World Health Organization

Responding to Bioengineered Pandemics: International Health Security in the Age of Synthetic Biology

BEYMUN 2025

Message from the Dais:

Dear Delegates,

Welcome to the World Health Organization at BEYMUN 2025!

We are thrilled to have you join us for a weekend of impactful dialogue, strategic negotiation, and global problem-solving. As your Chair and Co-Chair, we're honored to guide you through what promises to be an inspiring simulation of one of the world's most vital international bodies.

In this committee, you'll dive into some of the most pressing health challenges facing our world today. You'll be called upon to think deeply, collaborate meaningfully, and advocate passionately. Whether you're a seasoned delegate or stepping into your first MUN experience, this space is yours to explore ideas, test solutions, and refine your diplomatic voice.

What makes WHO unique is its human-centered mission. At the heart of every policy, every debate, and every resolution lies one goal: safeguarding the well-being of people across the globe. We urge you to embrace this responsibility with empathy, creativity, and a genuine commitment to understanding diverse perspectives.

Remember, success in MUN isn't about winning arguments. It's about elevating the conversation. Through respectful engagement, solid research, and dynamic teamwork, you have the power to shape this committee into something extraordinary.

We can't wait to witness the energy, insight, and innovation you'll bring to the table.

In solidarity,

Karim Al Awar — Chair

Tarek Harb — Co-Chair

Introduction to The Committee

The World Health Organization (WHO) is a specialized agency of the United Nations established on 7 April 1948, with its headquarters in Geneva, Switzerland. It serves as the primary authority responsible for international public health, working collaboratively with 194 Member States across six regions to promote health, keep the world safe, and serve the vulnerable. Its mandate is broad and encompasses all aspects of health, with an emphasis on preventing disease, prolonging life, and improving quality of life globally.

The World Health Organization operates under the guidance of the World Health Assembly, composed of representatives from all Member States, and the Executive Board, which implements the decisions and policies of the Assembly. WHO works hand-in-hand with governments, civil society, the private sector, and academic institutions to coordinate responses to both long-term and emergency health challenges.

The organization has laid out a comprehensive set of aims, among which are:

- Strengthening health systems and universal health coverage to ensure equitable access to essential services.
- Preventing and responding to global health emergencies through early warning systems and coordinated action.
- Tackling noncommunicable and communicable diseases through prevention, treatment, and health education.
- Addressing the social determinants of health and promoting health equity across populations.

Aligned with its mission, the WHO seeks to:

- Develop policies that foster fair and effective health outcomes globally.
- Support the development of sustainable health financing and delivery mechanisms.
- Ensure health systems are resilient, inclusive, and prepared for future pandemics.
- Advance mental health services, maternal and child healthcare, and nutrition programs.
- Drive research and innovation in medical science, particularly for underserved populations.

The WHO's work is guided by its Thirteenth General Programme of Work (GPW13), aiming to achieve triple billion targets: 1 billion more people benefiting from universal health coverage, 1 billion more people better protected from health emergencies, and 1 billion more people enjoying better health and well-being.

For the sake of this committee, delegates will be tasked with formulating comprehensive strategies to address the emerging global threat of bioengineered pandemics. As advancements in synthetic biology accelerate, the potential misuse of these technologies to create novel, highly infectious pathogens present a critical challenge to international health security. In this context, Member States must work collaboratively to establish robust frameworks for global surveillance, rapid response mechanisms, ethical oversight of biotechnological

research, and coordinated investment in preventive infrastructure, including vaccines, diagnostics, and international communication channels.

Rules of Procedure

This committee will operate on the basis of the regular BEYMUN rules of procedure. Delegates are required to use the following motions:

1. Setting the Agenda

"The delegate of [Country X] motions to set the agenda in favor of Topic A/B. "

Yet, this motion will not be used in the conference since there is 1 topic.

2. Speaker's List

"The delegate of [Country X] motions to open the Speaker's List with a speaker's time of [Y] seconds. "

3. Moderated Caucus

"The delegate of [Country X] motions to suspend the debate and move into a moderated caucus to discuss '[Subtopic Y]' for a total time of [Z] minutes, with a speaker's time of [W] seconds. "

4. Unmoderated Caucus

"The delegate of [Country X] motions to suspend the debate and move into an unmoderated caucus to [form blocs and alliances / discuss resolutions/work on the working paper or draft resolution / discuss the crisis] for a total time of [Y] minutes. "

5. Consultation of the Whole

"The delegate of [Country X] motions to suspend the debate and move into a consultation of the whole to discuss [the recommendations elaborated in the previous unmoderated caucus / the crisis] for a total time of [Y] minutes. "

6. Adjourn the Meeting

“The delegate of [Country X] motions to adjourn the meeting for [Y] minutes for the purpose of [a lunch break / a coffee break]. ”

7. Solicit a Third Party

“The delegate of [Country X] motions to solicit [Third Party Y], as they possess relevant information or expertise regarding [Subtopic Z / the crisis]. ”

8. Press Conference

“The delegate of [Country X] motions to suspend the debate and move into a press conference to discuss [a resolution related to Y / the crisis] for a total time of [Z] minutes. ”

9. Extend the Time of the Unmoderated Caucus

“The delegate of [Country X] motions to extend the duration of the current unmoderated caucus by [Y] minutes. ”

10. Introduce the Draft Resolution

“The delegate of [Country X] motions to introduce the draft resolutions with a speaker’s time of [Y] seconds per author or co-sponsor. ”

11. Close Debate and Move into Voting Procedure

“The delegate of [Country X] motions to close the debate and move directly into voting procedure. ”

(Note: This motion requires a two-thirds majority to pass.

