conference laid the groundwork for enhancing collective trust and early warning mechanisms. This reaffirmation positioned Article IV as a core legal firewall against the weaponisation of biological materials by both state and non-state actors, including terrorists. It marked a foundational moment where bioterrorism prevention became an explicit concern within BWC implementation frameworks.[10] Overall, the 1996 Conference underscored that without robust national laws and international cooperation, the BWC's prohibitions against the hostile use of biological agents, including by terrorists, would remain vulnerable.

The Fifth Review Conference (2001) was held shortly after the September 11 attacks and the anthrax letters in the U.S. This Conference marked a turning point in the BWC's engagement with bioterrorism. It underscored the threat posed by terrorist groups and individuals misusing biological agents. However, political divisions, particularly over a draft verification protocol developed by the Ad Hoc Group, led to the collapse of negotiations. The U.S. rejection of the protocol, citing concerns over industrial espionage and sovereignty, highlighted the deep geopolitical fault lines undermining collective verification and enforcement mechanisms.[11]

The Netherlands[12] and Italy[13] contributed working papers on bioterrorism during the BWC Meetings of Experts and States Parties in Geneva held in July and December 2004. The European Commission's biosecurity research agenda, framed under the 6th Framework Programme (2002–2006), emphasised coordinated scientific responses to emerging threats, including unknown pathogens and synthetic biology risks. The focus was on generating dual-use-sensitive yet open research outputs, integrating diagnostic platforms, vaccine development, and biotechnology applications. Meanwhile, Italy established a national risk assessment committee that ranked biological threats using CDC pathogen lists and quantifiable criteria, including transmissibility,

lethality, and the resilience of the public health system. The initiative highlighted the importance of inter-agency collaboration among civil protection, health, intelligence, and law enforcement institutions.

During the Meeting of Experts in Geneva in June 2005, Germany's intervention introduced the scientific community's ethical perspective on the regulation of bioterrorism. It acknowledged the pressing need for cures and diagnostics but warned of growing censorship and restrictions that could undermine scientific innovation. Concerns were raised about overregulation, especially regarding dual-use research and potential infringements on free scientific exchange and international collaboration. The paper emphasised responsible research practices, training, and stewardship rather than punitive restrictions.[14]

The Sixth Review Conference (2006) was considered a pivotal event for the BWC, marking the first consensus-based outcome since 1996. It marked a subtle yet important shift in the BWC's approach to bioterrorism, even if the phrase was not explicitly foregrounded. It emphasised national implementation measures to criminalise unauthorised biological activities by non-state actors, improved oversight of dual-use research, and revitalised confidence-building measures (CBMs) to enhance transparency, each directly relevant to bioterrorism prevention. Establishing the Implementation Support Unit (ISU) institutionalised assistance for states in biosecurity and legal frameworks, reinforcing the BWC's capacity to respond to emerging biothreats.[15] At this Review Conference, Italy presented a comprehensive position paper on bioterrorism on behalf of the European Union.[16] The document reiterated the urgency of bioterror threats in light of the global availability of biological agents and the proliferation of biotechnology expertise. Referencing past incidents such as the 2001 anthrax letters and Aum Shinrikyo's interest in biological weapons, the EU underscored the role of universal BWC adherence and full domestic implementation of Article IV to prohibit and prevent such activities. It integrated relevant instruments such as UNSC Resolutions 1373 (2001), 1540 (2004), and 1673 (2006) as foundational to preventing support to non-state actors. The EU also proposed future intersessional work to systematically review bioterrorism countermeasures under the auspices of the BWC.[17]

However, while it successfully established four intersessional work programs to be pursued annually until 2011, the Conference notably failed to

include bioterrorism as a formal agenda item despite growing international concern over non-state actor threats. Although bioterrorism was featured in discussions and received support from many delegations, its exclusion from the work program was mainly due to opposition from key states, notably Russia, which objected to elevating the issue within the formal framework. The United States and Russia also resisted proposals to strengthen confidence-building measures, citing poor participation and compliance under the existing voluntary system.[18] This omission was significant given the increasing global recognition of bioterrorism as a credible and evolving threat, especially with the proliferation of dual-use technologies. The sidelining of bioterrorism from formal agenda-setting reflected political divisions among major powers, which continued to constrain the BWC's capacity to adapt effectively to emerging threats posed by non-state actors and terrorist groups.

Australia brought a regional dimension to the bioterrorism discussion during the 2007 Meeting of Experts and States Parties (August–December, Geneva). Its submission detailed bioterror-related risks posed by groups like Jemaah Islamiyah and al-Qaeda in Southeast Asia. The paper described Australia's International Counter-Bioterrorism Strategy, which promoted regional capacity-building through biosafety and biosecurity training for Southeast Asian technical experts. The strategy integrated civilian and military institutions and reinforced Article X obligations of the BWC by offering technical assistance and knowledge-sharing with regional partners, thereby linking non-proliferation with peaceful biological development.[19]

In 2010, Switzerland and the United States submitted a joint paper on the Black ICE II exercise held in Montreux, Switzerland (7–8 September 2009). This tabletop exercise simulated a bioterrorism event involving aerosolised plague during an international sporting event. The goal was to evaluate international coordination across public health, law enforcement, and crisis management sectors. The exercise revealed significant gaps in information-sharing, crisis communication, and legal clarity during transnational bioterrorism events. Key findings emphasised the need for rapid needs assessment, consistent messaging, and flexible multisectoral responses. Participants agreed on enhancing national capacities and revisiting operational readiness in CBRN environments. The event was instrumental in testing interagency frameworks and reaffirming the importance of regional and international cooperation.[20] Similarly, the 2011 Tbilisi event, held in Georgia

as part of the BWC intersessional process, was a notable regional workshop focused on strengthening national implementation and enhancing capabilities to address bioterrorism and biosafety risks. The Tbilisi meeting brought together Eastern European and Central Asian states to share best practices in bio-surveillance, legal harmonisation, and response preparedness. Supported by the BWC ISU and international partners, the meeting underscored the growing recognition of regional cooperation in countering biological threats, particularly those posed by non-state actors and dual-use research in fragile governance contexts.[21] However, since the intersessional process lacked decision-making authority, bioterrorism often remained a secondary concern to broader biosafety and public health issues.

