



Members of the Alabama National Guard's 46th Civil Support Team work a threat scenario created by Dugway Proving Ground's Special Program Division mobile training teams 18 June 2014. (Photo courtesy of the U.S. Army)

# On Biological War

Al Mauroni

In 1990, the U.S. political and military leadership was significantly challenged by the possibility that Iraq, having the fourth largest offensive chemical and biological weapons program in the world at the time, might use those unconventional weapons against U.S. forces and its allies massing in Saudi Arabia. For all practical purposes, there was no real capability to rapidly detect and identify the deliberate release of anthrax spores or other biological weapons, and the U.S. military did not have sufficient vaccines or therapeutics for such an event. Due to this severe neglect to biological defense,

former Secretary of State James Baker gave a formal letter to the Iraqi foreign minister stating that Iraq would “pay a terrible price” if it used chemical or biological weapons against the U.S.-led coalition.<sup>1</sup> Had Saddam Hussein decided to use biological weapons, it could have caused thousands of casualties. Fortunately for U.S. forces, he did not have a significant biological weapons capability and there was no use of those weapons.

Despite dark predictions of both nation-states and violent extremist organizations planning biological attacks against the nation, there has been no test of

the U.S. military's biodefense capability. A "biological taboo" resulting from decades of arms control discussions has held, despite the lack of a verification regime behind the Biological Weapons Convention (BWC).<sup>2</sup> Concerns about Iraq's biological weapons capability in 2003 evaporated a year later, with nothing substantive to find. Despite concerns about a domestic terrorist biological incident following the anthrax attacks in 2001, there has never been a mass casualty attack caused by biological organisms in the United States since then. The Nation's recent public health challenges in addressing the 2019 coronavirus pandemic (COVID-19) have caused questions as to whether the U.S. military is sufficiently prepared for an adversary that might be emboldened to use biological weapons against U.S. national security interests.

Despite the lack of any biological attacks or even threat of attacks over the past twenty years, the potential impact of a large-scale use of a contagious disease concerns enough people to call for new national strategies and improved response capabilities for biological threats. Current strategies aim to mitigate natural disease, to regulate biological research associated with the more hazardous biological diseases, and to improve the U.S. public health system to better respond to biological threats.<sup>3</sup> Yet despite the development of four national strategies for national biodefense over the past twenty years, the U.S. government has not significantly advanced its capabilities for protecting against and responding to biological threats, defined as including natural diseases, deliberate biological releases, and laboratory accidents. Despite the high-level attention to this threat, assessments of the Nation's capability to prepare for deliberate biological threats have not, however, been positive.

Unclassified assessments from the State Department and the Department of Defense (DOD) suggest that China and Russia could have a biological weapons capability, as could North Korea and Iran.<sup>4</sup> The lack of any actual use of biological weapons against the United States has perhaps diminished the concern that potential weaknesses exist. In the event of a future conflict with great powers, there is the chance that biological warfare could emerge as a significant threat, perhaps in a form unrecognized from Cold War experiences. Prior to attempting the implementation of yet another strategy to counter biological threats, the Army needs to establish the context of how adversaries would deliberately use

biological threats against U.S. national security interests. Once a rational appreciation of the threat is developed, one can then create a defense strategy that directly addresses deliberate biological releases. Importantly, such a strategy needs to be resourced and implemented to address the future challenges of a deliberate biological release, understanding that natural infectious diseases pose a competing priority.

## What's the Threat Today?

Counter to the hypothesis that the pandemic outbreak has revealed potential vulnerabilities to biological weapons, COVID-19 has not in fact acted like a biological weapon. As a result, the lessons that apply from this contemporary crisis toward a biological weapons attack are few. A pandemic outbreak, affecting the general population over a year's time, requires a different approach than military forces protecting themselves from a focused deliberate biological attack. COVID-19 is not lethal enough and does not incapacitate people quickly enough to qualify as a potential weapon, despite the more than 750,000 deaths caused over twenty-four months across the United States.<sup>5</sup> A biological disease that does not significantly impact young, healthy people and that is easily countered by a national vaccine program is not prime material for a weapon system. COVID-19 may have slowed down economic activities, but it is not an existential threat to the U.S. government. Despite the potential impact on national security, pandemic diseases are best addressed separately from biological defense concepts.