Written Motions:

1. Right of Reply: Delegates can request the right of reply to another delegate who has offended their country. There is no right of reply to a right of reply.

2. Appeal to the Chair's Decision: If the delegates feel that the chair has made an unfair decision, the delegates can send it as a note to the

Chair.

Points:

- **Point of Order:** Used to correct a procedural or factual mistake. Interruptive, but do not overuse it.
- **Point of Personal Privilege:** Request to leave or adjust comfort (e.g., temperature). Interruptive.
- **Point of Inquiry:** Ask about the rules or current stage. Interruptive.
- **Point of Information:** Ask a question when the floor is open. Not interruptive.
- **Point to Instigate a Debate:** Challenge another delegate's resolution stance. Interruptive and subject to chair's approval.

Sustainable Development Goals (SDGs):

The threat of bioengineered pandemics intersects with several key SDGs, reflecting its wide-ranging impact:

- SDG 3 – Good Health and Well-Being: The primary goal affected, as synthetic outbreaks directly challenge the ability of nations to maintain public health, respond to emergencies, and ensure mental health support.
- SDG 4 – Quality Education: Biosecurity literacy is critically underdeveloped, and the lack of awareness among students, researchers, and educators can increase vulnerability.
- SDG 9 – Industry, Innovation and Infrastructure: While biotechnology is a key component of innovation, it requires responsible oversight to prevent misuse and ensure sustainable growth.
- SDG 10 – Reduced Inequalities: Synthetic pandemics often deepen global disparities, disproportionately affecting low-income nations and marginalized communities.
- SDG 16 – Peace, Justice and Strong Institutions: The lack of international biosecurity protocols and enforcement mechanisms

weakens global governance and cooperation in the face of these threats.

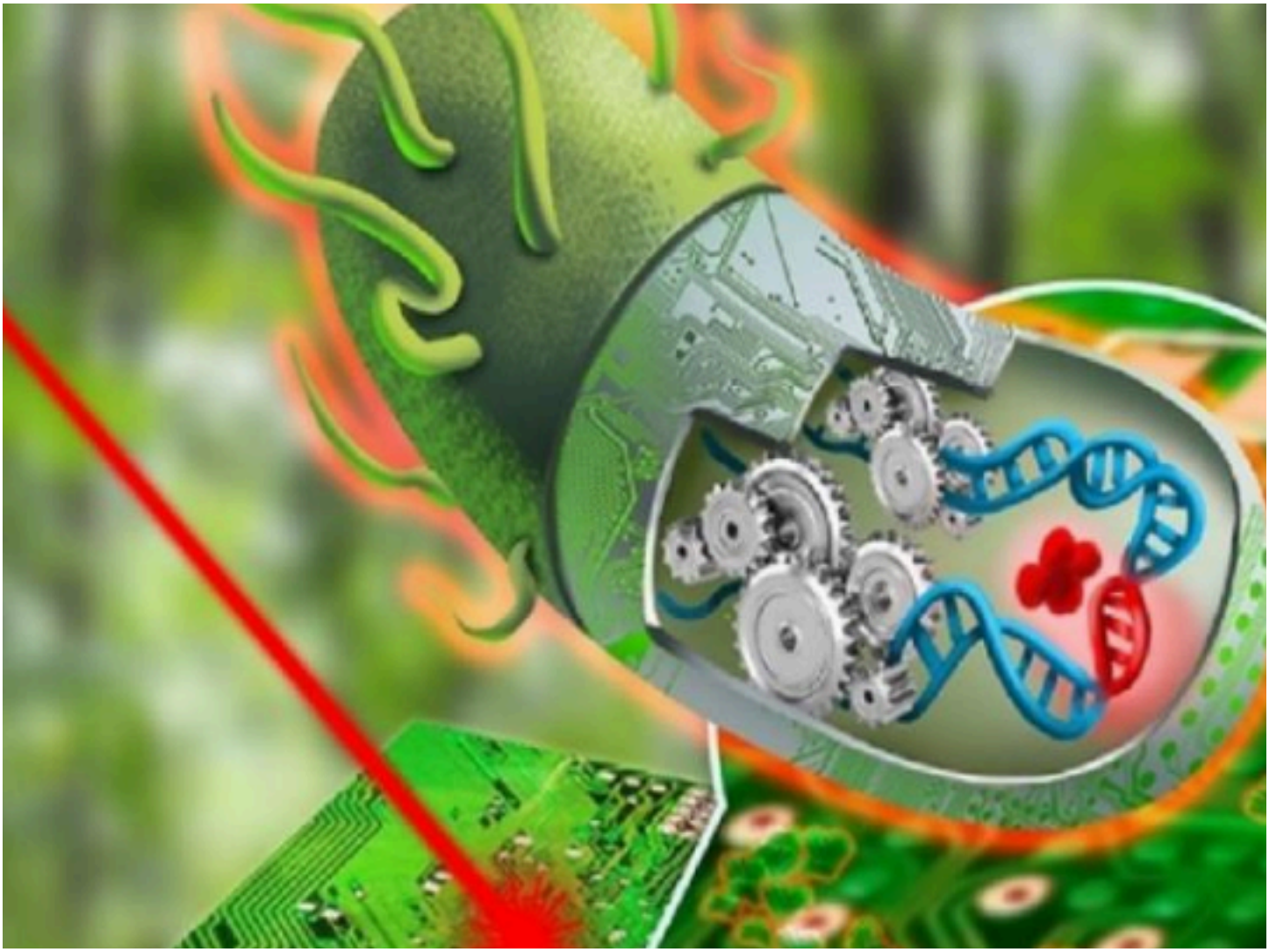
- SDG 17 – Partnerships for the Goals: Addressing this issue requires unified international collaboration in surveillance, data-sharing, regulation, and rapid response frameworks.