In the Seventh Review Conference (2011), the discussions intensified around biosecurity and the threat of emerging biotechnologies. The need for comprehensive national legislation and international cooperation was emphasised, particularly in controlling access to materials that could be misused for bioterrorism. These Conferences also stressed the role of confidence-building measures, urging states to share information about biosecurity practices and pathogen holdings transparently. In its Final Declaration, the Review Conference reaffirmed the States Parties' strong condemnation of terrorism in all its forms. It emphasised the need to prevent terrorists from acquiring or using biological agents, toxins, or related delivery systems for hostile purposes. It also acknowledged the vital role of fully implementing UNSC Resolution 1540, UNGA Resolution 60/288, and other relevant UN instruments in countering bioterrorism threats.[22]

In 2016, the Eighth Review Conference of the BWC underscored the international community's concerns regarding bioterrorism. States Parties reaffirmed that terrorism, in all its forms, is abhorrent and unacceptable, emphasising the necessity to prevent terrorists from acquiring or using biological agents and toxins for non-peaceful purposes. Germany, in particular, raised the issue of bioterrorism in its statement.[23] The Conference recognised, like earlier Review Conferences, the importance of fully implementing the BWC and relevant United Nations resolutions, such as UNSCR 1540 and UN General Assembly Resolution 60/288, in addressing the growing threat of NSAs using biological weapons.[24]

The Ninth Review Conference, which was held in 2022, one year after the scheduled dates, was due to the COVID-19 pandemic, revisited

bioterrorism concerns with renewed urgency. The issue was addressed in statements amid post-COVID-19 biosecurity concerns.[25] The U.S. reiterated the BWC's role in addressing biological threats, including deliberate acts by non-state actors, referencing the 2021 statement by National Security Adviser Jake Sullivan on strengthening the BWC to counter bioterrorism.[26]

Canada and co-sponsors highlighted Article X activities (2017–2022) to build capacity against bioterrorism, such as disease surveillance. Discussions also referenced workshops like the June 2019 Tbilisi event on countering biological threats aimed at averting bioterrorism.[27] The final document established a Working Group (2023–2026) to address compliance and biosecurity, reflecting bioterrorism concerns. Proposals like Kazakhstan's International Agency for Biological Safety aimed to enhance global bioterrorism prevention.[28]

While bioterrorism has gained increasing recognition within the BWC over the decades, meaningful institutional and operational progress has lagged, and the phrase has struggled to be mentioned in the final documents of review conferences. Persistent verification gaps, lack of enforceable oversight, and under-resourced support structures have prevented the BWC from effectively addressing non-state threats. Each Review Conference has acknowledged the problem, but the responses have been more rhetorical than practical.

13.4. Global Security Architecture and Complementary Mechanisms

The challenge of bioterrorism transcends the scope of the Biological Weapons Convention (BWC), necessitating a comprehensive and multi-sectoral approach rooted in international cooperation. Effective prevention and response hinge on the BWC's coordination with broader global biosecurity mechanisms, including those focused on public health, law enforcement, scientific governance, and legal enforcement. Among them, a key complementary instrument is United Nations Security Council Resolution 1540 (2004), which obligates states to implement domestic controls to prevent the proliferation of weapons of mass destruction (WMDs), including biological weapons, to non-state actors.[29] While the BWC provides the normative foundation for banning biological weapons, UNSCR 1540 addresses the operational gaps by mandating actionable national measures. Yet, coordination between the two frameworks remains limited. More robust collaboration, such

as joint reporting, cross-institutional training, and capacity-building, could enhance both treaties' efficacy in confronting bioterrorism.

Similarly, the World Health Organisation (WHO) contributes significantly to global biosecurity, particularly through its International Health Regulations (IHR 2005), which guide the detection and management of public health emergencies, including those caused by deliberate biological releases. The COVID-19 pandemic demonstrated the urgency of integrating public health preparedness into biosecurity planning. Strengthening BWC-WHO collaboration—especially in outbreak response, laboratory biosafety, and surveillance—can bolster resilience to natural and deliberate biological events. Another international agency, Interpol, is increasingly active in combating bioterrorism through its Bioterrorism Prevention Programme, which facilitates operational preparedness, intelligence-sharing, and capacity-building among member states.[30] Despite its contributions, formal cooperation between Interpol and the BWC framework remains underdeveloped. Creating joint response protocols, information-sharing platforms, and coordinated law enforcement training could improve global bioterrorism preparedness.

Legal instruments at the national level, such as the Biological and Toxin Weapons Convention Implementation Acts adopted by several countries, play a crucial role in operationalising treaty obligations. However, significant disparities exist across jurisdictions regarding enforcement capacity and scope. Bridging these gaps through harmonised legislation, technical assistance, and cross-border judicial cooperation is critical to deterring and prosecuting bioterrorism offences.[31] In sum, strengthening global resilience against bioterrorism demands enhanced institutional linkages between the BWC and complementary security, health, legal, and scientific frameworks. By promoting interoperability, shared accountability, and inclusive governance, the BWC can function more effectively as the central pillar of the international biosecurity architecture.

13.5. Challenges in Addressing Bioterrorism under the BWC

Despite the gradual incorporation of bioterrorism concerns into the Biological Weapons Convention (BWC), the treaty continues to face deep-rooted challenges that undermine its effectiveness in addressing evolving biological threats. These challenges are broadly structural, technical, political, and

institutional, requiring coordinated international efforts to address them. One of the most critical weaknesses is the absence of a legally binding verification regime. Unlike the Chemical Weapons Convention (CWC) and the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), the BWC lacks mechanisms to monitor compliance and investigate violations. Instead, it relies on Confidence-Building Measures (CBMs), which are voluntary and inconsistently implemented. Past attempts to establish verification protocols, such as the 2001 Ad Hoc Group negotiations, have collapsed amid concerns over national sovereignty and commercial confidentiality. This verification void significantly limits the global community's ability to detect and deter clandestine bioterrorism activities.

The rapid advancement of biotechnology has further complicated the landscape. Technologies such as CRISPR-based gene editing, synthetic biology, and AI-assisted biological design have made dual-use risks more acute.[32] The proliferation of open-source scientific platforms and decentralised research practices has expanded access to potentially dangerous tools, challenging existing oversight mechanisms. The BWC lacks the authority and resources to monitor these developments effectively, highlighting the urgent need for internationally agreed ethical standards and scientific governance frameworks. Significant disparities in national implementation further weaken collective biosecurity. While some states maintain comprehensive legal and regulatory frameworks, others, particularly in the Global South (LMIC: Low and Medium Income Countries), struggle with limited resources, technical expertise, and institutional capacity. These gaps create vulnerabilities that could be exploited by bioterrorist actors. Coordinated capacity-building efforts, supported through sustained international cooperation, are essential to levelling this implementation divide.

Efforts under Article X to foster international cooperation remain hindered by political disagreements. Some states emphasise the free exchange of scientific knowledge, while others prioritise safeguards against misuse. These divergent views have constrained collaboration and impeded the establishment of unified approaches to dual-use oversight and technology transfer. Again, the BWC's integration with other international instruments, such as UNSCR 1540, the World Health Organisation (WHO), and the Global Health Security Agenda (GHSA), remains limited. The lack of institutionalised coordination and data-sharing weakens the overall biosecurity architecture. Operational cooperation

among these frameworks must be enhanced to ensure a coherent global response to bioterrorism.

The Implementation Support Unit (ISU), while central to BWC operations, remains under-resourced and narrowly mandated. Its limited capacity restricts its ability to provide technical assistance, facilitate training, or support real-time outbreak responses. Strengthening the ISU through increased funding, an expanded mandate and regional outreach would significantly enhance the treaty's operational effectiveness.

Emerging threats posed by non-state actors and the rise of DIY biohacking communities pose additional concerns. The increasing accessibility of biotechnological tools through commercial markets and online forums makes it easier for malicious actors to experiment with biological agents. The BWC's state-centric framework does not sufficiently address these developments. Engaging with the private sector, scientific institutions, and informal research communities is crucial to extending the treaty's reach. Last but not least, persistent political divergences continue to stall substantive reforms in the BWC. Substantive disagreements over verification protocols, Article X implementation, and capacity-building efforts prioritisation have led to gridlock in the Review Conferences. This has eroded trust among state parties and undermined the BWC's credibility. Bridging these divides through inclusive diplomacy, sustained dialogue, and mutual confidence-building measures is essential for reinvigorating the Convention's role in global biosecurity.