The U.S. military does anticipate the potential use of biological weapons in combat operations. In that light, the Department of Defense has a counter-weapons of mass destruction (WMD) strategy and chemical, biological, radiological, and nuclear (CBRN) defense concept to guide its efforts to prevent, protect against, and respond to adversaries using biological weapons.<sup>6</sup> The ratification of the BWC has significantly reduced the number of potential adversaries that might use traditional biological warfare (BW) agents, allowing one to focus on particular actors and military scenarios. The traditional biological warfare agents such as anthrax, pneumonic plague, smallpox, and tularemia are still potent candidates for future warfare. However, the employment of said weapons may look very different than envisioned during the Cold War. North Korea may



be the exception to this statement, as it is unclear how that nation would use unconventional weapons, but its operational concept for warfare appears to be based in an industrial age, massed firepower approach, similar to what NATO might have anticipated in the 1970s.<sup>7</sup>

China and Iran are assessed as not complying with the BWC, and Russia and North Korea are believed to have retained offensive biological weapons programs.<sup>8</sup> While we can understand the biological warfare model that North Korea might employ, this does not necessarily apply to Russia's and China's concepts of employment for biological weapons. The Cold War model of using massive amounts of biological agents against troop concentrations, major population centers, and large military sites such as air bases and seaports requires large-scale production, storage, and testing capability. As Russia and China have modernized their nuclear and conventional forces, they have also changed their approach toward military confrontations with the United States and partner nations. While preparing for the possibility of total war, both countries have focused on conducting regional operations against U.S. allies using methods that fall below the threshold of open conflict.<sup>9</sup> Their nuclear arsenals cast a coercive shadow over regional operations that allow those nations to

Members of the U.S. Marine Corps' Chemical-Biological Incident Response Force demonstrate anthrax clean-up techniques during a news conference 30 October 2001 on Capitol Hill in Washington, D.C. (Photo by Kenneth Lambert, Associated Press)

aggressively push and attain their political objectives. As a result, a clandestine biological weapons program can offer them a capability to perform single, small-scale chemical or biological weapons attacks on focused targets (facilities or individuals) while claiming to be compliant with the BWC.<sup>10</sup>

The former Soviet Union had a massive biological warfare program, unmatched by any historical measure. Despite extensive documentation of this program, the Russian Federation has not fully acknowledged the former Soviet Union BW program. The State Department has gone so far as to designate specific Russian government facilities as "acting contrary to the national security or foreign policy interests of the United States" through their association as military defense facilities associated with a BW research program.<sup>11</sup> These are not recent concerns. Analysts will point out that in 2012, then Prime Minister Vladimir Putin talked about creating "weapon systems that use different physical principles ...

(beam, geophysical, wave, genetic, psychophysical and other types of weapons).<sup>12</sup> However, it is unclear that this attributed quote referred to a return to developing biological weapons to support military conflict. In 2019, Putin directed a budget of 220 billion rubles (or \$3.3 billion) toward the development of genetic technologies that could support a wide range of applications (biomedical, agricultural, or biodefense).<sup>13</sup>

At the same time, the Russian government has claimed that the United States is building offensive BW laboratories in countries surrounding Russia through the Biological Threat Reduction Program. For instance, the “Lugar Center for Public Health Research” in Tbilisi, Georgia, was funded by U.S. defense funds, but its intent is to promote health security against natural infectious disease outbreaks.<sup>14</sup> In response to U.S. government accusations of China’s role in the COVID-19 outbreak, Chinese government officials have recently echoed the same claims that the U.S. government has created biological weapons near their borders.<sup>15</sup> This type of disinformation campaign falls squarely in the “gray zone” set of tools. Both China and Russia have ignored international efforts to prevent the proliferation of unconventional weapons technology and materials.