Introduction to The Topic

In the shadow of one of humanity's greatest public health trials, the COVID-19 pandemic, the world has been awakened to the devastating power of infectious disease. Yet, as science propels us into a new era, we now face an even more complex frontier: the deliberate or accidental creation of synthetic pathogens through advances in synthetic biology. What was once the realm of science fiction has become a sobering reality.

Synthetic biology, an emerging field that allows scientists to design and construct new biological parts, systems, or even entirely novel organisms, holds extraordinary potential for medicine, agriculture, and industry. However, this same technology also carries a dual-use

dilemma: in the wrong hands, it could be exploited to engineer pathogens with enhanced virulence, resistance, and transmissibility, posing existential threats to global health security. What is more, bioengineered pandemics are not bound by borders. They are silent, invisible threats capable of spreading across continents in days, crippling health systems, economies, and societies. The global community, particularly under the auspices of the World Health Organization, must urgently reevaluate existing preparedness frameworks, ethical regulations, surveillance mechanisms, and international cooperation protocols to address this unprecedented challenge. Already, the technology to synthesize viruses from scratch exists. In 2002, researchers synthesized the poliovirus genome using only publicly available data. By 2017, scientists had reconstructed the horsepox virus, raising alarm across the global scientific community due to its similarity to smallpox, a virus that claimed over 300 million lives in the 20th century alone. With the falling costs and increased accessibility of gene-editing technologies such as CRISPR-Cas9, the technical barrier to engineering deadly pathogens is rapidly eroding.



History and Development of the Topic

The Past – Foundations and Early Warnings

Synthetic biology began to take shape in the 1970s with the discovery of recombinant DNA technology, which allowed scientists to cut and rejoin genetic material from different organisms. This sparked both scientific excitement and ethical concerns, leading to the 1975 Asilomar Conference that urged caution in genetic research. In 2002, the field reached a turning point when researchers created the poliovirus genome from published data alone, proving that viruses could be made without natural samples. Yet, despite these warnings, global oversight has not kept up. The Biological Weapons Convention lacks modern provisions for gene editing and synthetic biology.

The Present – A Tipping Point for Global Health Security

Today, synthetic biology is at the forefront of biotechnology innovation, reshaping how we understand and manipulate life itself. With revolutionary tools like CRISPR-Cas9, base editing, and automated DNA synthesis platforms, gene editing has become not only faster and cheaper, but also more precise and programmable. The cost of sequencing a human genome has fallen from nearly USD 100 million in 2001 to less than USD 200 today, and synthetic DNA can now be ordered online in mere days.

Understanding the Threat of Synthetic Biology and Bioengineered Pathogens

Synthetic biology has opened the door to revolutionary breakthroughs in medicine, agriculture, and environmental sustainability. However, with the rise of these technologies comes an equally powerful and dangerous potential: the creation and misuse of bioengineered pathogens. These pathogens, intentionally designed or accidentally released, could possess traits far more dangerous than naturally occurring viruses, such as enhanced transmissibility, increased lethality, or resistance to treatments. Unlike conventional diseases, bioengineered outbreaks blur the lines between health crises and national security threats. What makes synthetic pathogens particularly alarming is their potential to be released covertly and their capacity to destabilize societies far beyond their points of origin. The threat is no longer limited to nation-states; with the increasing accessibility of tools like CRISPR gene-editing kits and AI-based design models, even non-state actors or rogue scientists could theoretically construct a harmful organism in a lab.

A Global Phenomenon: Country Examples

To understand the scale and relevance of this issue, we must consider how various countries are responding to the dual-use nature of synthetic biology:

- United States: With advanced biotech research infrastructure, the U.S. has raised alarms about "gain-of-function" research and dual-use concerns. Agencies like DARPA and the NIH have funded biosafety studies but continue to face scrutiny over research transparency and oversight.
- China: As a leader in synthetic biology development, China has invested heavily in genome-editing technologies. However, international concerns grew after the controversial CRISPR baby experiment in 2018, underscoring the urgency of ethical oversight.
- Germany: Known for its strict scientific ethics policies, Germany has been active in EU-level discussions about regulating DNA synthesis companies and monitoring high-risk research.
- India: With growing capabilities in biotechnology and vaccine development, India has struggled with biosafety infrastructure gaps, particularly in rural and densely populated areas.
- South Africa: As one of Africa’s biotech leaders, South Africa has emphasized the need for regional biosecurity frameworks. However,

economic limitations and health disparities complicate preparedness.
- Brazil: Brazil has advanced synthetic biology labs and programs, but limited government investment in bio surveillance systems leaves it vulnerable to both natural and synthetic threats.
- South Korea: It emphasizes biodefense and has rapid genomic surveillance capabilities. It's leading in developing portable CRISPR diagnostic kits that could revolutionize outbreak response.
- Iran: This country has advanced biotechnological research despite sanctions. However, international mistrust and limited WHO collaboration complicate assessments of its capabilities and safety standards.

Strengthening Global Health Security Infrastructure

Strengthening global health security infrastructure is crucial in addressing the growing threats posed by bioengineered pandemics. As synthetic biology technologies evolve and become more accessible, the potential to intentionally or accidentally create dangerous pathogens rises. A resilient global health infrastructure is essential for the early detection, rapid response, and containment of such outbreaks. According to the Global Preparedness Monitoring Board, nations with well-established health security systems are 67% more likely to contain outbreaks within the first month, which significantly reduces both mortality rates and economic impacts. Investments in laboratory surveillance, genomic sequencing networks, and international data-sharing platforms are key to the swift identification of engineered pathogens. The Africa CDC's Pathogen Genomics Initiative, for example, has boosted regional sequencing capacity by over 300% since 2020, allowing for faster recognition of emerging viral threats.