Table 13.1: Key Bioterrorism-Related Events in BWC Evolution (1972–2022)[33]

Year	*Event*	*Relevance to Bioterrorism and the BWC*
1972	Adoption of the BWC	Prohibits development and stockpiling of biological weapons; initially focused only on state actors.
1975	Entry into force of the BWC	The treaty becomes legally binding and lacks verification and enforcement provisions.
1986	Introduction of Confidence-Building Measures (CBMs)	Voluntary mechanism for transparency among States Parties; limited utility for detecting bioterrorism.
1995	Aum Shinrikyo attack in Japan (sarin gas)	In the first high-profile case of non-state WMD use, the group attempted to produce biological weapons.

Year	*Event*	*Relevance to Bioterrorism and the BWC*
1996	Fourth Review Conference	First formal BWC discussions on non-state actor threats and dual-use concerns.
2001	9/11 attacks and U.S. anthrax letters	Marked a turning point in global focus on bioterrorism and biological threat preparedness.
2001	Fifth Review Conference	Verification protocol talks collapse; Bioterrorism gains recognition in BWC discourse.
2004	UNSC Resolution 1540 adopted	Mandates all states to prevent non-state actors from acquiring WMDs, reinforcing BWC objectives.
2006	Sixth Review Conference	Establishes the Implementation Support Unit (ISU); promotes biosecurity and national implementation.
2011	Seventh Review Conference	Strong condemnation of terrorism aligns BWC with UNSCR 1540 and other global counterterrorism measures.
2016	Eighth Review Conference	This highlights concerns over synthetic biology, dual-use, and limited outcomes on bioterrorism safeguards.
2019-2022	COVID-19 pandemic	Exposes global vulnerability; renews focus on lab safety, gain-of-function research, and disinformation.
2022	Ninth Review Conference	Emphasises the need for cooperation, dual-use oversight, and capacity-building to address bioterrorism.

13.6. Strategic Gaps, Emerging Threats, and Future Pathways

The Biological Weapons Convention (BWC) has made gradual progress in addressing bioterrorism; however, major strategic gaps persist. The Convention missed critical opportunities to strengthen its mechanisms following several global crises. The 2001 anthrax attacks raised international awareness about non-state actor threats, yet political disagreements led to the collapse of verification negotiations. More recently, the COVID-19 pandemic revealed systemic vulnerabilities in health systems and bio-preparedness, but the Ninth Review Conference failed to produce binding reforms. Until now, no commitments have been made to regulate gain-of-function research, bolster early warning systems, or integrate bio-surveillance technologies, demonstrating a recurring inability to leverage crises into structural advancement.

A key limitation of the BWC has been its Global North-centric orientation. Many developing countries face heightened bioterrorism risks due to fragile health systems, limited biosafety controls, and under-resourced laboratories. The boundaries between natural outbreaks and deliberate incidents in such regions are often blurred. Yet, the Global South remains underrepresented in shaping verification protocols and capacity-building mechanisms. Bridging this divide requires increased technical support and meaningful inclusion of these perspectives in treaty negotiations and implementation frameworks. Compounding these gaps are emerging challenges that transcend traditional arms control paradigms. The pandemic underscored the destabilising impact of disinformation, ranging from lab-origin conspiracy theories to extremist propaganda, which eroded public trust and amplified geopolitical tensions.[34] The BWC must incorporate digital threat mitigation into its framework by developing partnerships with international organisations and tech platforms to counter misinformation.

Artificial intelligence (AI) also poses dual-use dilemmas. While AI enhances bio-surveillance and disease modelling, it can lower the threshold for pathogen manipulation. The BWC should integrate AI governance and foresight tools into CBM templates and scientific oversight efforts. Similarly, the rise of do-it-yourself (DIY) biohacking and open-access gene-editing tools necessitates adaptive regulatory approaches. Ethical oversight remains another critical frontier. High-risk research, such as gain-of-function experiments, is insufficiently governed.[35] In response to the complex and evolving challenges posed by bioterrorism, the BWC must embrace a future-oriented strategy grounded in innovation and inclusive diplomacy. At the core of this strategy is the urgent need to establish a verification mechanism that employs artificial intelligence (AI), open-source intelligence, and other non-intrusive tools—ideally piloted in collaboration with willing states to build consensus and test feasibility. Equally vital is enhancing national capacity-building, particularly in developing countries, by creating a dedicated BWC Capacity Fund to support legal, technical, and infrastructural advancements.

The Implementation Support Unit (ISU) must be expanded and empowered with a broader mandate, including regional outreach capabilities and the authority to coordinate responses to emerging biosecurity threats. Institutional cooperation should also be deepened with relevant international bodies such as the World Health Organisation (WHO), Interpol, and the

UNSCR 1540 Committee to ensure cohesive and timely inter-agency collaboration. Most importantly, the BWC should promote responsible science by advancing international ethical standards and raising awareness of dual-use research risks within the scientific community. Disinformation, which increasingly undermines public trust and complicates response efforts, must be addressed through public education initiatives and partnerships with digital platforms to counter malicious narratives. Political divides that impede treaty reform should be bridged through incremental, issue-specific agreements and diplomatic mediation efforts. Similarly, CBMs should be standardised to improve quality and comparability and expanded to include monitoring of non-state actors supported by third-party technical verification. Lastly, leveraging emerging technologies such as blockchain and AI for real-time pathogen tracking and biological threat analysis can significantly enhance the Convention's operational readiness. Together, these measures form the basis of a revitalised BWC capable of addressing 21st-century biological security challenges.

13.7. Conclusions

Marking its 50th year on March 26, 2025, the Biological Weapons Convention (BWC) stands at a critical inflexion point in global arms control. Over the past five decades, the nature of biological threats has evolved from traditional state-based warfare to include decentralised bioterrorism and the misuse of rapidly advancing biotechnologies. The COVID-19 pandemic starkly revealed the vulnerabilities in global bio-preparedness, underscoring the urgent need for the BWC to adapt to the realities of a more interconnected and technologically dynamic world. The BWC must transition from a prohibition-centric treaty into a forward-looking regime rooted in prevention, transparency, and innovation to remain relevant and practical. Strengthening verification remains paramount. The development of non-intrusive, technology-enabled compliance mechanisms is crucial for detecting and deterring illicit activities. Equally important is the need for inclusive capacity-building, especially for the Global South, to address implementation gaps and promote equitable global resilience.

In light of evolving threats, future-proofing the BWC will require the adoption of several proposals discussed earlier, including digital threat monitoring, AI governance, and ethical oversight. Expanding stakeholder

engagement to include private biotechnology firms, academic institutions, and civil society actors will enrich governance, enhance accountability, and foster broader trust in the regime. As the boundaries between public health, security, and technology continue to blur, the prevention of bioterrorism must emerge as a foundational pillar of international peace and security. Ultimately, the BWC has the normative legacy and institutional foundation to lead global efforts against biological threats. However, it must be revitalised through coordinated reforms, cross-sectoral collaboration, and inclusive diplomacy. Without bold and adaptive measures, the Convention risks obsolescence in the face of escalating biological risks. The BWC's 50th anniversary presents a historic opportunity to reaffirm and modernise its mandate for the challenges of the 21st century.