China’s position as one of the leaders of the global bioeconomy increases its potential for realized or latent advanced biological warfare capabilities. Beijing appears committed to becoming a leader in biotechnology, which holds the promise of myriad public health applications. Yet, many biotechnology applications are dual-use, capable of delivering both public health benefits and advances in biological warfare capabilities. As one top U.S. expert noted, China “is pursuing a very aggressive strategy to become the world leader in biotechnology.”<sup>16</sup> Sustained public and private investment in synthetic biology technologies needed for DNA sequencing and synthesis as well as gene editing have enabled China to develop a wide array of dual-use biotechnologies in the field of synthetic biology. Many experts anticipate that synthetic biology advances will enable the development of “new and novel biomaterials” to include advanced bioweapons.<sup>17</sup> As a 2020 Brookings Institution study noted, “The determination of China’s one-party state to become a leading player in biotechnology is reflected by the rapid growth in investment in the sector. Some estimates claim that collectively, China’s central, local, and provincial



China’s People’s Liberation Army (PLA) soldiers conduct a nuclear, chemical, and biological warfare exercise November 2021 in the Tibet Military Region, according to PLA news sources. The People’s Republic of China has an extensive program for studying virulent biological agents for the reputed purpose of medical research but which also have potential for military use. (Photo courtesy of the PLA)

governments have invested over \$100 billion in life sciences research and development.”<sup>18</sup> China’s sustained and sizeable government investment in domestic biotechnology has created an industrial base capable of developing and manufacturing a range of extant and novel biological warfare agents.

And while the possibility of developing novel biological warfare agents is present, it is more probable that China wants to use its biotechnology lead to produce superior commercial pharmaceuticals and to

enhance its military forces. There is always speculation that advances in the life sciences will drive an evolution in biological weapons, making them more lethal, more environmentally hardy, more targeted toward specific populations, or more able to confound contemporary detection systems. This belief used to be rooted in the 1970s rise of biotechnology, and then it was 1990s genetics driving the concerns. Today, it is the promise (and dangers) of synthetic biology. And while it is true

that one could always improve characteristics of certain biological weapons, there are significant drawbacks as to such an approach.<sup>19</sup> Assuming that an adversary might develop altered biological weapons to be more operationally relevant, this would still be a violation of treaty (if it were China or Russia) and international norms. Modifying a biological organism to enhance its resistance to antibiotics might in turn reduce other desired characteristics, such as its lethality or dissemination qualities. Any use of a genetically modified organism would run the risk of direct attribution to a particular source.

Western military forces lack the capability to detect the deliberate use of biological weapons until after exposure. In addition, U.S. forces lack vaccines for a number of traditional biological warfare agents, let

alone engineered diseases.<sup>20</sup> Any nation with an advanced industrial capability can easily develop biological agents that can damage or destroy crops or livestock, in addition to targeting humans. There is no need for an overly sophisticated engineered biological warfare agent à la the latest James Bond movie, *No Time to Die*. And even if military forces had tactical biological detectors that could identify all biological warfare agents in a timely enough fashion to put on protective masks, traditional biological weapons would still be an effective strategic weapon against a civilian populace, its livestock, or cropland. There is no possibility that the United States and its Western allies can make biological weapons obsolete.<sup>21</sup> At the same time, we do not need to overexaggerate the threat of biological weapons as some Hollywood scripts portray them.

## What's the Right Concept?

There are several options that could be explored. The traditional approach has been to develop chemical and biological defense as a combined operational concept. Both chemical and biological warfare agents use similar delivery systems and target the human body's physiological response to hazards. Under the larger construct of countering WMD threats, the U.S. government can engage in arms control negotiations to limit biological weapons use, use preemptive strikes to target a nation's WMD capability, and respond to its use with protective equipment that limits the impedance of combat operations. None of these options are singular to biological threats. A second option is to task the medical community to identify and respond to both biological warfare attacks and natural disease outbreaks while limiting reliance on biological detectors and technical experts. The U.S. Air Force, for instance, endorses a biological defense concept that is separate from chemical defense and that relies on the medical community for initial detection and identification.<sup>22</sup> This is a very specific focus on biological threats that includes a conscious decision to limit investments in people and equipment in response to a lower probability of deliberate biological attacks. The Air Force concept is a subset of its counter WMD operations, as the Army's CBRN defense efforts are.