In addition, strengthening emergency operations centers and providing biosafety training for healthcare workers ensures that frontline systems remain operational during outbreaks. This is especially important considering that over 80% of synthetic biology research is conducted in regions with less robust public health infrastructures. International collaboration through organizations like COVAX, GAVI, and CEPI also plays a vital role in mitigating bio-pandemic threats. These organizations facilitate equitable access to vaccines, diagnostics, and treatments during global health crises, ensuring that low-income countries are not left behind. COVAX's role in vaccine distribution during

the COVID-19 pandemic demonstrated how coordinated global efforts can increase preparedness and response capabilities. GAVI and CEPI are integral in advancing research and development for vaccines and treatments, ensuring a faster and more equitable response to future synthetic outbreaks.

Furthermore, strengthening international partnerships through platforms such as the WHO Bio Hub and the Pandemic Fund allows for real-time exchange of resources, knowledge, and pathogen samples. This collaborative approach is critical in managing rapidly evolving synthetic threats. Without a well-integrated and connected global health infrastructure, even the most prepared nations risk exposure to spillover effects from regions with less-developed health systems. These challenges highlight the need for continued investment in global health security to ensure the world is ready to respond to future bioengineering threats.

The International Health Regulations Revision

The ongoing revision of the International Health Regulations (IHR) is a crucial step toward preparing for the realities of bioengineered pandemics. Originally designed to address naturally occurring outbreaks, the current framework falls short in dealing with synthetic biology risks. The updated version aims to close this gap by including specific provisions for detecting and reporting lab-created pathogens, which are increasingly accessible due to advancements in gene editing tools. One of the most significant changes is the push for real-time sharing of genetic data across borders, allowing faster recognition of unusual or manipulated strains. The new regulations also propose regular evaluations of each country's biosafety and biosecurity systems, which would help identify weak points before they become global threats. According to the WHO, delays in data sharing during past emergencies increased transmission by as much as 40%, something the revised IHR hopes to prevent. With synthetic biology blurring the line between natural and engineered outbreaks, these revisions are not just a legal update but a necessary transformation of global health policy. With synthetic biology blurring the line between natural and engineered outbreaks, these revisions are not just a legal update but a necessary transformation of global health policy. Organizations such as the World Health Organization, the Biological Weapons Convention Implementation Support Unit, and the Global Health Security Agenda are actively contributing to the revision process

to ensure that it reflects both scientific advances and geopolitical realities.

Countries like Singapore, the Netherlands, and South Korea have already begun aligning their national health systems with the proposed changes, emphasizing rapid diagnostics, secure data sharing, and strict oversight of genetic research.

Ethical Implications and Human Rights

Synthetic biology introduces powerful tools into global health, but with that power comes serious ethical and human rights challenges. The ability to engineer organisms that can affect entire populations raises questions about consent, justice, and who gets to decide how these technologies are used. In many cases, individuals may not even be aware that their genetic information is being collected or studied for pandemic preparedness. When governments or institutions act without transparency, especially in times of crisis, there is a real risk of eroding public trust. Emergency responses have historically pushed ethical

boundaries, such as during COVID-19 when some communities faced restrictions and surveillance that disproportionately targeted marginalized groups.

Human rights organizations like Human Rights Watch and the Global Justice Center have warned that synthetic biology must not become a tool for control or exclusion. Ethical use requires global standards that prioritize informed consent, equitable access to treatments, and protections against discrimination. As new biotechnologies become increasingly accessible, the potential for misuse grows, especially in regions with weaker regulatory frameworks. Unregulated research or unapproved applications could lead to the creation of harmful pathogens or the unintended consequences of manipulating ecosystems. Furthermore, the development of synthetic organisms that may inadvertently cross into natural environments raises concerns about irreversible ecological changes.

Topic in Depth

Health Security and Public Health Systems

Synthetic biology introduces a new class of biological threats that current public health systems are ill-equipped to handle. Unlike natural pathogens, engineered viruses can be designed to evade detection, resist treatments, and remain inactive until strategically triggered, making them harder to identify and control. One of the biggest vulnerabilities is the lack of global bio-surveillance capacity. According to the 2022 Global Health Security Index, fewer than 5 percent of countries have the infrastructure to monitor and respond to high-impact synthetic threats. Many regions still lack genomic sequencing tools, early warning systems, and secure data-sharing networks.

Even advanced nations face challenges, as traditional pandemic models do not account for engineered features like antibiotic resistance or selective targeting. To face this evolving threat, countries must modernize health systems to include synthetic biology expertise, rapid diagnostics for engineered pathogens, and stronger cross-border communication.

International Law and Policy Gaps

The international legal framework governing biological threats is increasingly out of step with the realities of modern science. The Biological Weapons Convention (BWC), established in 1972, was a pioneering agreement intended to prevent the development and use of biological weapons. However, it was conceived in a vastly different technological era, decades before the advent of CRISPR, synthetic genomes, or automated DNA synthesis. As a result, the convention lacks the scope, specificity, and enforcement capabilities necessary to regulate the evolving field of synthetic biology.

One of the most pressing issues is that the BWC does not contain any verification or inspection mechanisms. Unlike treaties in other fields such as nuclear non-proliferation, there are no routine international inspections or structured means of ensuring compliance. This has allowed significant gray areas to emerge, particularly around dual-use research and the creation of synthetic organisms. The language of the BWC is broad and outdated, failing to define what exactly constitutes a "biological weapon" in an age where entire viruses can be engineered from scratch using digital blueprints and mail-ordered genetic material. Furthermore, there is no binding international treaty or unified standard governing biosafety practices, DNA synthesis oversight, or the sharing of sensitive biological data. This lack of global alignment creates uneven levels of regulation from one country to another. While some nations maintain stringent controls over genetic engineering research, others operate with minimal oversight, creating potential safe havens for dangerous or unethical biological experimentation.