NOTES

1 The Biological Weapons Convention (BWC), UNODA. https://disarmament.unoda.org/biological-weapons/ Accessed on May 10, 2025. On the latest Kiribati's accession, See, US State Department, Press Statement, 'Kiribati Accedes to the Biological Weapons Convention', May 20, 2025. https://www.state.gov/releases/office-of-the-spokesperson/2025/05/kiribati-accedes-to-the-biological-weapons-convention/

2 For an in depth overview, See, W. Seth Carus, "*Bioterrorism and Biocrimes: The Illicit Use of Biological Agents Since 1900*", Center for Counterproliferation Research, National Defense University, Washington D.C., February 2001, https://irp.fas.org/threat/cbw/carus.pdf, accessed on 5 May 2025.

3 Riedel, S., "*Biological Warfare and Bioterrorism: A Historical Review*", Proceedings (Baylor University Medical Center), vol. 17 issue 4, Novmber 2004, pg. 400–6, 10.1080/08998280.2004.11928002

4 Jonathan B. Tucker, "*Historical Trends Related to Bioterrorism: An Empirical Analysis*", Emerging Infectious Diseases, vol. 5 issue 4, 1999, https://stacks.cdc.gov/view/cdc/14872/cdc_14872_DS1.pdf, 10.3201/eid0504.990406, accessed on 5 May 2025.

5 Gary Ackerman and Ryan Pereira, "*Jihadists and WMD: A Re-evaluation of the Future Threat*", CBRNe World, October 2014, pg. 27–34

6 Nasir Bin Hamad Al-Fahd, "*A Treatise on the Legal Status of Using Weapons of Mass Destruction against Infidels*", https://ahlussunnahpublicaties.files.wordpress.com/2013/04/42288104-nasir-al-fahd-the-ruling-on-using-weapons-of-mass-destruction-against-the-infidels.pdf, accessed on 5 May 2025; also see Animesh Roul, "*Apocalyptic Terror: Chemical and Biological Dimensions of Jihadi Terrorism*", Society for the Study of Peace and Conflict, http://www.sspconline.org/index.php/research-paper/apocalyptic-terror-chemical-and-biological-dimensions-jihadi-terrorism, accessed on 5 May 2025

7 Animesh Roul, 'Bioterrorism', The Palgrave Encyclopaedia of Global Security Studies, Cham: Palgrave Macmillan, Cham,14 September 2021, 10.1007/978-3-319-74336-3_521-1

8 United Nations Security Council (UNSC), "*Resolution 1540(2004)*", United Nations Monitoring, Verification and Inspection Commission (UNMOVIC), 28 April 2004, https://documents-dds-ny.un.org/doc/UNDOC/GEN/N04/328/43/PDF/N0432843.pdf, accessed on 5 April 2025.

9 Graham S. Pearson, "*Fourth BWC Review Conference*", Arms Control Today, Arms Control Association, January 1997, https://www.armscontrol.org/act/1997-01/features/fourth-bwc-review-conference, accessed on 8 April 2025.

10 "*Final Declaration, Fourth Review Conference of the Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction*", United Nations Office for Disarmament Affairs (UNODA), 1996, https://disarmament.unoda.org/fourth-review-conference-the-parties-to-the-convention-on-the-prohibition-of-the-development-production-and-stockpiling-of-bacteriological-biological-and-toxin-weapons-and-on-their-destruction/, accessed on 25 April 2025.

11 Jonathan Tucker, "*The Fifth Review Conference of the Biological and Toxin Weapons Convention (BWC)*", Nuclear Threat Initiative (NTI), 31 January 2002, https://www.nti.org/analysis/articles/biological-and-toxin-weapons-bwc, accessed on 25 April 2025

12 Delegation of the Netherlands, "*Research on Prevention of Bioterrorism: Overview of Recent Developments and Actions at European Community Level*", United Nations, 21 July 2004, https://documents.un.org/doc/undoc/gen/g04/624/15/pdf/g0462415.pdf, accessed on 8 April 2025

13 Delegation of Italy, "*Enhancing National Capabilities for Responding to and Mitigating Effects of Bioterrorism and Related Diseases*", United Nations, 28 July 2004, https://documents.un.org/doc/undoc/gen/g04/625/83/pdf/g0462583.pdf, accessed on 15 April 2025

14 Delegation of Germany, "*Regulations for the Prevention of Bioterrorism – Pros and Contras from a Scientist's Point of View*", United Nations, 13 June 2005, https://documents.un.org/doc/undoc/gen/g05/617/33/pdf/g0561733.pdf, accessed on 8 April 2025

15 Una Becker, "*Light at the End of the Tunnel? The Sixth Review Conference of the Biological Weapons Convention*", Peace Research Institute Frankfurt (PRIF), 2007, https://www.files.ethz.ch/isn/50213/prif79.pdf, accessed on 8 April 2025

16 Delegation of Italy on behalf of the European Union, "*Bioterrorism*", United Nations, 21 November 2006, https://documents.un.org/doc/undoc/gen/g06/653/74/pdf/g0665374.pdf, accessed on 15 April 2025.

17 Ibid.

18 "*The Biological Weapons Convention (BWC) at a Glance*", Arms Control Association, August 2024, https://www.armscontrol.org/factsheets/biological-weapons-convention-bwc-glance-0, accessed on 15 April 2025

19 Delegation of Australia, "*Regional BWC Cooperation And International Bioterrorism*",

United Nations, 20 August 2007, https://digitallibrary.un.org/nanna/record/610013/files/BWC_MSP_2007_MX_WP.13-EN.pdf, accessed on 15 April 2025

20 Delegation of Switzerland and the United States of America, "*Black ICE II Bioterrorism Response International Coordination Exercise*", United Nations, 27 August 2010, https://documents.un.org/doc/undoc/gen/g10/622/99/pdf/g1062299.pdf, accessed on 15 April 2025

21 Kirk C. Bansak, "*Enhancing Compliance with an Evolving Treaty: A Task for an Improved BWC Intersessional Process.*" Arms Control Association, 2011, https://www.armscontrol.org/act/2011-06/enhancing-compliance-evolving-treaty-task-improved-bwc-intersessional-process#5

22 "*Final Document of the Seventh Review Conferenc*e", Verification, Research, Training and Information Centre (VERTIC), 13 January 2012, https://www.vertic.org/media/assets/nim_docs/Treaty/biological/subsidiary/BWC-CONF_VII-7-en.pdf, accessed on 25 April 2025

23 Delegation of Germany, " '*General Statement', Eighth Review Conference of the States Parties to the BTWC*", United Nations, 2016, available at https://docs-library.unoda.org/Biological_Weapons_Convention_-_Preparatory_Committee_for_the_Eighth_Review_Conference_%282016%29/BWC_PC_8RC_Germany. pdf, accessed on 28 April 2025

24 "*Final Document of the Eighth Review Conference*", United Nations Institute for Disarmament Research (UNIDIR), 11 January 2017, https://digitallibrary.un.org/record/3856224/files/BWC_CONF.VIII_4-EN.pdf, accessed on 28 April 2025

25 Irene Velicer, "*Covid Heats Up Debate over Biological Weapons Convention*", Geneva Solutions, 20 June 2022, https://genevasolutions.news/science-tech/covid-heats-up-debate-over-biological-weapons-convention, accessed on 5 May 2025

26 Rachel Paige Casey, "*Weekly Bulletin",* The Pandora Report 15 October 2021, https://pandorareport.org/2021/10/15/pandora-report-10-15-2021/, UNID accessed on 5 May 2025

27 "*International Activities of Global Partnership Member Countries Related to Article X of the Biological and Toxin Weapons Convention (2017–2022)*", United Nations Institute for Disarmament Research (UNIDIR), 6 December 2022, https://bwcimplementation.org/sites/default/files/resource/G2260646.pdf, accessed on 28 April 2025.