The U.S. Army recently released a biological defense strategy that calls for the "synchronized implementation" of both biological warfare defense and infectious natural diseases across the Army.<sup>23</sup> Interestingly, the

**Al Mauroni** is the director of the U.S. Air Force Center for Strategic Deterrence Studies at Air War College, Maxwell Air Force Base, Alabama. He has more than thirty-five years' experience in Department of Defense counter-weapons of mass destruction (WMD) policy and program development. In this role he oversees the development and execution of Air Force education, research, and outreach initiatives relating to counter-WMD and nuclear deterrence operations. Prior to his current assignment, he worked counter-WMD and chemical, biological, radiological, and nuclear defense issues for the Air Staff. Mauroni holds a master's degree in administration from Central Michigan University and a bachelor's degree in chemistry from Carnegie-Mellon University. He is the author of eight books and numerous journal articles, to include articles in *War on the Rocks*, *Modern War Institute*, *The Nonproliferation Review*, and *Joint Force Quarterly*.



office responsible for implementing this strategy is the U.S. Army Nuclear and Countering Weapons of Mass Destruction Agency, not the Army’s chemical-biological defense specialists and not the Army’s medical experts who respectively own those areas of expertise. It is not immediately clear as to whether this strategy calls for the development of a stand-alone biological defense concept that combines capabilities for both infectious natural diseases and deliberate biological releases, or just a single agency that manages two very different concepts (counter-WMD and force health protection) that have a common scientific origin. The strategy details four “lines of effort” that include

- ◆ developing and managing talent and facilities that address biological threats;
- ◆ maintaining a biological common operating picture and awareness of biological defense forensics;
- ◆ building a readiness posture that includes protection, response, and training for biological defense capabilities; and
- ◆ directing modernization efforts for biological defense concepts and doctrine.

Will this new governance structure fundamentally change how the Army does biological defense? Given policy and budget direction, probably not.

New York Army National Guard Sgt. Casey Taylor, 2nd Weapons of Mass Destruction-Civil Support Team (2nd WMD-CST), and New York Air National Guard Master Sgt. Roger Yurko, 109th Airlift Wing emergency manager, investigate possible contamination 14 November 2019 during a training exercise at Stewart Air National Guard Base, New York. The 2nd WMD-CST supports civil authorities at man-made or natural disasters by identifying chemical, biological, radiological, and nuclear substances; assessing the consequences; and advising on response measures. (Photo by Master Sgt. Sara A. Pastorello, U.S. Air National Guard)

This is not the first time a military agency has suggested moving all biodefense activities into a portfolio for medical countermeasures for infectious diseases. There is an almost instinctual movement toward putting medical experts in charge of developing capabilities for countering all biological threats; however, that does not work for two reasons.

First, given a collection of biological threats—whether natural, deliberate, or accidental—medical leaders will always consider infectious natural diseases the most important concerns because of the large numbers of service members and their dependents who get sick from natural diseases. And there are a lot of infectious natural diseases to address. In 1990, the

U.S. military found itself without adequate vaccines for anthrax and botulin toxin when it was preparing to face an Iraqi military force that had an active chemical and biological weapons program. This was due to a deliberate decision to deprioritize research and development for biological warfare agents and focus instead on countermeasures for natural diseases such as chikungunya virus and diarrheal diseases.

Second, while the response to biological threats has often had a common core, the prevention and protection against biological threats certainly does not. While one can try to deter adversaries from using biological weapons, Mother Nature cannot be deterred. Protecting military forces from biological weapons during combat operations requires a completely different approach than protecting a military base's population from natural diseases. This requires a level of nuance to understand that a single biodefense concept cannot protect fundamentally different populations with different requirements and facing fundamentally different biological threats. There is a reason why there are different budgets and authorities for dealing with biological warfare agents, natural biological diseases, and biological research laboratory accidents.

## Problems with a Centralized Biodefense Enterprise

The primary purposes of any strategy document are to identify a specific mission or program, to identify policy objectives that should drive discrete programs, and to offer a plan to achieve those objectives. In the military, this is called “ends, ways, and means.” Ideally, a strategy will also aid decision makers in moving resources toward those goals that require funding to achieve those objectives. So, the problem with a biological defense strategy that aims to address all biological threats—whether at the Army, the DOD, or national level—is that there are multiple agencies with budget elements who are already directed to address specific biological threats. I will argue that at least five biological threat sectors require consideration in any biological defense strategy:

- ◆ disease prevention as a function of public health,
- ◆ bioterrorism response as a function of homeland security,
- ◆ military biodefense as a function as countering WMD,

- ◆ biosurety as a function of laboratory practices, and
- ◆ biosecurity and biosafety as a function of agricultural and food industries.