Political Stability and Global Cooperation

The emergence of a bioengineered pandemic can place significant strain on political systems at both national and international levels. Infectious disease outbreaks have historically challenged governmental structures, exposed institutional weaknesses, and, in some instances, acted as catalysts for civil unrest. When a pathogen appears to be synthetically engineered rather than naturally occurring, the political consequences become even more severe due to uncertainty, fear, and the perception of malicious intent.

In such scenarios, the global political climate can shift rapidly. States may engage in a race to assign blame, targeting foreign governments, laboratories, or international actors. These accusations, especially in the absence of conclusive evidence, can erode diplomatic relations and provoke intense geopolitical tension. In politically sensitive or rivalrous regions, this kind of suspicion may even escalate into broader conflict. On the domestic front, governments may face immense pressure to maintain control and transparency while managing public fear. Political leaders could be criticized for perceived failures in preparedness or response, and this erosion of public trust may lead to protests, political polarization, or a rise in populist rhetoric. In countries already experiencing instability, a synthetic pandemic could act as a tipping point toward deeper unrest or regime change. In addition, the spread of misinformation and disinformation further complicates the political landscape. False claims about the origin, transmission, or purpose of a bioengineered pathogen can polarize communities, spark xenophobia, and undermine science-based responses

Disruption of the Educational Sector and Long-Term Gaps and Biosecurity Literacy

The emergence of a bioengineered pandemic doesn't just strain hospitals or governments, it disrupts the very core of society, including education. When schools close, learning halts for millions, but the impact runs deeper than missed lessons. For many students, especially in low-resource communities, school is a source of stability, meals, and safety. A synthetic virus designed to spread silently or resist containment can prolong closures far beyond what traditional systems are built to handle. While some students transition to online platforms, countless others fall through the cracks, unable to access digital resources. The divide grows not only in academics but also emotionally,

as children lose structure, teenagers miss milestones, and university students put futures on hold.

This disruption affects educators too. Teachers struggle to connect with students remotely while managing personal challenges. Research programs are delayed or canceled as institutions shift focus. The flow of scientific discovery slows under the weight of an invisible, engineered threat. At the same time, a critical blind spot in education becomes clear: even as synthetic biology becomes more advanced, few students are taught about its ethical, security, or societal implications. Fields like CRISPR, gene drives, and DNA synthesis are taught in technical terms, but biosecurity literacy is often missing.

Mental Health and the Psychological Toll of Synthetic Pandemics

When the world faces a health crisis, the first instinct is to count infections and casualties. But beneath the surface numbers lies another, quieter pandemic, one that affects minds, not just bodies. In the event of a bioengineered outbreak, where the origins of a virus may be unknown, deliberate, or even weaponized, the psychological burden can be deeper and more lasting than in natural pandemics. Fear in such scenarios is not just about illness, it's about uncertainty, mistrust, and the unsettling sense that the danger is both invisible and man-made. During the COVID-19 pandemic, the World Health Organization reported a 25% increase in global cases of anxiety and depression in just the first year. But experts now warn that the mental health consequences of a synthetic outbreak could be even more intense.

Imagine a pathogen released silently, designed to delay symptoms and avoid detection, leading to sudden and prolonged lockdowns. In such synthetic outbreaks, the uncertainty and isolation caused by quarantines and social restrictions can trigger widespread mental health challenges. The World Health Organization (WHO) has recognized that extended isolation during health emergencies contributes significantly to psychological distress, especially when communities lack timely, clear information. Lockdowns, though critical for containment, sever daily routines and social connections, intensifying anxiety and emotional strain across all age groups.

The impact is particularly severe among youth and the elderly. Prolonged school closures have left millions of children cut off from friends, teachers, and support systems, increasing risks of anxiety, depression, and long-term emotional disruption. Older adults, often isolated in care facilities or at home, face loneliness and heightened fear. Healthcare workers, caught in the center of crisis response, are also deeply affected. According to WHO assessments during COVID-19, rates of burnout, trauma, and emotional fatigue surged, and similar or worse effects are likely in a synthetic pandemic. The WHO continues to call for integrated mental health support in emergency responses, emphasizing that managing public health is not only about stopping a virus, but also preserving psychological resilience in the face of isolation and fear.

Lockdowns, while essential for slowing the spread of infectious diseases, carry significant psychological and social consequences. In the context of a synthetic outbreak, where the pathogen may be engineered to resist detection or spread unpredictably, lockdowns can become more frequent and prolonged. This repeated isolation disrupts daily life, limits access to community support, and heightens feelings of uncertainty. The World Health Organization has stressed that prolonged restrictions without clear communication can intensify fear, mistrust, and mental health deterioration, especially in vulnerable populations. When people are confined without clarity or connection, the emotional toll can rival the biological threat itself.

Media, Misinformation, and the Shifting Narrative of Bioengineered Threats

In times of fear, confusion, and uncertainty, people naturally turn to the media. They search not only for facts, but for reassurance, understanding, and a sense of direction. But when a crisis is rooted in the unknown, like the possibility of a bioengineered pandemic, the media can find itself in a difficult position. It must inform a public that is desperate for answers, even as the facts are still being uncovered. And

sometimes, that search for clarity turns into a source of even deeper anxiety. Synthetic biology has complicated how we understand disease. The difference between a natural virus and man-made one is no longer as clear as it once was. When a new virus appears with strange behaviors or unexpected resistance, speculation can quickly spiral. The scientific process, which takes time and caution, often struggles to keep up with the urgency of public curiosity. Meanwhile, the media, caught between journalistic responsibility and the need to grab attention, may rely on incomplete information, unnamed sources, or headlines designed to provoke emotion rather than insight. In the early stages of the COVID-19 pandemic, many people feared the virus might have been bioengineered. Words like lab leak, synthetic virus, and genetic manipulation began appearing across headlines and news broadcasts. A study from the Harvard Kennedy School in 2021 revealed that misinformation about the virus was shared millions of times each day, especially when political tensions were high and scientific messages were unclear.