28 "*Final Document of the Ninth Review Conference*", United Nations Institute for Disarmament Research (UNIDIR), 22 December 2022, https://documents.un.org/doc/undoc/gen/g22/617/94/pdf/g2261794.pdf, accessed on 28 April 2025

29 "*20 years of the UN Security Council Resolution 1540 (2004) – a Customs perspective*", World Customs Organisation (WCO), 13 May 2024, https://www.wcoomd.org/en/media/newsroom/2024/may/20-years-of-the-un-security-council-resolution-1540-2004-a-customs-perspective.aspx 13 May 2024, https://www.wcoomd.org/en/media/newsroom/2024/may/20-years-of-the-un-security-council-resolution-1540-2004-a-customs-perspective.aspx

30 "*Bioterrorism: Reducing the threat of bioterrorism, and other bio related crimes, through effective countermeasures*", Interpol, https://www.interpol.int/Crimes/Terrorism/

Bioterrorism, accessed on 1 May 2025

31 See, for example, "*INDIA: Biological Weapons Convention National Implementation Measures Database*", United Nations Institute for Disarmament Research (UNIDIR) https://bwcimplementation.org/states/india, accessed on 4 May 2025

32 Rodolphe Barrangou, "*AI and SynBio Meet CRISPR Heralding a New Genome Editing Era*", The CRISPR Journal, vol 7 issue 4, 2024, pg. 179-179, 10.1089/crispr.2024.0063, accessed on 4 May 2025

33 Author's Compilation documenting key bioterrorism-related events and their relevance to the evolution of the BWC.

34 Joint statement by WHO, UN, UNICEF, UNDP, UNESCO, UNAIDS, ITU, UN Global Pulse, and IFRC, "*Managing the COVID-19 infodemic: Promoting healthy behaviours and mitigating the harm from misinformation and disinformation*", World Health Organisation (WHO), 23 September 2020, https://www.who.int/news/item/23-09-2020-managing-the-covid-19-infodemic-promoting-healthy-behaviours-and-mitigating-the-harm-from-misinformation-and-disinformation, accessed on 5 May 2025

35 Todd Kuiken, "*Oversight of Gain-of-Function Research with Pathogens: Issues for Congress*", Congressional Research Service, March 10 2025, https://www.congress.gov/crs_external_products/R/PDF/R47114/R47114.7.pdf, accessed on 1 May 2025

14

The Biological Weapons Convention at a Technological Crossroads

Prof. Manish and Ms. Vidhi Rathore

14.1. Introduction

The Biological Weapons Convention (BWC) entered into force in 1975, stands as the foundational international legal instrument which prohibits the development, production, and acquisition of biological and toxin weapons. As the multilateral disarmament treaty banning an entire category of weapons of mass destruction, it represented a major normative achievement in global arms control. As the convention marks its fiftieth anniversary, questions started to arise regarding its efficacy, robustness, and adaptability in the face of emerging biological threats and rapid technological change in 21st century.

Biological Weapons are those weapons which

> *"...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 for 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 recognized 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 post-WWII to achieve a comprehensive ban failed, though the UN continued advocating for the elimination of all weapons of mass destruction, including biological and chemical arms.[3] 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. A 1969 UN report and a 1970 WHO report emphasized the severe, unpredictable, and potentially irreversible impacts of these weapons, especially on civilians. Although many nations initially supported banning both types of weapons together, by the late 1960s it became evident that only a separate ban on biological weapons was feasible.[4] By 1972, negotiations at the Conference of the Committee on Disarmament (CCD) yielded the Biological Weapons Convention, signed by over twenty-two countries and entering into force in 1975.

For five decades, the BWC has served as a foundational framework for preventing the development, production, and use of biological weapons. With the rapid integration of Artificial Intelligence (AI) into life sciences research poses complex, emerging challenges that the BWC was not originally designed to address. As AI accelerates advancements in biotechnology, it raises new questions about verification, compliance, and the very nature of biological threats. As AI systems become more accessible and powerful, the potential for their misuse in the development or enhancement of biological weapons grows significantly. The building of these capabilities places the BWC at a technological crossroads. The treaty now faces the urgent challenge of adapting its framework to remain effective in a world where biological threats are no

longer confined to state-sponsored programs but can emerge from decentralized, digitally enabled networks. This chapter explores how emerging technologies threaten to outpace existing governance structures and what reforms are necessary to ensure that the BWC continues to uphold the global norm against biological weapons in this new era.

14.2. Technological Advancements Reshaping Biosecurity

Rapid advances in science and technology are creating new risks for the BWC. Some emerging technologies could lead to more advanced biological weapons by enhancing their spread, durability, or effectiveness—overcoming previous limitations. Others may even redefine biological warfare entirely.[5]

14.2.1. Artificial Intelligence

Artificial Intelligence (AI) is rapidly transforming the field of biotechnology by accelerating research, automating laboratory processes, and enabling complex modelling of biological systems. AI's role in biotechnological advances has expanded dramatically in recent years, significantly lowering the barriers for developing biological weapons. In the biological sciences, AI is especially valuable for analyzing large, unstructured datasets, enabling rapid innovation and decision-making. While these capabilities have advanced research and applications in biosciences, they also pose serious risks. AI could be exploited to design harmful biotechnologies, including the creation or enhancement of biological weapons.

As AI continues to transform how we address biological threats, the potential for misuse becomes an increasingly urgent concern.[6] Many AI tools now enable the design, simulation, and optimization of biological agents, which may not immediately appear dangerous in their natural form. AI systems can now autonomously design proteins and biological pathways with precision, thus it can be used to create a new generation of biological weapons with new characteristics such as the capacity to evade conventional detection methods.[7] These systems can optimize biological agents to increase their pathogenicity, resistance to treatment, or resistance to detection, effectively enabling the development of sophisticated biological weapons. AI tools such as Large Language Models (LLMs) and Biological Design Tools (BDTs) significantly enhance both the capability and accessibility of biological research, including potentially risky applications, due to their ability to process and analyze vast

amounts of information.[8] LLMs, such as chat bots, can generate and analyze vast amounts of data, potentially lowering the expertise needed to conduct biological experiments. This may assist hostile actors including non-state groups in acquiring biological weapons and planning attacks. LLMs also pose a risk in spreading misinformation during disease outbreaks or biological incidents. They can obscure the origins of a pathogen, disrupt public health responses, and decreases trust in medical interventions. A 2022 UN report warned that AI-driven disinformation could mislead investigations, hinder countermeasures, and incite public panic during health crises.[9]

Thus the threats from AI can bio-threat can be divided into: 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 an emerging risk with a moderate probability 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.[10] Similarly, engineered microbes that break down materials could pave the way for future anti-material biological weapons. Technological progress is also making delivery and targeting of biological agents easier.