None of these are new security concerns. Each has a dedicated government agency that focuses on a distinct threat using a congressionally approved budget. Because each biological threat sector already has a lead agency and agenda to pursue, the question comes as to what a centralized biological defense strategy would change or impact the direction of federal government or military biodefense programs.

Public health efforts addressing infectious biological diseases, to include aspects of disease prevention in the military's force health protection program, have been around for more than one hundred years. One of the challenges in the U.S. public health program is that it is federalized, meaning that states and local jurisdictions implement public health programs while the federal government provides research and funding for specific purposes. The Centers for Disease Control and Prevention (CDC) and the National Institutes of Health represent the largest government agencies in this area, putting tens of billions of dollars against infectious disease research, surveillance, and response. Within the military, the Army's Medical Research Institute for Infectious Diseases has a research and development program for infectious diseases to address potential biological threats to service members in U.S. and overseas theaters. Top threats include tuberculosis, measles, influenza, pneumonia, and malaria.

Bioterrorism response is a little more nebulous, since we have not seen a terrorist group successfully use a biological hazard to cause mass casualties in the United States since 1984. However, following the 2001 Amerithrax incidents, the concern that they might has thrown a few billion dollars a year toward the Department of Homeland Security and Department of Health and Human Services to develop response plans for the possibility.<sup>24</sup> The DOD needs to consider biological terrorism within its installation force protection plans, but for the most part, it is not an integral part of that effort due to the very low probability of such an incident. The DOD does have a massive CBRN Response Enterprise that would assist states and cities in any federal response to a biological terrorist incident. The top (realistic) biological threats usually include salmonella, ricin, botulinum toxin, sewage, and tainted body fluids.

Military biodefense has focused on protecting U.S. forces from biological warfare agents developed by adversarial nation-states for the purpose of combat operations. We have always envisioned biological weapons attacks as large-area coverage, mass casualty events on the battlefield. Because of technical challenges, military biodefense capabilities were largely lacking during the 1991 Persian Gulf conflict, leading to a crash program

can only provide suggestions on how the U.S. research and development community should implement good business practices. This area is not well funded (maybe \$500 million/year) or overseen from the federal level. The top threats for biosurety are too varied for listing, but in general, accidents are largely limited to individual researchers and not the general community surrounding a biological research lab.

“ The top threats for biosurety are too varied for listing, but in general, accidents are largely limited to individual researchers and not the general community surrounding a biological research lab. ”

in the mid-1990s to develop biological detectors and medical countermeasures for the services. Biological detection and vaccines were more readily available in 2003 as U.S. forces prepared for possible Iraqi biological weapons use. There is a central program office that manages all DOD biological defense programs, receiving maybe a half billion dollars a year for funding. Their top threats include anthrax, pneumonic plague, smallpox, tularemia, and brucellosis. The DOD's Biological Threat Reduction Program, which is more of an effort to secure other nations' laboratories and hospitals than biodefense, accounts for less than a \$300 million in annual funding over the past decade.<sup>25</sup>

Biosurety addresses the security and safety of laboratory research labs both across the United States and within the U.S. military. Unlike traditional biodefense efforts, biosurety is more about keeping biologicals safe from humans, as opposed to the other way around. The threat includes both the possibility that a researcher on the inside might deliberately or accidentally release a dangerous biological organism, or that an outsider might try to break in and steal them. There is also the danger of natural disasters or externally derived accidents to consider. The U.S. Army has had biosurety failures that resulted in CDC shutdowns at its Dugway Proving Ground (in 2015 due to anthrax shipments) and Fort Detrick laboratories (in 2019 due to unsafe laboratory practices). While the CDC has some oversight role for a small set of select agents and toxins, in general, the CDC

Biosecurity and biosafety challenges within the agricultural and food industries have been of two parts. First, many facilities have significantly large amounts of livestock or crops to protect against the introduction of any foreign disease that might wipe out their livelihood. In addition, foreign pests or animals could displace or eliminate native animals and crops. Second, there is the challenge of regulating food products as they are moved from the farm to the table, as the saying goes. Federal regulations aim to ensure that agricultural products used in meal production are both safe and accurately labeled. Both the Food and Drug Administration and U.S. Department of Agriculture have responsibilities to oversee this area, in addition to the Customs and Border Patrol. There is not a significant DOD equity in this area other than ensuring that meals prepared for the field are safe and free of contamination. Because Congress is very interested in ensuring that the public has safe food and a variety of different foods, this area gets funded between \$3 billion and \$4 billion a year. Its biological threats of concern include foot-and-mouth disease, swine flu, avian flu, wheat rust, and invasive species such as Asian carp, zebra mussels, cane toads, and brown marmorated stink bugs.