Border Control and Quarantine Measures

During the COVID-19 pandemic, many countries implemented strict border control measures to curb the spread of the virus. These measures included travel bans, mandatory quarantines, and testing requirements. While these actions were essential for limiting outbreaks, they also highlighted the challenges of balancing public health safety

with the need for global mobility. The introduction of vaccines added another layer of complexity, as countries with faster access to vaccines imposed less restrictive travel policies for vaccinated individuals. In contrast, many low-income countries faced difficulties in securing vaccines, resulting in prolonged travel restrictions for their citizens. This led to a significant gap between countries, with wealthier nations enjoying greater freedom for international travel due to higher vaccination rates.

A crucial aspect of border control policies involved airport and port screening protocols. As key points of entry, airports and seaports played a critical role in detecting and preventing the spread of COVID-19. However, the lack of uniform global screening procedures created inconsistencies. Countries had different requirements for testing, quarantine, and health checks, making travel more complicated for passengers and adding strain to the logistics of international trade. Some countries introduced temperature checks, while others required negative PCR test results or proof of vaccination. These varied measures led to confusion for travelers and disruptions to global commerce.

Efforts to coordinate airport and port screening protocols were essential to improve consistency and efficiency. The International Civil Aviation Organization (ICAO) and the World Health Organization (WHO) worked together to recommend global guidelines for screening, sanitization, and safe travel practices. These recommendations sought to standardize health checks and reduce barriers for international movement.

Vaccines and Global Mobility

Strengthening global health security infrastructure is vital in addressing the rising threats of bioengineered pandemics. As synthetic biology advances, the potential for creating dangerous pathogens increases. A resilient health infrastructure is key for early detection, rapid response, and containment. Countries with robust health systems are 67% more likely to control outbreaks within the first month, reducing mortality and economic disruption. Investment in surveillance, genomic sequencing, and data-sharing platforms aids in the early identification of engineered pathogens, with initiatives like the Africa CDC's Pathogen Genomics Initiative increasing regional sequencing capacity by over 300% since 2020.

Organizations like COVAX, GAVI, and CEPI play a crucial role in equitable vaccine distribution and advancing research to counter bio-

pandemics. COVAX facilitated vaccine access for low-income countries during COVID-19, and GAVI and CEPI are central to future R&D efforts. During the pandemic, vaccine development was fast-tracked using mRNA technology, with regulatory bodies allowing overlapping clinical trials to meet urgent needs while ensuring safety.

International cooperation on antiviral stockpiles and equitable distribution of treatments is essential. Platforms like the WHO Bio Hub and the Pandemic Fund enable real-time sharing of resources and pathogen samples. These collaborations are vital for managing synthetic threats and ensuring global access to medical countermeasures. The COVID-19 pandemic underscored the need for equitable vaccine access, showing that countries with stronger financial resources initially secured large vaccine quantities while others struggled.

Fast-Tracking Clinical Trials Without Compromising Safety

The urgency of the COVID-19 pandemic triggered an unprecedented global effort to accelerate the development of vaccines and treatments. Under normal circumstances, clinical trials are conducted in three separate phases over several years to assess safety, efficacy, and potential side effects. However, the scale and speed of the crisis pushed regulators like the U.S. FDA, the European Medicines Agency (EMA), and China's National Medical Products Administration (NMPA) to adopt innovative approaches. These included overlapping trial phases and real-time data analysis, known as rolling reviews, which significantly shortened the approval timeline without skipping key safety evaluations.

As a result, vaccines like Pfizer-BioNTech and Moderna were developed, tested, and authorized for emergency use in less than a year, an achievement that would have been unimaginable just a decade earlier. Synthetic biology played a critical role in this acceleration. Researchers used computational modeling to design vaccine candidates before testing them in the lab, and mRNA platforms allowed for quicker production because they did not require live virus cultures. This streamlined process reduced biosafety risks and improved the overall speed of development.

Yet, this rapid progress came with ethical dilemmas. Emergency authorizations were granted based on limited long-term data, raising concerns about informed consent, public transparency, and equitable access. Balancing the urgent need to save lives with the responsibility to ensure safety and fairness became a central challenge. Public trust

depended on transparent communication, open access to trial data, and clear explanations of the risks and benefits. The COVID-19 response showed that accelerating medical innovation is possible, but it must be matched by global cooperation, ethical oversight, and

Economic Preparedness and the Role of Financial Mechanisms in Global Biosecurity

The financial backbone of pandemic preparedness is crucial, especially as synthetic biology introduces unprecedented risks that demand swift and well-coordinated responses. While the global community has recognized the importance of scientific innovation, the economic infrastructure needed to support pandemic readiness often lags behind. Many low- and middle-income countries still face an annual funding gap exceeding $10 billion, according to the World Bank, leaving them underprepared in critical areas such as pathogen surveillance, laboratory capacity, emergency response systems, and research into advanced countermeasures.

To address these gaps, the World Health Organization, in collaboration with the World Bank, established the Pandemic Fund in 2022. This initiative supports essential public health functions in vulnerable countries, including the development of real-time surveillance networks, laboratory upgrades, and workforce training. The fund also encourages stronger health systems capable of managing future outbreaks, particularly those involving engineered pathogens. In parallel, the WHO's Health Emergency Preparedness, Response and Resilience (HEPR) framework emphasizes the importance of financial resilience as a central element of global health security.