Effective strategies are needed to regulate AI use in synthetic biology, control access to genetic data, and guide AI development to reduce future biosecurity risks. This includes careful evaluation of gain-of-function research, especially as AI can enhance synthetic biology methods that could be exploited for bioterrorism. The Centre for AI Safety outlines four major categories of catastrophic AI risks: malicious use (e.g., bioterrorism), competitive AI races, organizational failures, and loss of control over autonomous systems. As AI and gene-editing tools become more powerful and accessible, strong governance and oversight become critical.[11] Thus AI has shifted the biosecurity landscape from one where expertise and infrastructure were key limiting factors, to one where access to powerful algorithms and data may be enough to pose a serious threat.

14.2.2. CRISPR and the Democratization of Gene Editing

Gene-editing technologies such as *Synthetic Biology,* which the National Academy of Sciences defines as *"concepts, approaches, and tools which enable*

the modification or creation of biological organisms" pose a profound threat[12] and CRISPR-Cas9 have revolutionized genetic engineering by making it easier, cheaper, and more precise. It had made the modification of pathogens spread more quickly while infecting more people and causing more severe sickness, restraining form treatment more fully.[13]

Originally developed in high-security laboratories, CRISPR has now spread to universities, start-ups, and even do-it-yourself (DIY) bio hacker communities raising concerns about their misuse in developing biological weapons. While it has unlocked breakthroughs in treating genetic diseases and improving crops, it also presents potential security concerns. CRISPR can be used to modify pathogens, alter host susceptibility or create entirely synthetic organisms. Coupled with AI design tools, gene editing could allow individuals or groups to engineer organisms that are more difficult to detect, treat, or contain. Gene editing being cheaper will encouraging rogue or smaller states to reassess the limited benefits of pursuing biological weapons.

Therefore, any strategy aimed at reducing the threat of genetically engineered bioweapons must consider the interests and behaviours of a wide variety of states and not just the major powers.[14] Moreover, as synthetic DNA can now be ordered through commercial providers with minimal regulation in some jurisdictions, the risk of intentional misuse grows in parallel with technological capability. 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 decentralized and accessible. Genome editing tools like CRISPR-Cas9 now allow DNA to be designed digitally and synthesized remotely, challenging traditional export control systems.[15] Synthetic BWs could disable forces before conflict begins, using designed incubation periods or presymptomatic spread. Some may even be programmed to deactivate under specific conditions, reducing risk to the attacker. Concepts like "binary weapons", harmless agents released separately that become harmful when combined in a host, further complicate defence. For example, infections in distant ports could be used to secretly incapacitate a naval strike group ahead of conflict.[16] However, the lack of adequate regulatory oversight by government agencies creates a gap that increases the risk of these tools being misused to plan or carry out biological attacks.

14.2.3. Cloud-Based Laboratories

Some research tasks can now be performed remotely through cloud laboratories, allowing users to run biological experiments without being physically present. This creates challenges for national and international regulators trying to enforce biosafety standards or track potentially hazardous activities. Such decentralization marks a significant departure from Cold War-era models of bioweapons proliferation, where surveillance focused on state labs and physical stockpiles. In the age of AI and automation, the production of harmful biological agents could become more virtual, obscured, and difficult to intercept. Furthermore, user-friendly tools and platforms like "cloud labs (Cloud labs are remote, automated laboratories accessed via cloud-based platforms, allowing researchers to run and monitor experiments remotely using robotic systems. They offer flexibility, cost-efficiency, and scalability without the need for physical presence in a traditional lab)"[17] and single-use bioreactors lower the technical barriers, making advanced biological work possible even outside conventional labs.

This democratization of biology, seen in initiatives like the iGEM competition and DIY bio groups, brings both innovation and risk.[18] This easiness gives birth to bioterrorism. 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 state-centric by design. Terrorist groups, rogue researchers and even lone individuals may gain access to dangerous biological materials due to the democratization 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.[19] With the use of AI, cyber and cloud laboratories, these groups can work out and come up with the deadliest biological weapon for specific purposes.

Thus, technological advancements have significantly complicated efforts to control biological weapons. One approach to mitigating this risk is to regulate the export and transfer of dual-use materials through licensing and permit systems. However, this is particularly challenging when dealing with intangible technologies. Controlling access becomes even more difficult when dangerous genetic sequences are freely available online, allowing individuals including non-state actors with malicious intent to obtain them without necessarily knowing which sequences are considered hazardous.[20]

14.2.4. 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 programs, have fuelled disinformation and further eroded trust among nation. Amid these rivalries, states have rapidly expanded biotechnology capabilities, including a proliferation of high-containment laboratories, yet transparency has not kept pace.[21] Like the COVID-19 pandemic revealed deep systemic weaknesses in global bio-preparedness. Although the BWC does not directly govern naturally occurring disease outbreaks, it is intimately connected to broader bio-safety and bio-security 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.[22] The rapid integration of AI tools into the life sciences is compounding these challenges. AI can streamline complex biological processes, automate pathogen design, and enhance the capabilities of dual-use technologies making them more accessible to a wider range of actors, including those outside traditional state structures. This democratization of biological tools, paired with the proliferation of openly accessible genetic databases and automated cloud laboratories, is changing the threat landscape. While many of these groups are developing their own bio-safety standards, the growing number of actors working with dual-use technologies, biotechnologies enhanced by AI, increases the challenge of monitoring and enforcing BWC compliance.[23]

Although building a sophisticated biological weapon remains difficult 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 bio-security. 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 weaponize 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 biosecurity strategies than commit to global disarmament norms.[24]

14.3. Limitations of the BWC

14.3.1. Definition of Biological Weapons

Another bigger and structural limitation of the BWC is the way in which the BWC 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 BW Convention.[25]

While constructive ambiguity can be useful 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. This legal ambiguity becomes even more problematic in the age of AI, synthetic biology, and advanced cyber technologies. AI tools can now assist in designing pathogens, simulating disease outbreaks, optimizing delivery systems, or modelling gene-editing experiments, all without creating a physical agent. These non-material capabilities fall outside traditional definitions of weapons or delivery mechanisms and exist in a regulatory grey area under the BWC. Since these activities are digital and intangible, proving hostile intent or potential misuse is even more difficult, further complicating verification efforts.