This is just the tip of the challenge of trying to address all biological threats—natural, deliberate, and accidental—under one Army, DOD, or national strategy. There are more complex discussions as to what would constitute a national biosurveillance effort—surprisingly, this would not be solely focused on infectious



biological diseases to humans, but also include diseases affecting animals and plants, as well as chemical or radiological hazards to any biological organism. There is the challenge of addressing the impact of future technologies such as “gain-of-function” and synthetic biology. Even after we identify all of the potential issues that surround “biological threats,” there is the question of who ought to lead the effort. The public health community claims that if it were better funded, it could address all natural disease outbreaks as well as respond to biological terrorism. The national security community feels that it needs to have a larger voice in this effort, given that these are foreign threats that impact the armed forces and other U.S. national security interests. And given the national security community’s funding and ability to quickly form new project offices, they could very well dominate the discussion, which could result in different priorities than what the public health community sees as important.

## Concluding Thoughts

The military’s primary concern should be on deliberate biological threats, but there is no question that it has been distracted by COVID-19 and the general topic of natural disease outbreaks. If the DOD’s Chemical-Biological Defense Program decides to move from working on countermeasures to biological warfare agents and focus instead on “threat-agnostic” systems that address all biological threats, the military will not get necessary detectors, protective ensembles, medical vaccines, or decontaminants for biological warfare agents due to the larger number and greater impact of natural infectious diseases. This is, in essence, what happened in the 1980s; because the military medical community was focused on research and development for infectious diseases and not biological warfare agents, U.S. forces were unprepared for biological warfare in 1990.<sup>26</sup>

Military concepts of future war assure us that biological and nuclear warfare are expected threats to U.S. forces.<sup>27</sup> In the case of a conflict with North Korea, it may not look that different than Cold War concepts of massive, large-coverage attacks on U.S. military bases. In the case of China and Russia, it is less clear what the future of biological war will be. As technology such as drone swarms, artificial intelligence, and synthetic biology continue to mature, the shape of biological warfare threats will evolve. One can assume that the traditional biological warfare agents will still be viable candidates, or possibly enhancements on their natural forms. Terrorist use of biological hazards may be limited to crude toxins and improvised delivery systems—still a threat to installation force protection measures, but not necessarily a mass casualty event. This future operating environment requires us to focus on enhancing the survivability of critical infrastructure—in particular, command and control, power projection, and logistics bases—and the resiliency of military operations while impacted by biological weapons.

The only way to succeed in moving forward in a future biological defense posture is not, then, to dilute the Army’s efforts by trying to manage the development of defensive capabilities for all natural disease outbreaks and deliberate biological attacks under a single general construct. There needs to be a laser-sharp focus on both pandemic preparedness and biological defense during combat operations. In addition, the DOD needs to ensure that its biological research and development laboratories have the best practices in place to avoid future shutdowns due to biosurety challenges. This is not an either/or discussion nor is it the time to radically revise how military forces accomplish biological defense. Instead, Army leaders need to engage in these discussions, despite the complicated technical nature of the topic, and ensure that future operations can be maintained despite the threat of biological weapons use. ■

---

## Notes

1. “Confrontation in the Gulf: Text of Letter from Bush to Hussein,” *New York Times* (website), 13 January 1991, accessed 21 December 2021, <https://www.nytimes.com/1991/01/13/world/confrontation-in-the-gulf-text-of-letter-from-bush-to-hussein.html>.

2. Office of Treaty Affairs, “Biological Weapons Convention,” U.S. Department of State, entered into force 26 March

1975, accessed 23 December 2021, <https://www.state.gov/biological-weapons-convention-text/>.