Public-private partnerships (PPPs) are also playing a growing role in closing the preparedness gap. These collaborations help accelerate vaccine development, scale up diagnostics, and ensure the rapid deployment of therapeutics during emergencies. Organizations such as GAVI, CEPI, and the Global Fund bring together governments, industry, and philanthropy to pool resources and streamline responses. However, resource allocation remains uneven. While high-income countries often have the capacity to fund preparedness and response infrastructure, many developing nations rely heavily on international aid and multilateral funds.

Global pandemic preparedness now depends on sustained investments that are flexible, equitable, and proactive. Funding public health infrastructure, especially in developing countries, not only protects local populations but also strengthens collective global

defense against emerging bioengineered threats. Without this shared financial commitment, the risk of catastrophic fallout from future pandemics, natural or synthetic, remains dangerously high.

Supply Chain Resilience and Equitable Access to Medical Countermeasures

The global response to COVID-19 exposed deep vulnerabilities in the international medical supply chain. As the virus spread, countries faced critical shortages of essential medical equipment including personal protective equipment (PPE), ventilators, testing kits, and later vaccines. These shortages were exacerbated by export restrictions, limited manufacturing capacity, and unequal access, revealing how fragile global distribution networks are during a crisis. In a synthetic outbreak, engineered for stealth, speed, or resistance, these cracks in the system could have far more devastating consequences.

Medical supply chains depend on timely coordination across borders, but in the face of a bioengineered health emergency, delays in customs, border closures, and prioritization of national needs over global cooperation can disrupt the flow of life-saving materials. During COVID-19, wealthy nations secured priority shipments of vaccines and PPE, while many lower-income countries waited months for access. This unequal access not only prolonged the pandemic but also highlighted the dangers of vaccine nationalism, where procurement is based on purchasing power rather than public health need.

At the same time, countries with limited manufacturing capacity were left vulnerable. Global production hubs were quickly overwhelmed, and hoarding of resources at the national level strained international availability. The result was a fragmented system where access to basic medical tools depended largely on geography and income rather than urgency or severity of impact.

To address this gap, institutions like the WHO and its partners have emphasized the need for pre-existing international stockpiles and coordinated systems to distribute medical supplies efficiently during emergencies. The COVAX Facility, led by GAVI and CEPI, attempted to offer a model of pooled procurement and equitable distribution, but structural limitations and funding constraints hindered its full impact. In synthetic outbreaks where response time is critical, pre-positioned supplies and predictable distribution routes become even more vital.

International customs and logistics procedures also play a crucial role. Delays in transporting emergency equipment, whether due to

bureaucratic procedures or lack of emergency prioritization, can cost lives. Standardizing customs clearance for medical goods and establishing trusted delivery channels across regions are essential to avoid bottlenecks during future health crises.

Business Operations: Corporate Resilience in the Age of Synthetic Pandemics

Bioengineered pandemics pose a serious threat to global business continuity, particularly in industries reliant on international supply chains, workforce stability, and physical infrastructure. The COVID-19 pandemic revealed how vulnerable businesses are to large-scale biological disruptions, with global trade declining by 9.2% in 2020 and small to medium enterprises facing disproportionate losses. Synthetic outbreaks, which could be more targeted and harder to detect, raise even greater concerns for operational risk and long-term planning. Unlike natural pandemics, engineered pathogens may be designed to exploit economic vulnerabilities, disrupt critical sectors, or evade standard mitigation strategies, making recovery even more complex.

Companies in pharmaceuticals, biotechnology, logistics, and finance must now factor biosecurity into their risk assessments and contingency planning. Cyber-biosecurity has also emerged as a concern, as synthetic biology labs and databases become potential targets for sabotage or intellectual property theft. Business leaders are beginning to collaborate with global health agencies like the WHO and the World Economic Forum to strengthen resilience, including by investing in remote operations infrastructure, diversifying suppliers, and embedding bio-risk management into corporate governance. Additionally, major industries are participating in simulation exercises to test their response to bio-threats, recognizing that resilience is not just about continuity but about adaptation in a world where biological innovation and risk are advancing in parallel.

Case Studies

Great Powers, Greater Risks: China and the USA

The relationship between China and the United States in the realm of synthetic biology became especially pivotal during the COVID-19 pandemic, where both countries played significant roles in research, development, and vaccine distribution. Their efforts in response to the pandemic highlight both the potential and the risks associated with

synthetic biology, as well as the broader implications for global health security. While both countries contributed to the global effort to combat the virus, their approaches, controversies, and the geopolitical tensions surrounding their actions underscore the complex dynamics of synthetic biology in times of crisis.

In late 2019, the world was introduced to the novel coronavirus, SARS-CoV-2, which caused the COVID-19 pandemic. The exact origins of the virus remain a matter of debate and investigation, but there is no definitive evidence to support the claim that the virus was intentionally bioengineered by either China or the United States. The World Health Organization (WHO) has stated that the most likely origin of the virus is natural, with zoonotic transmission (from animals to humans) being a plausible route, most likely originating from bats or another intermediary animal species. However, theories about the virus's creation in a laboratory have been widely discussed, particularly because of the Wuhan Institute of Virology's (WIV) did play a crucial role in sequencing the virus, and Chinese researchers were the first to publish its genetic sequence, this does not provide evidence of intentional creation.

China and the United States are at the forefront of synthetic biology, each pouring billions into biotechnology research, biosecurity measures, and dual-use applications. Their dominance in the field places them in a unique position to shape the future of international health security, but it also raises complex concerns about transparency, regulation, and the potential weaponization of biological science.