The BWC's emphasis on 'intent' reflected in the phrase 'no justification' for possessing biological agents makes it a broad and future-proof instrument.[26] However, this general-purpose criterion is inherently difficult to verify, as proving intent without accompanying action[27] 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 BW Convention does not completely prohibit 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. Certain biological agents and toxins may be retained, produced, or acquired through other means, and tested in labs or in the field.[28] As a result, emerging technologies not only complicate the technical landscape, but also worsen the Convention's foundational weakness in determining intent and differentiating between offensive and defensive work. While the BWC's flexible language allows it to evolve with technological progress, this same flexibility increasingly undermines its effectiveness in an AI-driven world, where the line between scientific innovation and biological threat is more blurred than ever.

14.3.2. Absence of Verification Protocol

The most widely cited flaw of the BWC is its lack of verification and compliance regime i.e. there is no mechanism for dealing with the violation of rule established by the BWC or Geneva Protocol. The absence of an enforcement mechanism poses a significant threat to the international community.[29] Unlike the Chemical Weapons Convention (CWC), which empowers the Organization for the Prohibition of Chemical Weapons (OPCW) to conduct inspections on states abide by with the convention,[30] the BWC lacks similar institutional tools to for inspection, detect or deter violations of the treaty. Allegations concerning the Soviet Union's Biopreparat program say it is unclear whether biological weapons were destroyed or transferred to benign reasons,[31] 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 in relation to the BWC.[32] During the third BWC Review Conference in 1991, attempts were made to form an ad hoc committee of verification experts known as VEREX to examine and decide possible verification techniques using scientific and

technology methods. A decade later, state parties held a Special Conference of States Parties to form another ad hoc body tasked with crafting a legally enforceable protocol, part of which focused on verification. Despite several years of negotiations among states in the late 1990s and early 2000s, the protocol failed owing to technological challenges and was rejected in 2001, mostly due to US opposition.[33] This shortfall has fostered a climate of mistrust and compliance ambiguity. 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, with the weak institutional support from BWC Implementation Support Unit (ISU), established in 2006,[34] remains grossly under-resourced. With a small staff and limited mandate, the ISU cannot 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 like 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. Thus in today's technologically advanced environment where AI can aid in the design of synthetic pathogens and lab processes can be outsourced or automated, the ability to verify compliance has never been more urgent. However, the BWC's original framework is not equipped to monitor digital workflows, detect virtual designs, or respond to AI-enabled biological threats. This regulatory gap severely limits the treaty's ability to deter or detect violations.

14.3.3. 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.[35] It is been debated for a long period time as to what extent does the BWC prohibits the bio-weapons related research. Looking at the Articles 1 of BWC, unlike production or stockpiling, research is not explicitly mentioned anywhere.[36] This was 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.[37] 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. Each of these technologies AI, CRISPR, cloud labs, presents a classic dual-use dilemma: their legitimate benefits are immense, but so is their potential for misuse. What distinguishes today's challenges is the scale and speed at which dual-use tools are spreading. Advances that once took years now unfold in months. Innovations that once required elite laboratories can now be replicated by common person with the use of tools. The BWC, originally crafted in a world of analogue biology and state-run programs, now finds itself confronting a digital, decentralized, and democratized reality. This makes the question of biosecurity not only a matter of international law but of digital governance, ethics, and responsible innovation.

14.4. Modernization of BWC

To ensure the BWC remains relevant in the current and future technological landscape, it becomes very important to integrate emerging technologies into its framework. Regular BWC meetings should make AI, synthetic biology and digital threats permanent agenda items to help mitigate the risk of misuse. The Convention must also engage non-state actors including academic institutions, private companies, and independent researchers as partners in prevention, and foster a new global consensus on the safe and ethical use of powerful technologies. There is also a need for the establishment of a Scientific and Technological Advisory Body. Although the BWC agreed in 2022 to monitor scientific and technological developments, there is a pressing need to stay ahead of rapid advancements, not only in AI but also in advanced cyber capabilities.[38] Similar to the Organization for the Prohibition of Chemical Weapons (OPCW), this body could offer expert analysis and guidance on emerging threats and opportunities. The BWC should also serve as a platform for international cooperation, ensuring that all states benefit from the peaceful applications of life sciences. Efforts by the BWC working group to reach consensus on issues like equitable access to AI and its role in advancing

bioscience collaboration should be reinforced. AI, for instance, can play a valuable role in early disease detection, outbreak monitoring and analyzing large biological datasets to identify potential vaccine targets.[39] Finally, the BWC should also develop international guidelines for the ethical use of AI and biotechnology which will outline responsibilities for parties, researchers, students, and independent laboratories. Strengthening global capacity building is also crucial, particularly by supporting developing countries with biosecurity infrastructure, AI literacy, and biosafety training. These efforts would not only reduce technological disparities but also promote a unified approach to global biological risk management.

14.5. Conclusion

Over the past fifty years the Biological Weapons Convention played important role in controlling the use of biological weapons. The BWC has facilitated dialogue among parties, generated norms and encouraged cooperation on peaceful biological uses. Today, the Biological Weapons Convention stands at a critical juncture after five decades. Artificial intelligence and technological development is reshaping the boundaries of biotechnology, creating both unparalleled opportunities and grave new risks. The Convention, in its current form, lacks the mechanisms to detect, deter, or respond to AI-enabled biological threats. Addressing these vulnerabilities requires both structural reform and normative innovation. By recognizing the dual-use nature of AI, investing in transparency and digital monitoring, and building inclusive governance frameworks, the international community can reform the BWC and ensure it remains a foundation of global bio-security in the age of rapidly growing intelligent machines.

NOTES

1 "*What Are Biological Weapons?*" United Nations Office for Disarmament Affairs (UNODA), https://disarmament.unoda.org/biological-weapons/about/what-are-biological-weapons/, Accessed 10 May 2025

2 Ibid.

3 Jozef Goldbat, "*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 James Revill, John Borrie, Richard Lennane, "*Back To The Future For Verification In*

The Biological Disarmament Regime?", United Nations Institute for Disarmament Research (UNIDIR), 13 June 2022, pg. 7, 10.37559/WMD/22/BWC/02

6 Renan Chaves De Lima et al, "*Artificial Intelligence Challenges in the Face of Biological Threats: Emerging Catastrophic Risks for Public Health*", Frontiers in Artificial Intelligence, Vol 7, 10 May 2024, 10.3389/frai.2024.1382356

7 James Revill, Clarissa Rio, Louison Mazeaud, "*What Will Be the Impact of AI on the Bioweapons Treaty?*", 16 November 2024, https://thebulletin.org/2024/11/what-will-be-the-impact-of-ai-on-the-bioweapons-treaty/

8 Ibid.

9 Ibid.

10 Renan Chaves De Lima et al, "*Artificial Intelligence Challenges in the Face of Biological Threats: Emerging Catastrophic Risks for Public Health*", Frontiers in Artificial Intelligence, Vol 7, 10 May 2024, 10.3389/frai.2024.1382356

11 Ibid.

12 Washington DC: National Academies Press of Science, Engineering, and Medicine, "*Biodefense in the Age of Synthetic Biology*", 2018, 10.17226/24890

13 Katherine Charlet, "The New Killer Pathogens: Countering the Coming Bioweapons Threat", Foreign Affairs, Carnegie Endowment for International Peace, 17 April 2018, https://carnegieendowment.org/posts/2018/04/the-new-killer-pathogens-countering-the-coming-bioweapons-threat?lang=en.