3. The White House, “American Pandemic Preparedness: Transforming Our Capabilities” (Washington, DC: The White House, 2021), accessed 21 December 2021, <https://www.whitehouse.gov/wp-content/uploads/2021/09/American-Pandemic-Preparedness-Transforming-Our-Capabilities-Final-For-Web.pdf>.

4. Terri Moon Cronk, "DOD Officials Warn of Increased Threat from Weapons of Mass Destruction," Department of Defense News, 13 February 2020, accessed 21 December 2021, <https://www.defense.gov/News/News-Stories/Article/Article/2083671/dod-officials-warn-of-increased-threat-from-weapons-of-mass-destruction/>.
5. "COVID Data Tracker," Centers for Disease Control and Prevention, accessed 22 December 2021, [https://covid.cdc.gov/covid-data-tracker/#trends\\_totaldeaths|tot\\_deaths|select](https://covid.cdc.gov/covid-data-tracker/#trends_totaldeaths|tot_deaths|select).
6. Department of Defense Strategy for Countering Weapons of Mass Destruction (Washington, DC: Office of the Secretary of Defense, 2014), accessed 22 December 2021, [https://dod.defense.gov/Portals/1/Documents/pubs/DoD\\_Strategy\\_for\\_Countering\\_Weapons\\_of\\_Mass\\_Destruction\\_dated\\_June\\_2014.pdf](https://dod.defense.gov/Portals/1/Documents/pubs/DoD_Strategy_for_Countering_Weapons_of_Mass_Destruction_dated_June_2014.pdf); Joint Publication 3-11, *Operations in CBRN Environments* (Washington, DC: U.S. Government Publishing Office, 2020), accessed 22 December 2021, [https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3\\_11.pdf](https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_11.pdf).
7. John Parachini, "North Korea's CBW Program: How to Contend with Imperfectly Understood Capabilities," *PRISM* 7, no. 3 (15 May 2018), accessed 22 December 2021, <https://cco.ndu.edu/News/Article/1516496/north-koreas-cbw-program-how-to-contend-with-imperfectly-understood-capabilities/>.
8. "Part V: Other States' Compliance with and Adherence to Arms Control, Nonproliferation, and Disarmament Agreements and Commitments Pertaining to Biological Issues," in *2021 Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments* (Washington, DC: U.S. Department of State), accessed 22 December 2021, [https://www.state.gov/2021-adherence-to-and-compliance-with-arms-control-nonproliferation-and-disarmament-agreements-and-commitments/#\\_Toc69385144](https://www.state.gov/2021-adherence-to-and-compliance-with-arms-control-nonproliferation-and-disarmament-agreements-and-commitments/#_Toc69385144).
9. Lyle Morris et al., *Gaining Competitive Advantage in the Gray Zone: Response Options for Coercive Aggression Below the Threshold of Major War* (Santa Monica, CA: RAND Corporation, 2019).
10. Christopher Ford, "Biosecurity, Biological Weapons Nonproliferation, and Their Future" (remarks, U.S. National Defense University, Fort Lesley J. McNair, Washington, DC, 11 April 2019), accessed 22 December 2021, <https://2017-2021.state.gov/biosecurity-biological-weapons-nonproliferation-and-their-future/index.html>.
11. "Part V," in *2021 Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments*.
12. Aleksey Nikolsky, "Being Strong: National Security Guarantees for Russia," RT, 19 February 2012, accessed 22 December 2021, <https://www.rt.com/russia/official-word/strong-putin-military-russia-711/>.
13. Anna Nemtsova, "Is Putin's Fascination with Genetics Just Eugenics in Disguise?," *The Daily Beast*, 30 May 2019, accessed 22 December 2021, <https://www.thedailybeast.com/is-putins-fascination-with-genetics-just-eugenics-in-disguise/>.
14. Vladimir Isachenkov, "Russia Claims US Running Secret Bio Weapons Lab in Georgia," Associated Press, 4 October 2018, accessed 22 December 2021, <https://apnews.com/article/public-health-north-america-health-ap-top-news-in-state-wire-0cf158200e674f41bd3026133e5e043d>.