In the wake of COVID-19, both countries have intensified investment in synthetic biology. The U.S. Department of Defense has identified synthetic biology as a top-tier emerging threat, dedicating over $1.6 billion to bio-innovation through programs like Bio MADE and DARPA's Safe Genes initiative. Meanwhile, China has made synthetic biology a national strategic priority under its 14th Five-Year Plan, with state-backed labs accelerating research into gene editing, vaccine development, and pathogen engineering.

While collaboration has occurred in areas such as early virus sequencing and vaccine trials, tensions remain high due to concerns over biosecurity breaches and limited transparency. Allegations around the origins of COVID-19, particularly theories involving the Wuhan Institute of Virology, have fueled geopolitical friction. Although no conclusive evidence has confirmed a lab origin, the debate has intensified global calls for stricter oversight of high-containment research facilities.

Both nations have also built extensive infrastructure for pathogen surveillance, genome sequencing, and rapid vaccine deployment. However, their parallel paths in synthetic biology development raise fears of a biosecurity arms race, where scientific advancements may be driven more by competition than cooperation. The lack of a binding international framework regulating synthetic biology leaves a dangerous vacuum in global governance.

Dr. Ralph Baric and the Role of Synthetic Biology in Pandemic Preparedness

Dr. Ralph Baric, a renowned virologist at the University of North Carolina, is a key figure in the field of synthetic biology, particularly in the context of viral research and pandemic preparedness. His pioneering work on coronaviruses has been instrumental in understanding how these viruses evolve and how they might be engineered to pose new threats. Baric's research has contributed significantly to the development of vaccines and antiviral therapies, making him a central figure in both combating natural and bioengineered pandemics.

Dr. Baric's research on coronaviruses, particularly his work with the SARS-CoV-2 virus, directly ties into the growing concerns surrounding synthetic biology and its potential for both beneficial and harmful applications., facilitating rapid responses to emerging threats.

These tools have been critical in the race to develop vaccines, as they enable researchers to quickly understand viral mutations and adapt vaccine candidates accordingly.

However, Baric's research has also raised ethical concerns due to the dual-use nature of his work. While his discoveries have accelerated the development of life-saving vaccines, the same technologies can potentially be used to engineer pathogens with enhanced transmissibility or resistance to existing treatments. This dual-use dilemma highlights the need for stringent biosecurity measures and international regulation in synthetic biology to prevent misuse.

Dr. Baric himself has advocated for robust oversight and ethical guidelines in viral research to ensure that scientific advancements are used for the public good and not for creating bioengineered threats. His work exemplifies the delicate balance between scientific progress in biosecurity and the potential risks associated with synthetic biology, underscoring the need for global cooperation and regulation in the face of bioengineered pandemics.

Questions to consider

- What has the World Health Organization done so far to address the potential threats of synthetic biology and bioengineered pathogens on a global scale?
- What are the primary gaps in international legal frameworks that allow synthetic biology research to be misused or go unregulated?
- How can healthcare systems, particularly in low- and middle-income countries, be made more resilient to respond to bioengineered outbreaks without compromising ethical research?
- In what ways can misinformation and media sensationalism that surround the synthetic biology impact global health responses, public trust, and mental wellbeing?

- What are the socioeconomic consequences of a bioengineered pandemic, and how can economies balance innovation in biotechnology with preparedness for biological threats?
- How has the emergence of synthetic biology reshaped global mental health challenges, especially among healthcare workers, marginalized communities, and youth?
- What role does global inequality play in the ability of countries to monitor, detect, and respond to potential biosecurity threats stemming from synthetic pathogens?
- What systems are currently in place for bio surveillance and laboratory safety, and how can countries build more effective mechanisms for early detection and containment?
- How does the lack of educational exposure to biosecurity literacy impact future generations of scientists, and how can responsible research culture be fostered?
- In what ways do gaps in media literacy and scientific communication contribute to fear, conspiracy theories, or social division during bio-crisis scenarios?
- How can international bodies inspect labs while respecting national sovereignty?
- What defines an “acceptable risk” in dual-use biotech research?
- How can we ensure equitable access to biosecurity tools and vaccines in low-income countries?
- What global system can combat misinformation during engineered health crises?
- How should AI and synthetic biology be regulated together to prevent misuse?

Recommendations

- Delegates should understand the capabilities of synthetic biology, its applications, and the potential risks associated with its misuse, including the creation of bioengineered pathogens.

- Delegates must refrain from discussing political matters or placing blame on particular countries or regions, focusing instead on the broader international health security framework and collaboration among nations.
- Delegates should consider the economic, health, and social factors associated with bioengineered threats, proposing solutions that address vulnerabilities within global health systems while accounting for varying levels of national preparedness.
- Delegates are expected to conduct extensive research to understand the roots of the potential biosecurity risks, exploring both the scientific advancements in synthetic biology and the socio-political challenges that could exacerbate the threat of engineered pandemics.
- Delegates should be aware of existing international frameworks, such as the Biological Weapons Convention (BWC), and understand their limitations in addressing modern biosecurity challenges, proposing ways to strengthen global legal mechanisms and regulatory oversight.
- Delegates are encouraged to come up with innovative, science-based approaches to strengthen global bio surveillance systems, improve emergency response mechanisms, and foster international cooperation to address synthetic biology risks.
- Delegates should explore ways to balance the benefits of synthetic biology for public health with the need for strict oversight, ensuring that advances in medical and biotechnological research are not exploited for harmful purposes.
- Delegates should work towards the integration of biosecurity literacy into global education systems, particularly within scientific communities, to foster responsible research and innovation in synthetic biology.

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