14 Ibid.

15 James Revill, John Borrie, Richard Lennane, "*Back To The Future For Verification In The Biological Disarmament Regime?*", United Nations Institute for Disarmament Research (UNIDIR), 13 June 2022, pg. 7, 10.37559/WMD/22/BWC/02

16 Michael Knutzen, "*Synthetic Bioweapons Are Coming*", Proceedings, Vol 147 issue 6, June 2021, https://www.usni.org/magazines/proceedings/2021/june/synthetic-bioweapons-are-coming

17 James Revill, Clarissa Rio, Louison Mazeaud, "*What Will Be the Impact of AI on the Bioweapons Treaty?*", 16 November 2024, https://thebulletin.org/2024/11/what-will-be-the-impact-of-ai-on-the-bioweapons-treaty/

18 Stewart Patrick 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

19 Ayesha Sikander, "*Biological Warfare: A Global Security Threat*", Modern Diplomacy, 5 May 2021, https://moderndiplomacy.eu/2021/05/05/biological-warfare-a-global-security-threat/

20 James Revill, Clarissa Rio, Louison Mazeaud, "*What Will Be the Impact of AI on the Bioweapons Treaty?*", 16 November 2024, https://thebulletin.org/2024/11/what-will-be-the-impact-of-ai-on-the-bioweapons-treaty/

21 Ibid. Pg. 16-18

22 Ibid. Pg. 20

23 Ibid.

24 Ibid.

25 Ibid.
26 James Revill, John Borrie, Richard Lennane, "*Back To The Future For Verification In The Biological Disarmament Regime?*", United Nations Institute for Disarmament Research (UNIDIR), 13 June 2022, pg. 24, 10.37559/WMD/22/BWC/02
27 Jaroslav Kransny, "*The Biological Weapons Convention: Challenges and Opportunities*", Geneva Centre for Security Policy, Policy Brief No. 15. Geneva: Geneva Centre for Security Policy, June 2024, Pg. 5, https://www.gcsp.ch/publications/biological-weapons-convention-challenges-and-opportunities
28 Ibid.
29 Karan Dhall, "*The Challenges Related to the Biological Weapons Convention*", RGNUL Student Research Review, 27 April 2021, https://www.rsrr.in/post/the-challenges-related-to-the-biological-weapons-convention
30 André Munro, "*Organisation for the Prohibition of Chemical Weapons*." Encyclopedia Britannica, April 11, 2025. https://www.britannica.com/topic/Organisation-for-the-Prohibition-of-Chemical-Weapons
31 Lukas Trakimavièius, "*Is Russia Violating the Biological Weapons Convention?*", Atlantic Council, 23 May 2018. https://www.atlanticcouncil.org/blogs/new-atlanticist/is-russia-violating-the-biological-weapons-convention/
32 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 Vol 4 issue 1, June 2022, pg. 50–53. 10.1016/j.jobb.2021.11.003.
33 Jaroslav Kransny, "*The Biological Weapons Convention: Challenges and Opportunities*", Geneva Centre for Security Policy, Policy Brief No. 15. Geneva: Geneva Centre for Security Policy, June 2024, Pg. 5, https://www.gcsp.ch/publications/biological-weapons-convention-challenges-and-opportunities
34 United Nations Office for Disarmament Affairs (UNODA), "*Biological Weapons Convention – Implementation Support Unit.*" Accessed May 19, 2025, https://disarmament.unoda.org/biological-weapons/implementation-support-unit/
35 Lena Raxter, "*A Dangerous Loophole: The Biological Weapons Convention's New Interpretation That Better Addresses Potentially Deadly Biological Research.*" International Journal of Legal Information, Vol 49 issue 2, 2021, pg. 102–129, 10.1017/jli.2021.13
36 James Revill, John Borrie, and Richard Lennane, "*Back To The Future For Verification In The Biological Disarmament Regime?*", United Nations Institute for Disarmament Research (UNIDIR), June 2022, pg. 1-30, 10.37559/WMD/22/BWC/02
37 Ibid., 21.
38 James Revill, Clarissa Rio, Louison Mazeaud, "*What Will Be the Impact of AI on the Bioweapons Treaty?*," 16 November 2024, https://thebulletin.org/2024/11/what-will-be-the-impact-of-ai-on-the-bioweapons-treaty/
39 Ibid.

ANNEXURE 1

CBW Deliberations during the Arms Traffic Conference

Date	*Level*	*Action*
5 May	Plenary, 2nd meeting	US announces CW initiative
7 May	General cmte, 1st meeting	US and Poland present proposals in detail
8 May	General cmte, 2nd meeting	Consideration of US and Polish proposals; referral to the Legal cmte
11 May	Legal cmte, 2nd meeting	Election CBW sub-cmte
19 May	Legal cmte, 8th meeting	Consideration report by CBW sub-cmte
20 May	Legal cmte, 9th meeting	Approval report by CBW sub-cmte
23 May	Military cmte, 12th meeting	Request for new US text
25 May	Military cmte, 13th meeting	Consideration report Legal cmte and new US text
26 May	Military cmte, 14th meeting	Continuation debates and appointment drafting cmte for report
26 May	Military cmte, 15th meeting	Statement by Great Britain
27 May	Military cmte, 16th meeting	Adoption report
5 June	General cmte, 17th meeting	Report of General Rapporteurs
8 June	General cmte, 20th meeting	Consideration draft protocol prepared by the drafting cmte; Sosnkowski's intervention
10 June	General cmte, 22nd meeting	Consideration revised draft text by drafting cmte; adoption protocol text
16 June	Plenary, 6th meeting	Adoption general report of General cmte
17 June	Plenary, 7th meeting	Approval of the agreements; Signature of the instruments of the conference

ANNEXURE 2

Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare

THE UNDERSIGNED PLENIPOTENTIARIES, in the name of their respective Governments:

Whereas the use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices, has been justly condemned by the general opinion of the civilised world; and

Whereas the prohibition of such use has been declared in Treaties to which the majority of Powers of the world are Parties; and

To the end that this prohibition shall be universally accepted as a part of International Law, binding alike the conscience and the practice of nations;

DECLARE:

That the High Contracting Parties, so far as they are not already Parties to Treaties prohibiting such use, accept this prohibition, agree to extend this prohibition to the use of bacteriological methods of warfare and agree to be bound as between themselves according to the terms of this declaration,

The High Contracting Parties will exert every effort to induce other States to accede to the present Protocol. Such accession will be notified to the Government of the French Republic, and by the latter to all signatory and acceding Powers, and will take effect on the date of the notification by the Government of the French Republic.

The present Protocol, of which the French and English texts are both authentic, shall be ratified as soon as possible. It shall bear to-day's date. The ratifications of the present Protocol shall be addressed to the Government of the French Republic, which will at once notify the deposit of such ratification to each of the signatory and acceding Powers.

The instruments of ratification of and accession to the present Protocol will remain deposited in the archives of the Government of the French Republic.

The present Protocol will come into force for each signatory Power as from the date of deposit of its ratification, and, from that moment, each Power will be bound as regards other Powers which have already deposited their ratifications.

Index

www.pentagonpress.in

₹ 1295

ISBN 978-81-988370-1-1