15. Julia Davis, "Russia, China Team Up to Peddle Insane US COVID Lab Theory," *The Daily Beast*, 9 April 2021, accessed 22 December 2021, <https://www.thedailybeast.com/russia-china-team-up-to-peddle-insane-us-covid-lab-theory>.
16. Many Mayfield, "China Pursuing 'Aggressive' Biotechnology Strategy," *National Defense* (website), 9 July 2020, accessed 22 December 2021, <https://www.nationaldefensemagazine.org/articles/2020/7/9/china-pursuing-aggressive-biotechnology-strategy>. Quote attributed to Dr. Tara O'Toole, a senior fellow and executive vice president at In-Q-Tel.
17. Michael Morrell and Ken Wickiser, "West Point Biochemist Warns about Threat of Bioweapons," 20 January 2021, in *Intelligence Matters*, produced by Paulina Smolinski, podcast, accessed 22 December 2021, <https://www.cbsnews.com/news/bioweapons-threat-synthetic-biology/?tag=CNM-00-10aac3a>.
18. Scott Moore, *China's Role in the Global Biotechnology Sector and Implications for U.S. Policy* (Washington, DC: Brookings Institution, April 2020), accessed 22 December 2021, [https://www.brookings.edu/wp-content/uploads/2020/04/FP\\_20200427\\_china\\_biotechnology\\_moore.pdf](https://www.brookings.edu/wp-content/uploads/2020/04/FP_20200427_china_biotechnology_moore.pdf).
19. National Research Council, *Biotechnology Research in an Age of Terrorism* (Washington, DC: National Academies Press, 2004), 22–23.
20. Matthew Cox, "The Next Major Battlefield Threat Facing US Troops May Be Undetectable," *Military.com*, 2 September 2020, accessed 22 December 2021, <https://www.military.com/daily-news/2020/09/02/covid-19-may-force-pentagon-pay-attention-major-weak-spot-bioweapons.html>.
21. Paul Rhien, "Can the U.S. Make Bioweapons Obsolete?," *Sandia LabNews*, 12 March 2020, accessed 22 December 2021, <https://www.sandia.gov/labnews/2020/03/12/bioweapons/>.
22. Air Force Doctrine Publication 3-40, *Counter Weapons of Mass Destruction (WMD) Operations* (Maxwell Air Force Base, AL: LeMay Doctrine Center, 2016), Appendix A, "Preparing the Force," accessed 22 December 2021, [https://www.doctrine.af.mil/Portals/61/documents/AFDP\\_3-40/3-40-D14-CBRN-App1-Preparing.pdf](https://www.doctrine.af.mil/Portals/61/documents/AFDP_3-40/3-40-D14-CBRN-App1-Preparing.pdf).
23. U.S. Army, *Army Biological Defense Strategy* (Washington, DC: Headquarters, Department of the Army, 2021), accessed 22 December 2021, [https://armypubs.army.mil/epubs/DR\\_pubs/DR\\_a/ARN32553-SD\\_04\\_STRATEGY\\_NOTE\\_2021-01-000-WEB-1.pdf](https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN32553-SD_04_STRATEGY_NOTE_2021-01-000-WEB-1.pdf).
24. "Amerithrax or Anthrax Investigation," Federal Bureau of Investigation, accessed 23 December 2021, <https://www.fbi.gov/history/famous-cases/amerithrax-or-anthrax-investigation>.
25. Under Secretary of Defense (Comptroller), *Defense Budget Materials* (Washington, DC: Department of Defense, 2013, 2016, 2018, 2021), accessed 17 February 2022, <https://comptroller.defense.gov/Budget-Materials/>.
26. Yasmin Tadjdeh, "Pentagon Reexamining How It Addresses Chem-Bio Threats," *National Defense* (website), 27 October 2021, accessed 22 December 2021, <https://www.nationaldefensemagazine.org/articles/2021/10/27/pentagon-reexamining-how-it-addresses-chem-bio-threats>.
27. *Joint Operating Environment 2035: The Joint Force in a Contested and Disordered World* (Washington, DC: Joint Chiefs of Staff, 14 July 2016), accessed 22 December 2021, [https://www.jcs.mil/Portals/36/Documents/Doctrine/concepts/joe\\_2035\\_july16.pdf](https://www.jcs.mil/Portals/36/Documents/Doctrine/concepts/joe_2035_july16.pdf).